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Electrical Machinery in Joliet Steel Works.

The iron and steel industry is one which makes use of various forms of power in amounts, which, perhaps, exceed what may be found in any other line of manufacturing. The industry is an old one, and yet modern methods have produced great improvements over old practices. While these improved methods have been productive of great advantage, still the steelmaker is a most conservative man, for every change is expensive, and if a mistake is made, it is a costly one. In view of this well-recognized conservatism of the steel and iron manufacturer, the wonderful growth of the use of electric power in his mills and about his furnaces tells its own story.

A little more than a decade has passed since the introduction of the electric motor into steel mills. It had few friends at first, but it made its way with rapidity. The chart given in Fig. 2 on the next page shows year by year the total horsepower in motors installed in one of the large steel plants of the United States. It may be taken as typical of the growth of the use of electric power in the steel and iron industry.

At the time of the introduction of electric power into steel plants, the only well-developed types of motors were those operating from direct-current circuits. The peculiar conditions to be met caused the selection of 220-volt motors, which were standard at that time. These were supplied from 250-volt direct-current generators. The condition to-day, therefore, in practically all large steel plants is that they are equipped with a large 250-volt, direct-current system. To replace this system with some other system would be a costly undertaking, and would only be justified by very great advantages to be derived from the change.

The alternating-current motor, as at present developed, is particularly well adapted for some classes of rolling-mill work, and for this reason the alternating-current system would be desirable in most steel plants. Not sufficient advantage can be claimed for the alternating motor, however, to warrant the installation of an alternating-current system, unless conditions are exceptional. Rolling mills contain much machinery for which the direct-current series motor is practically necessary. They also contain much machinery which may be driven by shunt or compound direct-current motors, or, better yet, by alternating induction motors.

The future increase of the use of electric power must be for the latter class of machinery and must extend to large units; that is to say, the roll trains and similar machinery. To supply motors used in such places will require the installation of large generating stations—by "large" meaning 10,000 to 20,000 kilowatts, for instance.

The rolling-mill manager has been loath to install alternating-current motors up to the present time, because the general practice in the rolling mills has been to use direct-current motors. One western steel plant, however, has taken the initiative in the matter of alternating-current installations, and now has running a plant using both alternating and direct-current power. The Joliet works of the Illinois Steel Company, located at Joliet, Ill., are referred to. Previous to the year 1901 this plant had in operation a direct-current, 250-volt system, for which it was developing its own power. At that time the Economy Light and Power Company of Joliet, which develops 60-cycle, 2,200-volt, three-phase, alternating-current power from the Drainage Canal, contracted to supply the Illinois Steel Company with power. The steel company arranged to use this power, but provided a small increase in its own generating station, so that it would be able to take care of its whole load itself in case the Economy Light and Power Company should be unable to supply power at any time owing to the failure of water supply, or other reasons.

The Illinois Steel Company installed a 500-kilowatt, 60-cycle rotary converter, with the necessary 2,200—150-volt step-down transformers, to secure 250 volts on the direct-current end of the rotary. The rotary was manufactured by the Westinghouse Electric and Manufacturing Company, and is compound-wound. It is arranged to be operated either alternating to direct current, or direct to alternating current, as occasion may require. It is provided with separate exciter, direct-connected to the rotary shaft on one end, and an alternating-current starting motor, direct-connected to the rotary shaft on the other end. Fig. 3 shows the transformers and rotary, the starting motor of the latter having been removed for repairs. The step-down transformers for the rotary were manufactured by the General Electric Company. They are of the well-known oil type, and are provided with commutator dials for the regulation of the secondary voltage five per cent. each way of the normal 150 volts. These transformers are shown in the center of Fig. 3. Under normal operation, when the Economy Light and Power Company is supplying power, the rotary supplies the direct-current motors of the steel plant.

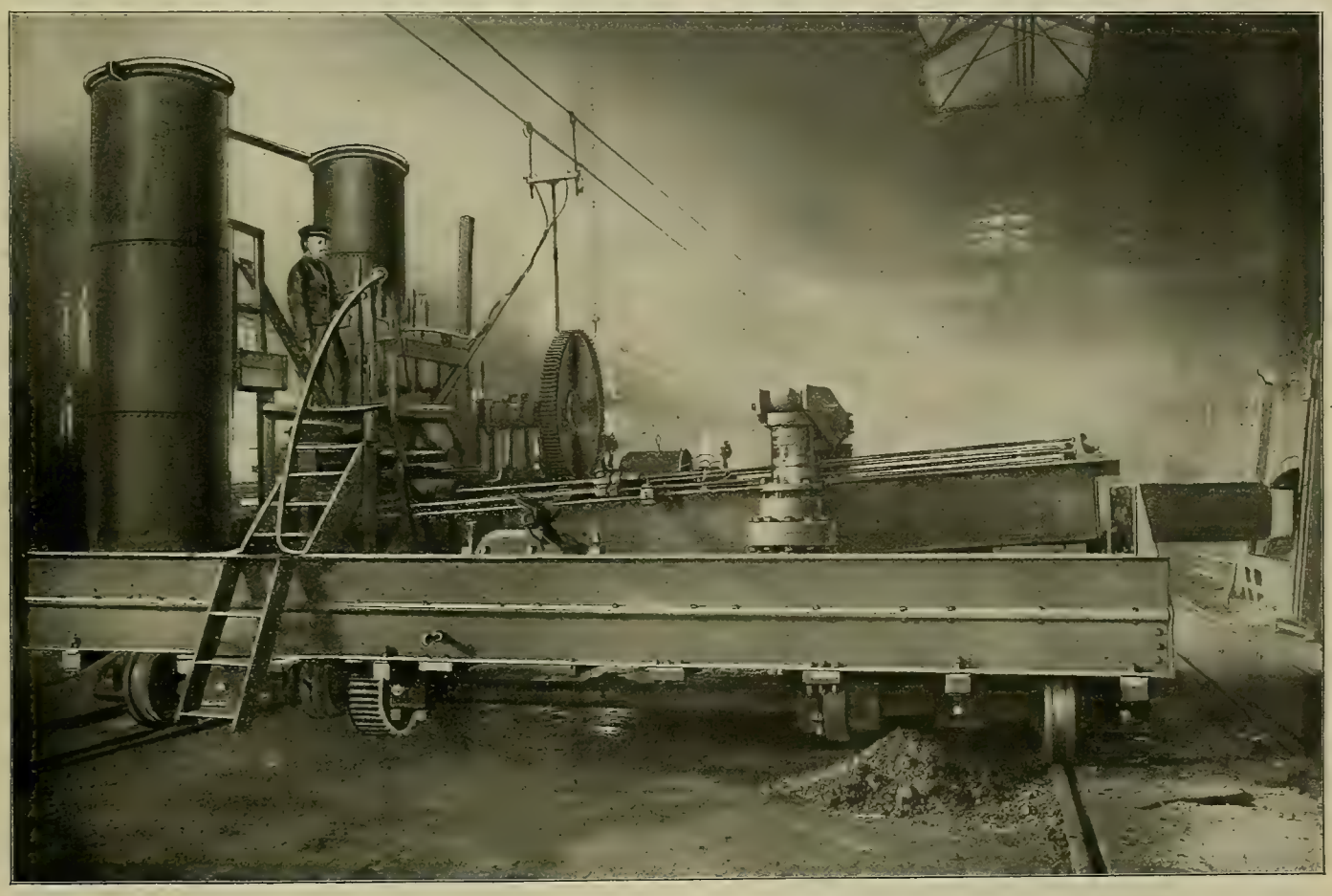


FIG. 1. ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.—ELECTRO HYDRAULIC INGOT-CHARGING MACHINE.

So far as possible, all further motor installations in the Joliet Steel Works are being made with 400-volt, three-phase induction motors. The circuits for supplying these motors are connected to the secondaries of three 75-kilowatt, 2,200 to 440-volt Westinghouse transformers, shown at the left in Fig. 3. The arc lighting of the plant, which formerly was done by the open direct-current series lamps, supplied by current from engine-driven dynamos, is now done by the Manhattan alternating-current system. Nine arc-light circuits, of 25 lights each, are connected, three on each phase of the power system. Each circuit is controlled by a Manhattan regulator, shown at the right in Fig. 4.

The switchboard (Fig. 4) was built by the Westinghouse company and consists of 10 panels of blue Vermont marble. Beginning on the left, the first panel is devoted to the lighting circuits and contains a total integrating wattmeter for measuring the total power supplied to the lighting, and an ammeter

which may be plugged into any arc circuit. In addition to these instruments there are nine pairs of arc-circuit plugs and three pairs of incandescent-circuit plugs. The incandescent lighting is used for the office and clubhouse and is operated on 110 volts. The arc lighting is used for the general illumination of the works, both interior and exterior.

The second panel of the switchboard is devoted to induction motors and contains an 800-kilowatt in-

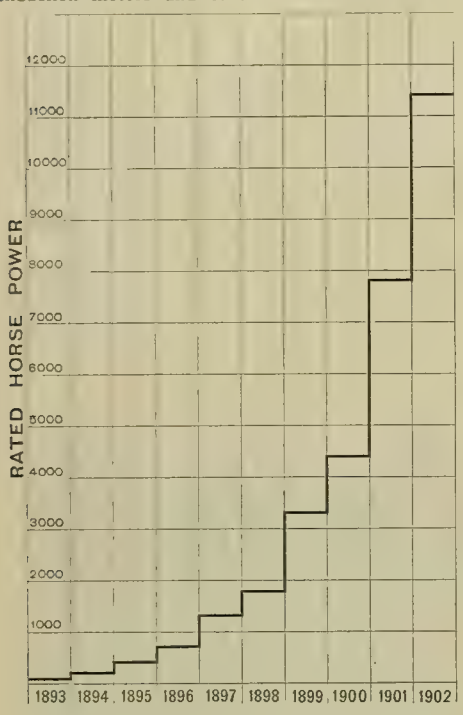


FIG. 2. TOTAL RATED HORSEPOWER OF MOTORS INSTALLED IN A LARGE STEEL PLANT.

tegrating wattmeter for measuring the total power supplied to the induction motors. In addition to this, there are three 300-ampere, triple-pole switches connected in the secondaries of the induction-motor transformers; also a pair of fuse blocks for each of the three circuits.

The third panel is the receiving panel for the alternating-current power. It contains a triple-pole, non-automatic circuit-breaker connected in the receiving line. This panel is also provided with a 1,600-kilowatt, polyphase, indicating wattmeter, a

FIG. 5. ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.—RESERVE POWER PLANT.

1,600-kilowatt, polyphase integrating wattmeter that records the total power received from the Economy company, and a 3,000-volt, alternating-current voltmeter. Below these instruments are three quick-break switches for the shunt field of the rotary. It is possible to run the rotary self-excited, separately excited from the exciter, or separately excited from the 250-volt direct-current bus-bars.

The next panel is devoted to the alternating-current side of the rotary. It has a 3,000-ampere, double-pole, automatic circuit-breaker, a 3,000-ampere alternating-current ammeter, which may be plugged onto any phase, sychronizing lamps, and three single-pole machine switches. On the sub-panel is mounted a switch for the starting motor of the rotary.

The fifth panel is devoted to the direct-current side of the rotary. It has the usual complement of direct-current instruments, consisting of single-pole circuit-breaker, ammeter and positive, negative and equalizer switches. On the sub-panel is mounted the rheostat.

The next four panels are devoted to the four 250-volt, direct-current generators which are held in reserve in the station. Each panel has a single-pole circuit-breaker, direct-current ammeter, triple-pole machine switch and plugs for connection to a differential voltmeter. On the sub-panel is mounted the field rheostat.

The last panel on the right is devoted to the 250-direct-current feeder circuits. Three circuits are

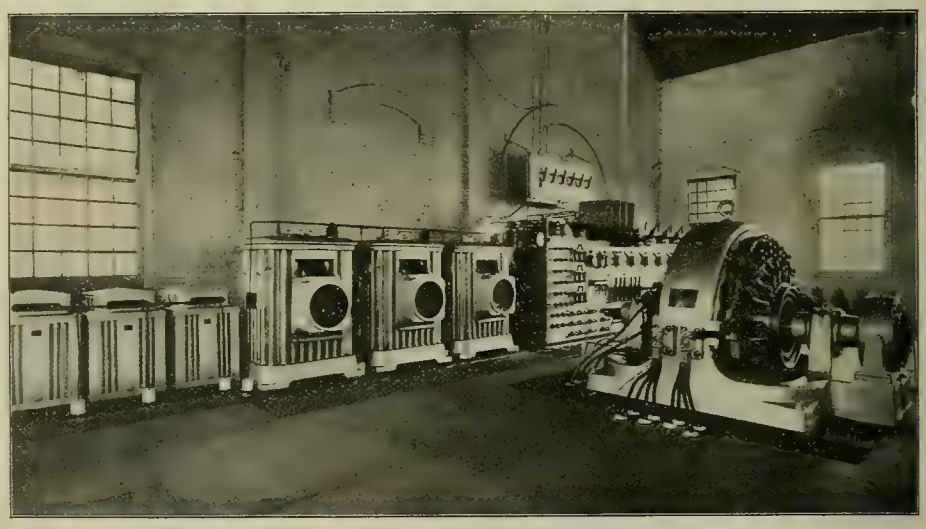


FIG. 3. ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.—TRANSFORMERS AND ROTARY CONVERTER.

provided with a pair of single-pole switches for each circuit. This panel is also provided with a 2,500-ampere Thomson recording wattmeter. The synchroscope and power-factor indicator are mounted on a swinging bracket at the left-hand end of the board and the 300-volt, direct-current voltmeter is mounted on a swinging bracket at the right-hand end of the board. At the right of the board is shown a panel for taking care of grounds on the arc circuits. By means of this board a 15-kilowatt transformer of equal ratio is cut in when an arc circuit is grounded, thus isolating the ground on the high-tension system.

All of the instruments, circuit-breakers, switches, etc., with the exception of the Thomson recording wattmeters, are of the Westinghouse manufacture. None of the feeder circuits is provided with fuses or circuit-breakers, it being considered unnecessary to provide protection for the lines. All generators are protected with circuit-breakers, and all motors in the mills are protected with circuit-breakers or fuses.

As mentioned above, there are only three direct-current feeder circuits leaving the main switchboard. These feeders are carried to distributing boards located at suitable points about the works, from which the individual motor circuits are distributed. The engineers of the Illinois Steel Company have found this method preferable to running a number of smaller circuits from the main switchboard, the saving in copper being considerable. The pole lines are constructed in the best possible manner and, as already stated, are provided with no fuses or circuit-breakers whatever, the protective devices being placed at the motors so that the main feeder circuits may be kept as free from interruption as possible.

The high-tension feeder line from the Economy company's power house comes in at one end of the electric station and is carried through to the opposite end above the switchboard, as seen in Fig. 5. It consists of three No. 0000, rubber-covered copper wires, carrying a 2,200-volt, three-phase current. A duplicate set is to be installed to provide against accident. The distance of transmission is about 1¼ miles. The feeders pass through a separate switchboard mounted above the main board and equipped with lightning arresters before reaching the receiving panel.

The reserve power plant is well shown in Fig. 5, the rotary and its equipment being seen at the farther end of the room. The reserve consists of two 150-kilowatt General Electric, one 120-kilowatt Westinghouse and one 62-kilowatt Thomson-Houston bipolar generators, separately belted to four steam engines. These machines are all 250-volt, direct-current generators. Steam for this reserve plant is supplied from three 300-horsepower Stirling water-tube boilers used in the rod-mill system. Should the Economy company have to shut down its power for any reason, the electrician at the steel works is notified by a private telephone line, and in from 15 to 20 minutes he can have his reserve station in operation. As a rule, from 45 minutes to an hour's notice is given, so that there is ample time to change over from the Economy to the reserve power.

One feature of peculiar interest in connection with this plant is the use of the 500-kilowatt, 60-cycle rotary. It has been found to be a most satisfactory machine, no trouble of any kind having been experienced. In changing over from the purchased power to the steel company's generated power, or vice versa, it is essential that the service shall not be interrupted. Therefore, this is done by starting up and running the direct-current generators in multiple with the rotary. If the plant is running upon purchased power, the direct-current motors are supplied through the rotary; if upon generated power, the alternating-current motors and arc lamps are supplied through the rotary. The rotary is started from the alternating-current end in the usual manner by means of the induction motor. It is started from the direct-current end by separately exciting the shunt field from the bus-bars and connecting the armature to the armature of one of the direct-current generators while the latter is developing a very low voltage. Then the voltage on the direct-current generator is gradually brought up to normal and the generator thrown onto the bus-bars. The rotary comes up to speed as the voltage rises on the generator, and its direct-current side is finally thrown onto the bus-bars also. The separate exciter of the rotary is then allowed to build up, and it is thrown onto the bus-bars also by closing the proper field switch of the rotary, thus putting the exciter and generator in multiple. The field switch which excites the rotary field from the 250-volt bus-bars is then opened, leaving the rotary run-

ning as a separately excited machine. The rotary is then brought into synchronism with the alternating-current supply and the switches on the alternating-current side of the rotary are closed. The rotary is run always separately excited.

The Joliet works of the Illinois Steel Company cover about 40 acres of ground and comprise three blast furnaces, two Bessemer converters, three rod mills, billet mill, spike factory, splice-bar shop, machine shops, etc. The principal products consist of rod, steel billets, spikes and splice bars. All the auxiliary machinery in the shops is electrically operated, and of the total motor equipment about one-fifth is of the alternating-current type. Considering the short length of time the alternating supply has been available—less than a year—this proportion of alternating to direct-current motors is regarded as important. The use of the alternating-current motors in the Joliet works has been most satisfactory, and the future development of electrical progress in steel making may be expected to lean strongly toward the use of the alternating current wherever practicable.

In Fig. 1 is shown one of the most interesting applications of electric motors in the Joliet plant. The machine illustrated is an ingot-charging machine, and is used in the furnace room of the billet mill to charge and draw the furnaces. On this machine is mounted a 20-horsepower, direct-current motor geared to the wheels for propelling the machine the length of the shop in front of the furnaces. A 35-horsepower direct-current motor is also geared to a hydraulic-pressure pump, the working pressure for operating the tongs of the machine being 550 pounds to the square inch. The motor is controlled automatically by variation in the pressure. Current for operating the motors is received from a double overhead-trolley line.

Fig. 6 shows a skip hoist used for charging pig iron and coke in the steel-mill cupolas, which are six in number. This hoist is operated by means of a drum shaft with a 35-horsepower Westinghouse railway 220-volt direct-current motor on each end, the motors being connected in series-parallel. One end of the shaft, showing one of the motors and at the extreme left an electric automatic brake, is illustrated in Fig. 7.

Practically all of the induction motors are belt-connected to their machines or to line shafting. One of the motors, shown in Fig. 8, is a 30-horsepower, type-C, 400-volt machine, and is installed in the roll-turning shop, where the rough rolls are prepared for the different mills.

The driving of a rod-mill roll train by an induction motor has been thoroughly investigated by the company's engineers, and it is considered feasible and very advisable. A motor for this purpose would be a 1,200-horsepower, 2,200-volt machine with resistance in the secondary for securing speed regulation, Such a motor would be by far the largest induction motor ever built, the largest now in operation being, it is said, of 800 horsepower. A blast furnace that is being remodeled at the Joliet works will be equipped with a new type of automatic ship hoist, designed by Mr. Eugene B. Clark, electrical engineer for the Illinois Steel Company. Mr. Clark has also designed much of the electrical equipment of these works, and it is largely to his credit that the alternating-current plant has been installed and placed in such successful operation. The electric system at Joliet is in charge of Mr. G. M. Sturgess, chief electrician at the Joliet works.

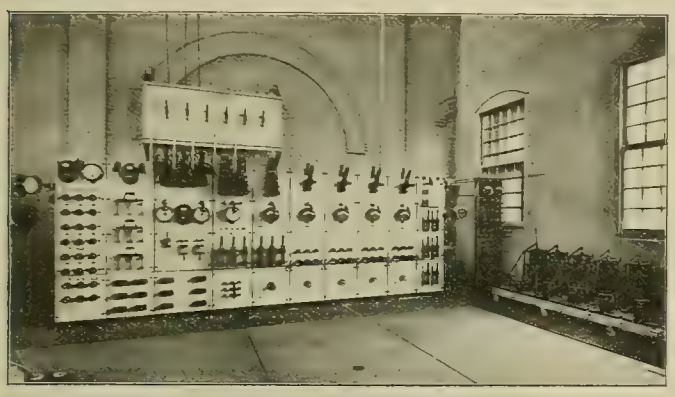


Fig. 4. Switchboard.

Fig. 6. Skip Hoist.

ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.

FIG. 7. ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.—DRIVING MECHANISM FOR SKIP HOIST.

The Commonwealth Electric Company of Chicago has certified to an increase in capital from $5,000,000 to $10,000,000. Of the increased capital stock only $1,000,000 will be issued at present, the remainder being issued as is convenient to the affairs of the company. A large plant is under construction on Fisk Street and the Chicago River, and the proceeds of the issue will be used to defray expenses incurred for this work.

Fire Hazard of Electrical Apparatus.

A disastrous fire broke out in the power house of the Helena Light and Traction Company at Helena, Mont., recently, completely demolishing the building and nearly all of the machinery, the exception being a number of oil-insulated transformers, which were practically uninjured. The building originally contained a steam plant, which has gradually been abandoned, power being purchased from the Missouri River Power Company, which supplies power from Canyon Ferry, 18 miles distant, over a double 11,000-volt circuit. The effects of the fire upon the high-tension apparatus of the Missouri River Power Company installed in the station may be summarized as follows: The high-tension switchboard, lightning-arrester equipment, and, in fact, everything but portions of the six 11,000-volt, 150-kilowatt, Westinghouse transformers, were totally destroyed. However, two of the transformers were not upset, and, being oil-insulated, their vital parts were protected from the fire. The oil did not burn away sufficiently to injure their coils or cores, and it is probable that it would not have ignited at all had not the covers been removed from the cases before the fire to facilitate cooling, the transformers being worked at a heavy overload. The four other transformers were standing on a wooden floor, and as soon as the latter was burned away they were upset and poured their oil into an engine pit below.

FIG. 8. ELECTRICAL MACHINERY IN JOLIET STEEL WORKS.—INDUCTION MOTOR IN ROLL-TURNING SHOP.

There were also in the station two 100-horsepower induction motors driving, through a line of shafting, six direct-current arc-light dynamos. The arc machines were totally destroyed, but, from the report of the appraisers, it appears that the induction motors were damaged only to the extent of 50 per cent. of their value. Although the marble distribution switchboard of the station was completely destroyed, there were found behind it three oil-insulated Westinghouse potential regulators in cast-iron cases, which were practically uninjured, the damage appraised being $20, to provide handles, cable terminals and cleaning up.

ELECTRICAL PROGRESS IN UNITED STATES IN 1902.

By Morgan Brooks.

It is generally believed that the various industrial applications of electricity have contributed largely to increase the wealth of the United States in 1902. The most obvious progress of the year is seen in more substantial construction, in increased efficiency, in commercial expansion—all signs of prosperity. This extraordinary development has been due to the engineer rather than to the inventor, to the sagacity of the capitalist as much as to the researches of the scientist. Electrical inventions no longer remain dormant, as did the arc, and even the incandescent lamp[1] for so many years.

Electrical manufacturing companies have been unable to make even reasonably prompt shipments. The extraordinary call for men of even moderate technical training has resulted in the increased enrollment in our technical and correspondence schools. The graduate no longer conceals his diploma, but has his choice of many positions. Even the undergraduate is sought. Renewed attention has been given to the problems of technical education, and conferences between teachers and practicing engineers, such as that at Great Barrington, Mass., last June, under the auspices of the American Institute of Electrical Engineers, will prove of substantial benefit. The recent invitation of the same society to technical institutions throughout the country to join in the reading and discussion of its papers by holding simultaneous meetings has been accepted with alacrity by many schools.

An incentive to "notable scientific or industrial achievement" has been established in the medal to be awarded annually in honor of the services of John Fritz to engineering. The four great American engineering societies join in determining the award.

The organization during the year of the National Bureau of Standards at Washington makes it possible now to have legal standardizing of all electrical as well as other measuring instruments. This may serve to expedite the introduction of the metric system of weights and measures, with which all electrical engineers are familiar. It is evident, from the growing vehemence of the opponents of the system, that they fear an impending change.

Electrochemistry.

The incorporation in April of the American Electrochemical Society with 355 members, since increased to more than 400, emphasizes the importance of electrochemistry. [A monthly periodical devoted to this subject has also been started during the year.] In no department of electrical engineering has progress in 1902 been more marked. Not only have the well-known industries, such as the production of carbide, of carborundum and of aluminum, increased their output enormously, but the growth of more recent developments might be described as startling, if we were any longer to be startled by anything electrical. Electricity has wrought a revolution in chemistry, not only by bringing such metals as aluminum and sodium, previously merely laboratory products, upon the market at prices reckoned in cents instead of dollars per pound, and causing the salts of potassium, calcium and barium to be sold by the ton instead of by the ounce, but also by superseding old-fashioned methods, such as that of making caustic soda. Moreover, a lively competition is in progress in the manufacture of phosphorus, graphite, and lead products by electrical methods. The carbides and the silicides seem destined to play an important role in the manufacture of iron and steel, and still further to increase the demand for these electrical products.

The emery manufacturers, not to be passively outdone by electrical carborundum, have introduced an electrical method of making corundum, and have taken up a strategic position at Niagara Falls, within view of their young rivals. Even the air has been harnessed by electricity, and compelled to give up its nitrogen to the chemist's uses, a factory for this purpose being one of the most recent acquisitions. One discovery has led to another. Rumors of other chemical products, such as artificial camphor and rubber, come from Niagara Falls, and several factories with sealed doors hint that we may look for still further revelations.

Three-quarters of the immense power already derived from Niagara Falls is used by the chemical and metallurgical industries, and it is probable that the same proportion of the output of the additional Niagara stations and of the recent installation at Sault Ste. Marie will be similarly used.

Power Plants.

The year has seen the erection of a number of exceptionally large power plants, both hydraulic and steam. The Niagara Falls Power Company has its second power house nearly completed; the new turbines are of enough greater efficiency to permit the installation of 11 5,000-horsepower units to use the same quantity of water required for the 10 present units. Some of the new generators have internal revolving-field magnets, a simpler construction. Upon the Canadian side an associated company is beginning the construction of an immense power plant, with 10,000-horsepower units, and an ultimate capacity of 250,000 horsepower. On the American side the Niagara Falls Hydraulic and Manufacturing Company is preparing to enlarge its modest plant of 30,000 to 100,000 horsepower. Even this enormous development will scarcely make a perceptible diminution of the water actually going over the Falls.

Last autumn marked the opening of the water-power plant of the Michigan Lake Superior Power Company at Sault Ste. Marie, Mich. Owing to the small head available and consequent turbine difficulties, the units are of but 400-kilowatt capacity, but as there are to be 80 of them the total capacity will be 32,000 kilowatts. (The new plant has discarded a horsepower rating.) This extraordinary plant, occupying a building more than a quarter of a mile long, presents the latest developments in switchboard practice. All circuits are electrically controlled from a comparatively small board, containing compact measuring instruments, and small auxiliary switches. Owing to the magnificent distances, the generator fields are excited by a 600-volt current. The carbide industry will utilize upon the spot about half the total capacity of the "Soo" plant, by using single-phase, 90-volt, 60-cycle currents. The remaining dynamos are of three-phase, 2,400-volt, 30-cycle type.

Another notable water plant has been started in 1902 in Montana by the Missouri River Power Company, following high-tension development in California with three-phase, 50,000-volt transmission, 65 miles. There are duplicate pole lines, with wires spaced 78 inches apart. The generators are wound for 550 volts only.

In steam plants activity has been quite as great. In New York city alone three plants—for the New York Edison Company, for the Metropolitan (surface) Street Railway Company and for the Manhattan (elevated) Railway Company—have recently been installed, the last marking the belated beginning of electric traction on the elevated roads. These plants have an aggregate capacity exceeding the power at present generated at Niagara Falls. The individual steam units are also notable for their great size. These stations show the harmony between alternating and direct-current working, for while all the systems distribute direct current only, all use alternating transmission. Here may be seen the latest types of combined horizontal-vertical engines and all the refinements of economical steam consumption and of boiler firing.

Such enormous power houses must not prevent recognition of the many important isolated plants, some of no mean size, and of the great activity of the year in replacing inefficient and small generators and steam engines with larger units of improved design.

The brilliant future of the steam turbine should not be overlooked. A notable installation, in connection with water, has been made at Hartford, Conn. The Commonwealth Electric Company of Chicago is now building a station to be equipped with enormous turbines. Their development seems to be chiefly in increasing power along the lines that have proved them so much more economical than reciprocating engines.

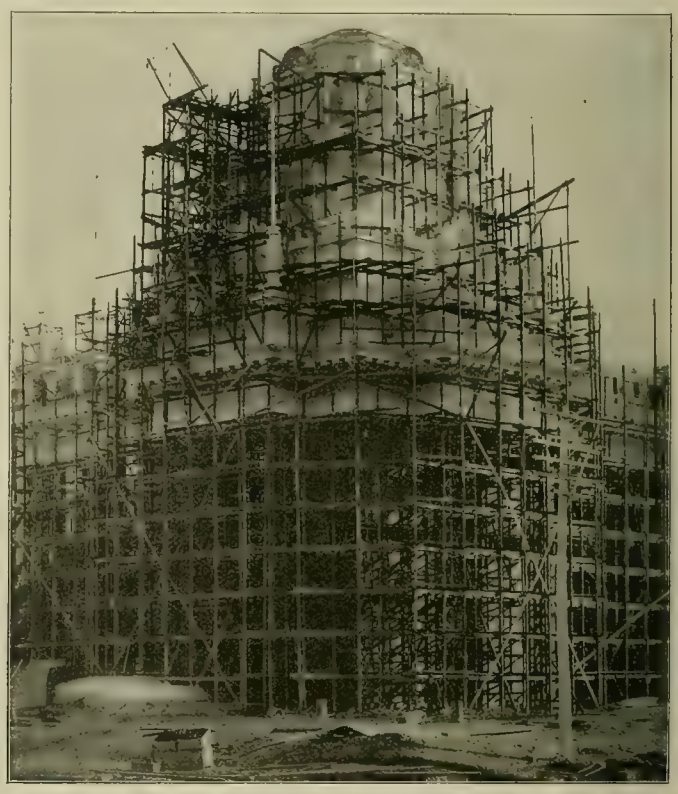
Motors.

Elaborate systems of individual motor speed-control have been installed at costs that would, until recently, have been prohibitory. Development has tended toward greater flexibility and perfection of details.

Electric Railways.

The building of cross-country electric roads has continued with unabated vigor. Here, as elsewhere, improved construction, equal in many cases to the standard on steam roads, is seen. Speeds have increased until it is becoming common to secure a private right-of-way. A typical example of such construction, with stone-ballasted track, concrete bridges, and the heaviest of track rails, with third rail for current, is found in the lately opened Aurora, Elgin and Chicago Railway. A feature of this road is the use of stranded aluminum wire for feeders. As in other modern roads, 600-volt direct current is standard for distribution, with alternating current for transmission.

The converter sub-station has been carried to a limit. To economize on the cost of permanent sub-stations, a New Hampshire road has equipped a car as a portable sub-station, to be moved from place to place, caring for special demands of traffic.



CORNER TOWER OF ELECTRICITY BUILDING AT WORLD'S FAIR.

The handling of perishable freight, such as milk and garden truck, upon electric roads, is increasing, and a recent (November) decision in the New York Court of Appeals, regarding compulsory interchange of traffic between electric and steam roads, with reasonable requirements as to freight-car equipment, bids fair to increase greatly the importance of electric roads. The same decision affirms the right of street-car companies to operate freight cars under proper restrictions upon city streets.

Perhaps the greatest question confronting steam-railway men at present is the possible application of electricity throughout. With the tendency toward lower rates of fare, electricity may prove the factor of economy wanted. The adoption by the New York Central Railroad of direct-current electric traction in the Fourth Avenue tunnel in New York city is not significant of electric progress on steam railways, as it was chosen solely to diminish the danger of tunnel operation with smoke-producing locomotives. It may, however, be an entering wedge. Steam-railroad companies are conservative, and await something superior to present direct-current practice. The satisfactory delivery of ample power with small current means the employment of an alternating system. Polyphase motors require at least two trolleys, and efforts have been made to devise a satisfactory single-phase system.

Mr. B. J. Arnold announced before the Great Barrington meeting of the American Institute of Electrical Engineers, on June 19th last, the principles of a new single-phase railway system, and it is stated that the preliminary tests are most encour-

1. Patented by King in 1848.

aging. An induction or synchronous motor is used, which runs continuously in one direction regardless of the direction of motion of the car. Neither the stator nor rotor is fixed relatively to the car, it being possible to operate each mechanically through two air engines. The motor has capacity equal to the average power requirements of the car and is run at full load. At normal speed of the car the motor is coupled through the air engines directly to the wheels, the direction of motion of the car depending upon whether the stator or the rotor is so coupled. When the car is standing still the motor operates the air engines as air compressors, and, in addition, uses the kinetic energy of the train in stopping for storing energy in steel tubes for use in starting, or in switching, or even in running, should the current be cut off for any reason. When it is remembered that the modern electric car uses air for braking and whistling, it is seen that little complication is added, with the great advantages of uniform station load, and an independence of operation hitherto unknown, except with storage-battery cars.

Another single-phase solution of the same problem has been announced for the Washington, Baltimore and Annapolis Railroad. Taking advantage of the fact that direct-current motors run in the same direction, regardless of the direction of current, the company which is to operate this road has equipped its cars with series-wound motors, similar to those commonly used on electric cars, and has applied a very low frequency (15 periods per second), single-phase alternating current with considerable success. Commutator troubles have been practically eliminated, and, by using a transformer upon the car, any desired voltage may be used upon the line, with consequent economy. The operation of this road will be watched with great interest.

MACHINERY BUILDING AT WORLD'S FAIR.—VIEW FROM THE INSIDE LOOKING WEST.

AUTOMOBILES.

In this electrical age the public has demanded the electric carriage, while electricians have purchased gasoline or steam vehicles, knowing the shortcomings of the present heavily loaded electric; yet fully expecting that the introduction of a light storage battery will eventually place the electric automobile in entire possession of the field.

STORAGE BATTERIES.

For lighting and power plants the use of storage batteries of the standard lead tyne has rapidly increased, many enormous installations having been made this year. The reliability of the secondary battery has reached a stage near perfection, and such installations are no longer looked upon as luxuries with present rate of interest.

LIGHTING.

A renewed growth in the electric-lighting industry may be noted. A remarkable wave of reduced charges for electric current has swept the country from New York city. New York was not the first to reduce rates, but the effect of a 25 per cent. reduction in the eastern metropolis was quickly felt in all parts of the Union. Probably increased prosperity is responsible for an observable return from Welsbach gas lamps to electricity. There is, moreover, a reaction from interior arc lighting to incandescents, with their greater possibilities for decorative illumination.

The beautiful Nernst lamp has obtained a strong foothold, and with its demand for 220-volt alternating current has extended the use of 220-volt lamps. For satisfactory color effects it has no superior. Of greater economy is the Cooper-Hewitt mercury-vapor lamp, as yet rather unsatisfactory as to color, and requiring direct current, but by far the most efficient of artificial lamps, even surpassing the arc in that respect. McFarland Moore is striving with the gas-tube lamp problem, and has made some remarkable demonstrations of economic illumination with lamps entirely disconnected from their exciting wires.

Minor improvements, such as what may be called "pin-cushion lighting" for quick decorative effects, turn-down lamps and sign-controlling devices are numerous and worthy of more than mere passing mention.

The modification of the Underwriters' Rules in 1901, making "low potential" include 550 volts, has resulted in a movement toward the use of an Edison three-wire system of distribution with 220-volt lamps and the discarding of transformers within reasonable distance of a central station. At the same time, a distant customer may be supplied at higher voltage.

HEATING.

An improvement in electric heaters is announced, doing away with wires entirely. A carbon or other conducting film replaces the wire, and promises reliability with cheapness. The electric heater must remain a luxury, except upon the smallest scale, or in such exceptional conditions as those of a street car, until the charges for current are greatly reduced.

TELEGRAPHY.

In the field of regular telegraphy it is not possible to report any progress. This is not for want of inventions—matured inventions—for we have the page-printing typewriter telegraph of the late Professor Rowland, and the sine-wave high-speed instruments of Crehore and Squire, as well as other promising inventions. In other fields of electricity such inventions would have had active commercial trial.

The year 1902 closes with the laying of the cable from San Francisco to Honolulu, and the opening of the "all-British" cable from Vancouver to Australia. Both these cables were manufactured in England, but that our own factories can make submarine cables of superior quality in competition with England is shown by the laying of an American-made cable from Vera Cruz to Campeche for the Mexican government early in the year.

Another long step in wireless telegraphy was announced on December 21st by Marconi, who has spanned the broad Atlantic with actual messages from Cape Breton to Cornwall in England. Faint signals were received a year ago, but at Newfoundland, a somewhat shorter distance. This achievement is indeed a climax, rewarding all Marconi's efforts, for to him is due the extension of the message distance from 100 to 2,000 miles. In the United States Professor Fessenden has been active in the wireless field, receiving a patent on December 2d for a receiver of greater sensitiveness than the Branly coherer, and one which may lead to wireless telephony. So far, wireless telegraphy has been a feeder for the land-telegraph lines. That wireless communication will supplant the ordinary is unlikely.

The policy of the great telegraph and telephone companies not to invade one another's preserves has perhaps delayed the simultaneous use of wires for telegraphy and telephony in this country, although this is being done in a small way for appointments by the American Telegraph and Telephone Company.

TELEPHONY.

Development in telephony is seen in the phenomenal increase in the use of instruments by Bell and Independent exchanges, and especially by private systems, some of which, like the installation by the Illinois Central Railroad during the year, are of remarkable extent. More elaborate construction is also noticeable in telephony. Great systems of telephone tunnels, like that at Chicago, are building. A reduction of exchange rates, especially to the small user, has increased business materially. Reduction of long-distance charges, particularly by reducing the minimum time charged for, even to one minute in the Northwest, has attracted a new class of business. The importance of the Independent toll lines should not be underestimated. A novel mechanical method of distributing toll-message calls to the proper operator has been introduced in the Chicago exchange during the year. There is a renewed interest in automatic exchanges, due to greater perfection of detail than ever before. The new Chicago telephone system expects to use 25,000 of the automatic instruments, as soon as they can be manufactured.

The Pupin method of reducing retardation in telephone lines by the insertion of induction coils in series in the circuit has been put into operation between New York and Chicago, to the improvement of the service.

ELECTRICAL PROPERTIES AS INVESTMENTS.

The greatest hope for continued electrical prosperity lies in the changed attitude of the investment interests toward electrical properties. Capitalists are ready to foster legitimate enterprises, under competent engineers, and are no longer deceived by the preposterous schemes of the promoter. Excessive profits are not expected. The progress of 1902 seems to presage an equal advance in the new year.

Electrical Preparations for St. Louis Exposition.

[From the St. Louis correspondent of the Western Electrician.]

Although scarce 10 months have elapsed since the organization of the Department of Electricity of the Louisiana Purchase Exposition, yet much has been accomplished through the activity of Professor W. E. Goldsborough, chief of the department. The beautiful building set apart for the exposition of all that applies to electricity and its uses is rapidly nearing completion, and, at the date of writing, glaziers are putting the finishing touches on the huge windows and skylights that will make it one of the best lighted buildings ever erected for exposition purposes.

The accompanying views give at best a poor conception of what the Electricity and Machinery Buildings will be when completed. The four corner towers of the former will be crowned with groups representing Electricity, Magnetism, Heat and Light, while numerous figures will complete the extensive scheme of ornamentation. A heroic statue of Henry will be located at the main north entrance, while one of Volta will grace the southern gateway, and smaller statues of Ampere, Ohm, Faraday, Maxwell, Franklin and Morse are proposed for the six secondary entrances. The interior court will be made inviting by the lavish use of aquatic, horticultural and sculptural effects, while the wide gallery surrounding will resemble a palm grove.

Manufacturers of electrical apparatus all over the country are taking an unprecedented interest in the World's Fair, and it is stated on good authority that applications have been filed for over 60 per cent. of the total space allotted to American manufacturers.

The keynote of Chief Goldsborough's exploitation has been "working exhibit," and hardly a piece of literature has emanated from the department in which the advantage of a working display has not been contrasted with the ineffectiveness of showcases filled with products, however well arranged. The very liberal policy of the exposition in providing space free and free power for working exhibits, where meritorious, will result in a collection of small factories and assembly rooms in active operation, and there is no doubt but that the electrical exhibit will prove an object lesson of great value to the millions of visitors, as well as an advertising medium of the most advanced type. No longer will the layman wonder how it is that in a few seconds he can be put into communication with a party in another city. The latest examples of multiple central-energy

switchboards will be in operation, with attendants to explain their workings. Nor will the little light-emitting bulbs be a source of wonder to the visitor. He will see the globes blown, the filaments prepared, flashed and deftly attached to the platinum wires, the vacuum established, and the lamp tested and rated.

He will see sand, coke and salt put into the electric furnace, and carborundum, the king of abrasives, will be formed by the intense heat there developed. Then, too, if he be of an inquiring turn of mind, he can watch the assembly of wattmeters of various types and obtain an insight into the workings of the instrument that determines his light bills. The most favorable facilities will be offered for the comparative testing of various products, and this phase will be of the greatest interest to the intending purchaser.

Thus it will be seen that the aim of the department is to bring together, in the most instructive and valuable form, a collection of exhibits that will mark the phenomenal progress in the electrical arts.

The wide acquaintance of the chief of the department has greatly facilitated the work of securing the co-operation of the electrical manufacturers in the proposed exhibitors' power plant, and already over 7,000 kilowatts of generators of various classes has been placed at his disposal This is in addition to the 8,000 kilowatts to be installed by the Westinghouse company. This power plant will consist of boilers, generators and engines installed by different exhibitors, and the electrical energy developed will be utilized for lighting and power purposes. Perhaps the piece de resistance so far secured will be the 3,000-horsepower Cockerill gas engine secured by Lieutenant Carden of the Department of Machinery, in a recent visit to Belgium. This monster weighs 200 tons, and will develop five times as much power as the largest gas engine at the Paris Exposition. The perfection and enormous output obtained by the foreign manufacturers of gas engines is, as yet, unapproached in this country, and their exhibits will undoubtedly be carefully studied by the American engineers.

Chief Goldsborough has been particularly active among the technical societies, and, one after another, they have fallen into line and passed unanimous resolutions indorsing the attitude of the Department of Electricity toward the electrical and allied industries. Among the societies taking such action are the National Electric Light Association, Independent Telephone Association of the United States, American Electrotherapeutic Association, American Electrochemical Society, American Street Railway Association, Interstate Independent Telephone Association and the American Roentgen Ray Society.

The appointment by President Francis of a committee on international congresses leads to the question of a great gathering of scientists, whose names are known to every student and worker in the electrical field, and it is to be hoped that, in the realization of the plan, an international electrical congress may assemble that will rival the notable Chicago congress of 1893.

Especial attention will be given to electrochemical and electrotherapeutic problems and, with the co-operation of the chief of mines and metallurgy, exhibits showing the application of electricity to mining and the reduction of ores are promised on a large scale.

With the practical completion of the building, over half of the space applied for, and the rapidly growing interest as manifest by the inquiries and offers of co-operation from manufacturers, engineers and inventors, and nearly 18 months in which to develop and round out the extensive plans outlined, there is little doubt but that the electrical display at St. Louis will be even more wonderful and successful than anticipated by the most sanguine. F.

The Power of Marconi's Apparatus.

An idea of the extraordinary power that is used at Marconi's Table Head station for transmitting messages across the Atlantic by space telegraphy is given by Dr. Parkin, who sent to the London Times the first complete message a few days ago. He says the apparatus is of such remarkable power that the sound, as each letter is transmitted, is so great in volume that it is necessary to use cotton as a protection for the ear-drums. He compares the sending of a message to a miniature thunderstorm. A spark, fully half an inch in width, is shot out upon the air when the key is pressed.

The Hamlet Electric Light Company of Hamlet, N. C., has been incorporated with a capital of $100,000. The company purposes to establish electric-light plants. The incorporators are G. O. Sanders, F. C. Allen and N. G. Stewart.

ELECTRICAL PROGRESS ON THE CONTINENT IN 1902

By Francis E. Drake.

In spite of almost universal depression not only in the electrical and allied industries, but in nearly every branch of commercial activity, there will be found unmistakable signs of progress in nearly every country, although the struggle to keep many of the old enterprises intact and the new and partly tried ones from complete liquidation has made the year one of discouragement to investors, engineers and workers alike.

Russia, with her limitless territory and partially developed manufacturing industries and lack of capital for electrical enterprises, as they are known in the more Western countries, will show relatively about the same forward movement as her neighbors. Austria and Hungary suffer from internal political dissensions and legislative deadlocks, so that even if all other conditions were favorable capital would flow rather timidly into electrical enterprises.

Italy possesses great natural waterpowers, which will eventually be a source of encouragement and profit to the northern section especially, where electric railroading has received a strong impetus, as shown by the Valtellina line, which will be more fully referred to below. So far, there are few electrical manufactories in Italy, most of the apparatus used being supplied by Swiss, German and French builders.

Germany is by far the most important center for electrical manufacture and exploitation in the whole of Europe. It has been commonly stated that the present depression in Germany was due to the reckless expansion of the electrical industry, carrying in its downfall the innocent allies and general commercial world. This is so manifestly unfair and wide of the mark that it is interesting only as it shows how the public frequently confuses cause and effect. The electrical industries of the Continent have not been overcapitalized and inflated to a greater average degree than many other lines.

During the present year the shrinkage in values has been far more than during previous years. There are many concerns which, according to facts and sound finance, should be liquidated. In fact, if these properties were owned principally by the public, instead of by the various banks, nothing could save them from a receivership. Without entering upon a discussion as to the wisdom of bank ownership and management, we may admit that the plan has had the effect of supporting properties during the crisis, when, had they been forced into liquidation, many innocent parties as well as the workmen supported would have suffered. This policy is also thought to be effective in preventing the widespread liquidation of small independent concerns who could hardly sustain themselves in the face of the great calamities.

Since the electrical manufacturing concerns reflect, more or less, the condition of the entire industry the following table will be interesting as indicating the general situation:

	Total stock and bonds in marks.	Last dividend 1901. Per cent.	Stock quoted Jan. 1, 1902.	Quoted Nov 1, 1902.
Allgemeine	75,000 000	12	180	170
Siemens-Halske	84,500,000	8	141	113
Schuckert	77,000 000	—	99	76
Union	34,000 000	6	120	109
Helios	40,000,000	—	35	11
Lahmeyer	12,000,000	10	110	68

Of these principal and well-known concerns the Helios company is hopelessly entangled and can no longer be considered as a live factor. Schuckert & Co. admit a deficit of 16,000,000 marks in their last year's balance sheet, and have had such internal dissensions and trouble that only heroic measures can save the concern from reorganization at least. Lahmeyer, in spite of a very active policy, is sorely pressed financially, as may be seen by the late estimate of the Bourse.

FIG. 1. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—TYPICAL TUNNEL ON VALTELLINA LINE IN ITALY.

The Allgemeine has held its own and is entrenched by strong reserves, powerful bankers, a modern plant well written off and an aggressive commercial management. Siemens-Halske have the prestige of great age, large achievements and government favor. Their facilities are somewhat antiquated, but since they are largely patronized by the government for telegraph, telephone and railway signal work, their heavier products may not figure so largely in an analysis of their present condition.

The Union is the youngest of the principal concerns occupying an important relation to the field, and as licensee of the General Electric Company has the advantage of the successful experience of

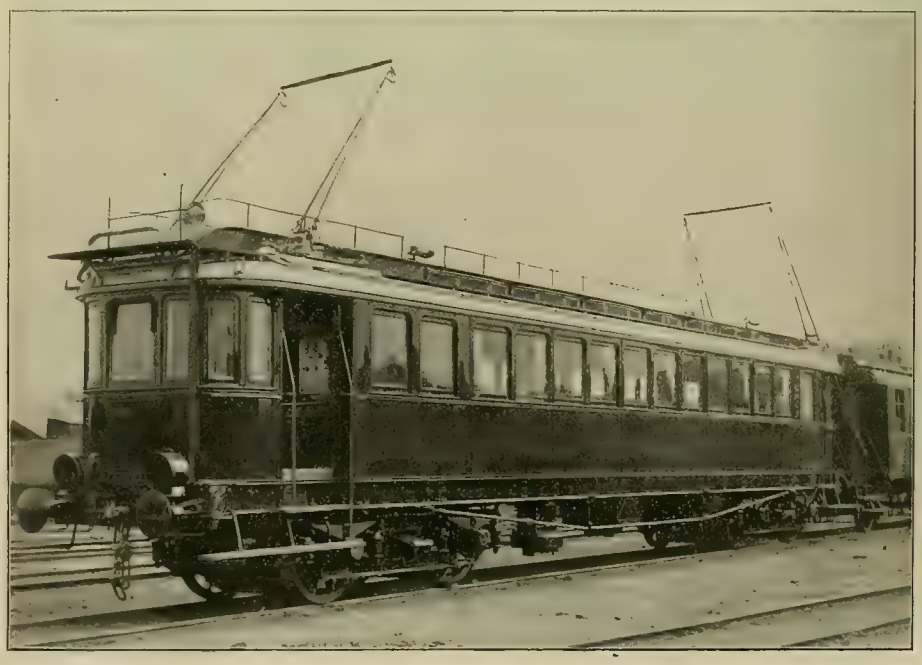


FIG. 2. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—MOTOR CAR ON VALTELLINA THREE PHASE LINE IN ITALY.

the greatest American company. It has held the lead over all in the tramway field and has done excellent work in other lines, notably harbor crane work, of which we have no examples of note in the whole of the United States. Judging the Union by the financial measure—the Bourse—its securities have sustained a smaller percentage of loss than any concern excepting the Allgemeine.

Passing to the several companies financing and operating electric plants, tramways or other enterprises, we have the following:

	Total stock and bonds in marks.	Dividend 1901. Per cent.	Stock quoted Jan. 1, 1902.	Quoted Nov. 1
Continental, Nuremberg	52,000,000	7	50	48
El. Undertakings, Berlin	65,000,000	4	92	81
El. Undertakings, Zurich	52,400,000	6	114	115
El. Undertakings, Col'gne	16,000 000	—	30	—
Light and Power, Berlin	40,000,000	5	94	85

These concerns do not show quite as great a depreciation during the year as the manufacturing companies, but being held in most cases by banks, the shares are not active. No doubt the coming annual reports will cause a general decline as their undertakings have been almost uniformly unprofitable.

The continental manufacturers have been active bidders for English work and have in several important cases been successful. There is a strong feeling, however, at present in England against the policy of giving large orders to German and Belgian

FIG. 4. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—PNEUMATIC TROLLEY VALVE ON VALTELLINA ROAD IN ITALY.

builders, and the prospect is not encouraging for continental houses. Their plants are far larger than home demands justify, and export business is ardently sought. Manufacturing and operating costs are considered at minimum values whenever a foreign order is in sight. Raw materials and wages are lower than at any previous period since the industry could claim much attention.

For some months plans for the fusion of the Allgemeine and Union companies have been under consideration, and cable advices just received make public the successful termination of the scheme. This consolidation brings together the most important banking interests identified with electrical enterprises and will strengthen the industry in Germany. The fusion is based upon an exchange of three shares of Union stock to two of Allgemeine, both concerns continuing their separate organization but with a uniform policy obtained by making the present directors officially connected with both corporations. Economy of management will no doubt follow, and the cessation of severe competition between these two rival concerns will steady the market and advance the value of their securities.

The success of this fusion predicates an extension of the combine. It can be predicted that the Siemens-Halske will early succumb to the blandishments of the trust when assurances can be given that the name of Siemens can be preserved and duly recognized.

Electric Railways.

The most significant advance in the railway field has been the successful commercial opening of the Valtellina line in Italy, which was designed and equipped by Ganz & Co. of Budapest. Since this is the first important line to be equipped for using three-phase current a brief description may be permitted. The Valtellina road is 100 kilometers long, of standard gauge, and has been in service as a steam road. The conversion has been made to electric without disturbing the regular functions of the system. The line extends along Lake Como and the Adda River with three branches—Lecco-Colico, Colico-Chiavenna and Colico-Sondrio. The water-power of the River Adda is utilized at Morbegno, where a head of 30 meters is used to drive three turbine-alternators of 2,000 horsepower each at 150 revolutions per minute. Three-phase current at 20,000 volts is taken direct from the generators to the distributing mains, and nine static transformer stations along the line transform the current to 3,000 volts, which is the working pressure of the motors.

There are 32 tunnels on the line—a typical one being shown in Fig. 1—and except in these tunnels the high-tension wires are carried on the same poles

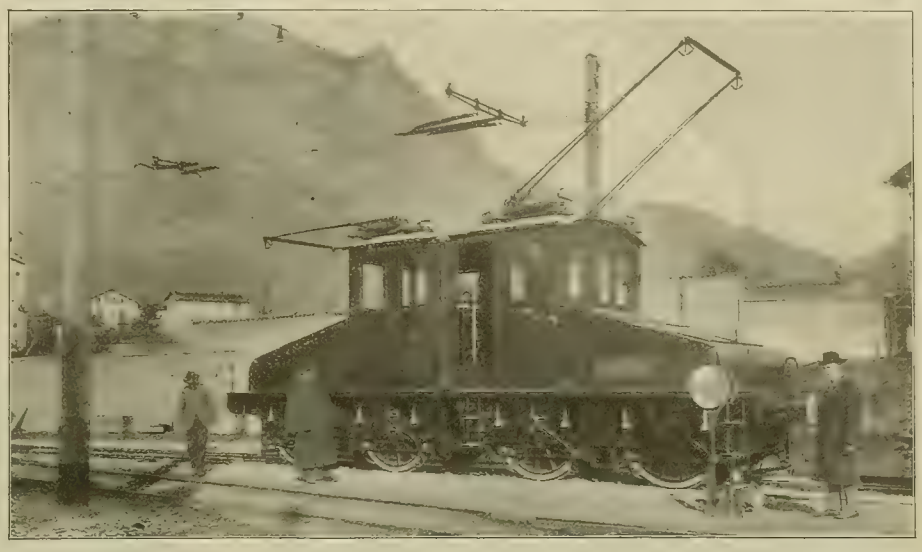


FIG. 3. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—LOCOMOTIVE ON VALTELLINA THREE-PHASE LINE IN ITALY.

as the 3,000-volt feeders to trolley wires. Much difficulty was encountered in securing types of insulators and attachment devices for these tunnel trolley wires. During the construction period ordinary locomotives were hauling trains over the line and the fumes and gases emitted were damaging to overhead systems devised to carry 3,000 volts.

The present equipment, which was put in official service on September 4th last, consists of 10 motor cars for passenger and express service and two locomotives for freight trains. The motor cars (one is

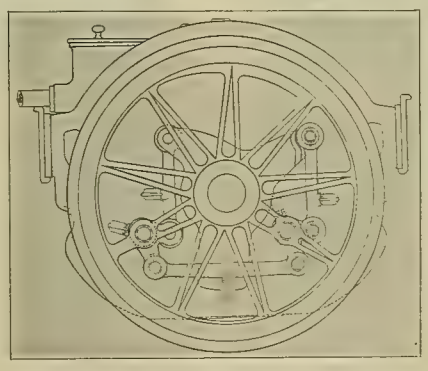


FIG. 5. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—COUPLING DEVICE ON VALTELLINA LINE.

illustrated in Fig. 2) weigh 53 tons each, and draw trains consisting of five to seven passenger trailers of 10 to 12 tons each. There are four motors on each motor car attached to the axles through special flexible couplings. In starting, and when running at half speed the motors are connected in "cascade," the current from the secondary part of the primary or 3,000-volt motor being conducted to the primary part of the secondary motor, in whose secondary the starting rheostat is inserted. The maximum speed is 67 kilometers. The locomotives (see Fig. 3) have a similar equipment to the motor cars except that but one speed—33 kilometers an hour—is provided. The locomotives can exert a maximum draw-bar pull of 8,000 kilograms.

The starting resistances are of the liquid type, and air pressure is used to raise or lower the level. The air-compressor is operated by a small motor fed by a low-tension transformer, which also furnishes current for lighting the car, fans, etc.

A rather unique device has been adopted for raising and lowering the trolley by means of compressed air. The general construction of the value is shown in Fig. 4. In Fig. 5 is given a drawing showing the device used to couple the motor to the driving wheels.

This line is being closely watched by all engineers and its commercial results will, if favorable, stimulate three-phase railway work throughout the world. The engineers of Ganz & Co. deserve great credit for the practical solution of many problems occurring in this, the first real practical test of alternating-current railway work. The mountain roads of Switzerland do not give the same opportunity as afforded by this Valtellina road.

In Berlin the high-speed experiments at Zossen, conducted by the Allgemeine and Siemens-Halske companies have during the year made little headway. Both concerns have completely changed the trial cars of last year and have reached a speed of slightly over 100 kilometers an hour. The value of these experiments as a means of procuring data on wind resistance, mechanical arrangement of trucks and motors, efficient trolley contacts, etc., has been very great. That the present motors, means of control, etc., are but tentative, is conceded by all students of these tests.

Notable among the great developments along standard lines is the Metropolitan underground of Paris, which still carries more passengers daily than any other similar system. Many new lines and branches are now under construction and in project, so that the city will eventually possess a most comprehensive system of tunnel lines.

Train Lighting.

There is active and energetic work in electric train lighting throughout the continent. The best known and used systems are the Stone (English), the Vicarino (French), and Boehm (German). The advocates of these and other systems have no difficulty in securing the co-operation of the various authorities to equip trains and even whole divisions. The Russian and German railroads are making trials with storage-battery and axle systems, and will soon place

FIG. 7. ELECTRICAL DEVELOPMENT ON THE CONTINENT.—ROCK CRUSHER IN SOUTH GERMANY.

in service steam turbines on the locomotives which will drive dynamos of requisite capacity for the trains. None of the known systems has yet arrived at a stage of commercial progress which will predicate a general adoption.

Telegraph.

The telegraph service on the continent has been augmented by about 10 per cent. increase in new lines and mileage and about the same proportionate increase in messages transmitted. In Germany the system of multiplex printing telegraph invented by the late Professor Rowland has been under critical test and examination with gratifying results. A

regular service between Berlin and Hamburg has been installed and sold to the government, and preparations are under way for a Frankfort line, to be built at an early date. The system has been much improved since its first public exhibition in Paris in 1900, and finds strong advocates among the most critical government telegraph engineers. The Italian government has contracted with the Rowland people for a line from Rome to Naples, for which it is clamoring now that the German experiments are so satisfactory.

In wireless or aerial telegraphy there have been sensational developments, but serious rivalries and commercial difficulties have served to prevent the public from gaining a clear idea as to the relative position of the various inventors and claimants. The German government invited the principal nations to appoint delegates to an International Convention to study the subject and to formulate some rational plan of dealing with it. England, the United States, France, Italy and Russia have responded favorably to the invitation and the meeting will no doubt take place during the early summer.

The Allgemeine and Siemens-Halske companies have been for months in a legal controversy over the question of priority of the patents granted to the inventors of the Slaby-Arco system on one side and Professor Braun on the other. The courts are not expected to pass upon this controversy for several months.

TELEPHONE.

About the most important addition to existing facilities in this branch of the public service has been the opening of a line from London to Brussels with a toll rate of 10 francs per five-minute connection. The prospective business for this line is very important.

The purchase of the Pupin patents by the Siemens-Halske Company indicates the appreciation on the part of foreign engineers and manufacturers of this decided improvement in speech transmission.

LIGHTING.

In arc-lighting circles the most notable progress is visible in the widespread introduction of the Bremer lamp and its prototypes. A year ago there were only a few lamps in public use where to-day there are thousands. The long-burning arc lamp so universally used in the United States has never received favorable consideration from European users and engineers for two reasons—first, the preponderance of violet rays, and second, that the individual user of arc lamps on the Continent almost invariably does his own trimming, and therefore applies to the central-station manager for assistance only when repairs are needed or other failure occurs beyond the mere care of the lamp. The yellow color of the Bremer light meets with little or no criticism, while the enclosed lamp is generally detested.

The Nernst lamp is being very actively pushed and many are in commercial use. The financial results to consumer or maker have not as yet been fully or reliably established. That the lamp must still undergo considerable evolution is generally conceded.

SPECIAL APPLICATIONS.

In mining and mill work much is being done to broaden the scope of the electric motor. Heavy mining pumps are being operated by induction motors, direct-connected, at the extreme slow speed of 100 to 125 revolutions per minute and a maximum of 1,000 horsepower and over. The other extreme is also found in pumps of the Sulzer type direct-connected to 150-horsepower motors running 1,200 to 1,500 revolutions.

Hoists are being designed and built to be operated by electric motors up to 2,000 horsepower. Several schemes are offered, the most popular being the one in which the variation of speed is obtained by field regulation. At the Düsseldorf Exposition a large hoist was shown by the Siemens-Halske company where rheostatic control was utilized. Practical engineers will not admit the feasibility of this method when a current volume of 3,000 amperes must be broken every half minute. This particular hoist will soon be in service, when opportunity for positive results will be afforded.

In smaller sizes three-phase motors up to 250 horsepower have already been successfully installed. Typical underground work in South German mines is shown in the illustration (Fig. 6).

A very practical stone crusher, motor-driven and mounted for use on rails, has been developed and is shown in Fig. 7. These units have proven to be extremely economical and have a distinct place among special applications for mining work.

The manipulation of dampers at the top of blast-furnace stacks by enclosed direct-current motors semi-automatically controlled has become current practice near Dortmund. Certain features of the application, as shown in Fig. 8, will appear novel to those interested.

IN GENERAL.

While the industry on the whole has experienced a grave depression, a distinct forward movement toward standardization of apparatus and installation has taken place. If the engineers have been held back from interesting new work for lack of funds, it is equally true that the absence of regular orders has stimulated them to study new fields and to prepare for a more favorable business condition.

Fig. 6. Typical Mining Locomotives near Dortmund, Germany.

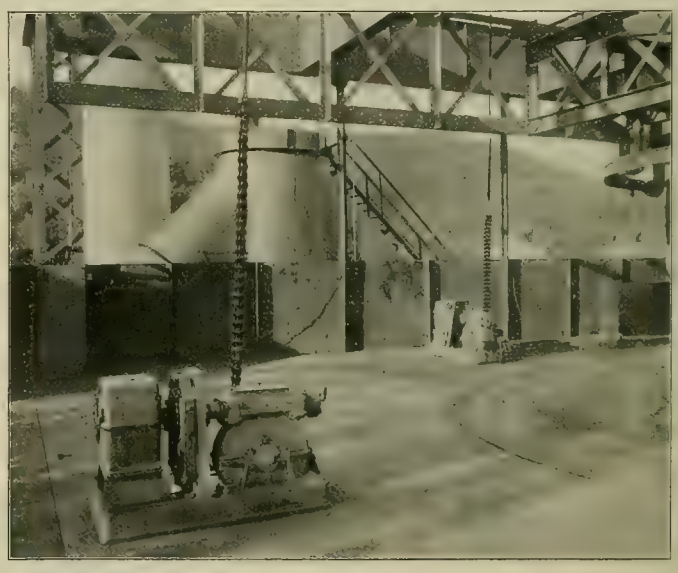


Fig. 8. Motor Application for Operating Dampers on Blast furnace Stacks.

ELECTRICAL DEVELOPMENT ON THE CONTINENT.

Electric Heat for the Third Rail.

The recent blockade on the Manhattan elevated system in New York has brought forward all kinds of schemes for removing ice and snow from the third rail during stormy winter weather. The latest proposal comes from Elias E. Ries, an electrical engineer of New York city. Mr. Ries has devised a scheme for raising the temperature of the third rail by electricity, thereby to melt the ice from it.

By connecting the third rails of both the up and down tracks of a system at intervals of about 2,000 feet, short sections would be constituted, in each of which there would be an opportunity for a complete circuit. In these Mr. Ries would cause a current to flow that would be entirely independent of the one used to propel the cars. The latter has a pressure of 550 volts. What the inventor wants is one of 25 volts. Moreover, the driving current is of the direct type. For the work to be done an alternating current would be the most convenient. This could readily be obtained from the wires which the railroad company employs for lighting its power house and sub-stations. This has a pressure of 2,500 volts, but by the means of transformers would be brought down to any desired level. One of these transformers would be placed in such a position as to feed each of the 2,000-foot sections into which the road would be divided.

The inventor believes that the apparatus and work of installing it would not amount to more than $10,000 for 10 miles. When it was in service, an increase of temperature of about 20 degrees, if necessary, would be effected, with an expenditure of about 400 horsepower, or the amount of current required to start a train. After a few minutes much less current would be adequate to maintain the warmth.

Electrical Imports of the Philippine Islands.

The War Department has completed its compilation of statistics showing the commerce of the Philippine Islands during the fiscal year of 1902 (ended June 30th), from which it appears that the import trade of the islands during that period was the largest in their history. The importation of metal and metal manufactures, including machinery, cars, carriages, etc., increased from $3,038,284 in 1901 to $3,631,401 in 1902, a gain of $593,117; the United States showing an increase from $564,108 to $728,730. The United Kingdom still retains the lead in these lines, although the United States during the last year shows a greater gain in iron and steel and their products than any other country, except the British East Indies, which, in addition to a few small shipments, is credited in the month of November, 1901, with $244,395 worth of cars for steam railways. In the absence of more definite information on this matter, it is presumed that the shipment did not originate in the East Indies, but consisted of a consignment from some other country, which was transshipped at Singapore.

The imports of electrical instruments during June, 1902, amounted to $5,225, of which $3,854 came from the United States. The total value of these imports during the year was $27,949, of which $15,517 came from the United States. During the entire American occupancy of the islands the importations of electrical instruments from all countries, up to June 30, 1902, amounted to $57,472, the United States leading with a value of $34,228; France second, with $5,750, and Germany third, with $4,422.

The total value of the importations of incandescent lamps during the entire period of occupancy was $7,049, as follows: British East Indies, $2,303; Austria-Hungary, $1,879; United States, $1,608; Germany, $581; Australasia, $400; China, $212; Belgium, $57; Hongkong, $5, and United Kingdom, $4.

Electrical machinery is imported considerably, the only importation in June being from the United States. For the total time of occupancy the value of these importations was $39,398, the United States leading with $30,302; Germany, $5,678, and the United Kingdom third, with $1,441, France coming a close fourth, with $1,022.

Mansfield Technical Society.

The Mansfield Technical Society of Mansfield, Ohio, has been organized among the officers and employes of the Ohio Brass Company of that city. The object of the society is the promotion of technical knowledge among its members. The regular meetings of the society are held on every third Tuesday, at which time papers pertaining to various branches of technical work are read and discussed. A reading and reference library has been established in connection with the society, and a number of technical papers, trade journals, etc., are kept on file for the use of the members. Any contributions in the way of scientific or trade papers will be thankfully received by the society.

THE ELECTRICAL INDUSTRY IN GREAT BRITAIN DURING 1902.

[From a Special Correspondent of the Western Electrician.]

The electrical industry in Great Britain during 1902, despite the South African war, which terminated in the first half, and other adverse influences, such as the "American invasion," has shown a steady determination to keep abreast with the times. Whereas in 1901 telephony was the most absorbing topic, this branch of the industry gives way emphatically at the moment to electric traction. Indeed, the year 1902 has seen great strides in the application of electricity to locomotion, and the interest shown by the managers of the leading steam railways of the country in the possibilities of electric traction augurs well for the manufacturers of this plant during the coming year. As will be seen later, telephony, viewed from the municipal standpoint, would appear to have taken a somewhat retrogressive step. Electric power transmission over large areas, however, is gradually extending its influence, and the recent evidence of the greater willingness of the Board of Trade to enforce a little less rigidly its powers respecting the use of overhead wires should gladden the hearts of those who have for many years advocated this.

Electric Traction.

Throughout England the progress in electric traction has been more pronounced, probably, than at any time in the history of the industry. In London, where the main interest has centered by reason of the appearance of Mr. Morgan in conflict with Mr. Yerkes, the controversy has raged, not so much from the engineering point of view or from the point of view of the suitability of electric traction under London conditions, but as to the capabilities of various sets of promoters to cater for the public convenience and conveyance. It is perfectly obvious that, in crowded cities like the metropolis, the sanctioning by Parliament of piecemeal railways deep down under the surface is all against public interest and possible future developments, and it is in this respect that Mr. Yerkes, having secured the direct control of so many belated tube railways, as well as the Inner Circle, and the indirect handling of the London United Tramways Company, is in a most satisfactory position for standardization of fares and organization, if he is so disposed. Whatever his intentions are—and from daily-newspaper interviews, he would appear to assume a very philanthropic attitude toward the British workingman—he is in far too strong a position for Morgan or any other outside promoter coming fresh into the field to menace seriously his prospects. So far as actual mileage is concerned, London is in very much the same position as it was two years ago, but by reason of the formation of Mr. Yerkes' Underground Electric Railway Company of London, which has taken up and is rapidly developing many stagnant concessions, the map of London underground electric railways presents a vastly improved appearance. Without going too deeply into details, the sole result of the last parliamentary session has been absolutely nil, but the greater activity of Mr. Yerkes in pushing forward lines sanctioned years ago, makes the lack of new schemes not undesirable. Although this places a certain monopoly in the hands of this one particular American millionaire, the electrified Inner Circle, with its associated lines and means of intercommunication with other steam railways (which may be looked to to similarly electrify in the near future), will so completely be able to disseminate the traffic, north, south, east and west of London, that any contemporary schemes must of necessity overlap, and financial failure would await someone.

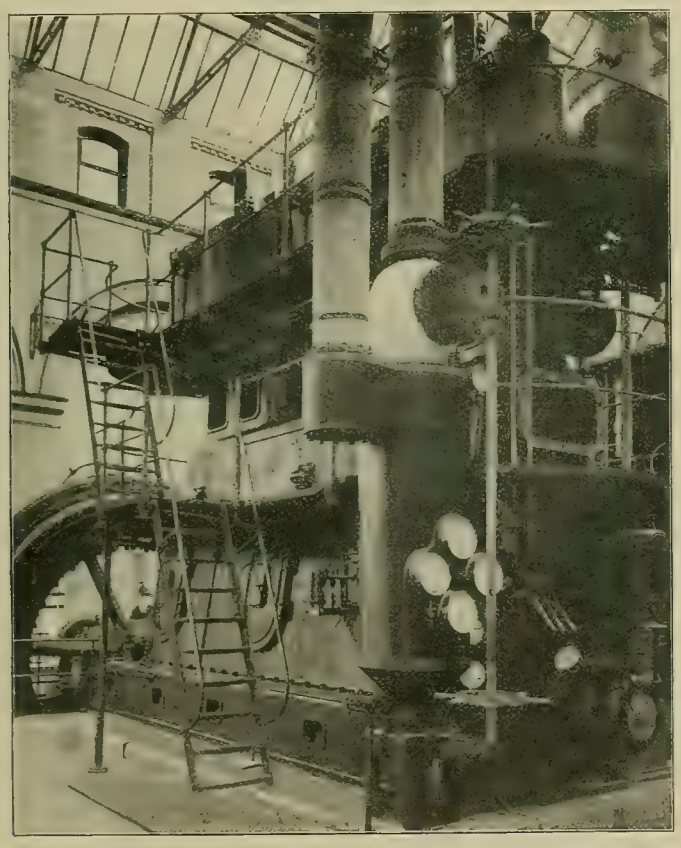
With regard to the power house which the Underground Electric Railway Company of London is building for the supply of energy to the Inner Circle, Brompton and Piccadilly, Charing Cross, Euston and Hampstead, Great Northern and Strand and the Edgware and Hampstead Railways, this will be the largest in the world for supplying energy purely for traction purposes, aggregating, as it will, some 50,000 kilowatts. The buildings will be 453 feet long and 175 feet wide. It is proposed to construct 20 substations in connection with the system, the first few miles of which is expected to be ready shortly. In connection with Mr. Yerkes' ramifications, too, must be noted the fact that the first open-air electric railway—i. e., heavy surface road—hitherto sanctioned in Great Britain goes to him, viz., the Hampstead and Edgware Railway, which was passed through Parliament during the 1902 session. A piece of similar surface railway, some seven miles in extent, was also included in the famous bill of Mr. Morgan.

Still, dealing with the means of communication in London and its immediate suburbs, it will be noted that much progress has been made by the London County Council, with its conduit system, and the last section of the horse lines south of the Thames has now passed into its hands. In the west of London, the London United Tramways Company continues, at frequent intervals, to put new sections into operation, and next year will no doubt witness important developments respecting transfer fares between these tramways and the Yerkes railways. In Great Britain, as elsewhere, the highest bidder wins. Finally, it may be noted that the London County Council secured powers for a short length of shallow-tunnel tramways, but no start has been made yet.

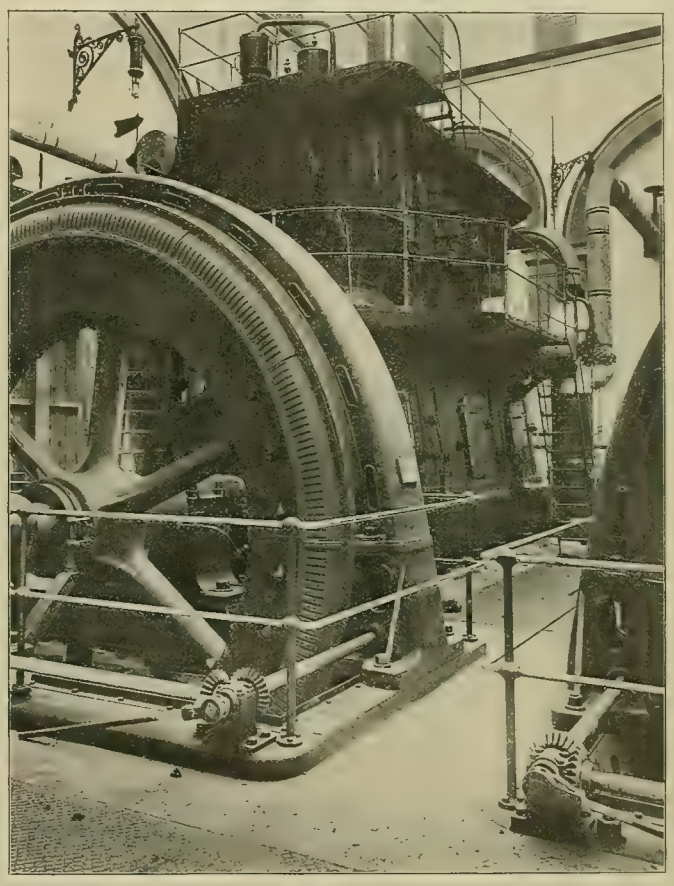
Outside London, the most prominence must be given to Lancashire in matters appertaining to electric traction. In this quarter of the kingdom, the South Lancashire Electric Tramways Company has very rapidly equipped an extensive system, which, by amicably working with the Liverpool corporation electric tramways, has caused havoc to the local steam railways, and even seriously interfered with the traffic on the Liverpool overhead (electric) railway. The far-reaching influence of the electric tramways in South Lancashire at present, as compared with only a few months ago, is well told by the fact that it is now possible to travel, without changing cars, over three different systems, and that waiting rooms have been erected along the route. No doubt much of the publicity gained by electric traction during the past year has been due to the disastrous effect caused by it to steam railways wherever it has come into competition, and, besides the instance above mentioned, both the Northeastern Railway and the Lancashire and Yorkshire Railway (steam lines) have decided upon the electrification of certain local lines in order to meet this competition, tenders having been let, while a Glasgow suburban railway has withdrawn certain services altogether. The Liverpool overhead line has put into service some higher speed trains in order to retain its traffic. Up in the northeast of England, the experiment of the Tyneside Tramways Company in building lines over land which it had purposely bought for the purpose, and not confining itself to the public roads is working out well, both from the point of view of speed, as well as economy. The Wolverhampton corporation's exploitation of the surface-contact system has caused a number of other municipalities to view the possibilities of the "stud" system with favor, and the proprietors of the few companies manipulating such systems are on the qui vive for possible converts, in spite of the great hold which the trolley system has taken.

Telephony.

The year had been very quiet as regards the effect of municipal telephony upon the stability of the National Telephone Company until, during the last few months, the Tunbridge Wells corporation, which inaugurated its system with such a flourish of trumpets about 18 months ago, created a flutter by going over to the enemy (the National Telephone Company) in a most ignominious fashion. Glasgow, Portsmouth,



Engine Side.



Generator Side.

TWO-PHASE UNIT IN LEEDS CENTRAL STATION.

Swansea, Brighton and a host of other large towns sturdily maintain the attitude adopted from the commencement (Portsmouth has, in fact, opened a municipal exchange), and continue to show a bold front with great confidence, and the action at Tunbridge Wells, which seeks the permission of the postmaster-general to sanction the transfer of its system to the National company at cost price on the plea that it has been a financial failure, really only exemplifies the disastrous result of any possible weakness in the face of such a strong combination as the National Telephone Company. This little contretemps is really quite local, and in no way reflects the general opinion concerning the efficacy of municipal telephony. Apart from this, and the laying of new underground telephone lines to the north of England, nothing startling has developed during the last year.

Electric Lighting.

A number of large and important electric-lighting stations have been opened, including an extension of the City of London Company's existing buildings and the Stuart Street station of the Manchester corporation and an additional power house at Leeds. These are probably the most important in a branch of the industry which has remained fairly stationary as regards general principles and designs, for several years. At Leeds two-phase machinery has been adopted, the units being of 2,400-horsepower capacity, the output of the dynamos being 1,500 kilowatts each. The frequency is 50 cycles per second, with 2,000 volts on each phase. Quite characteristic of the general tendency in all large manufacturing centers in Great Britain, the growing demand for electric current for power purposes has seriously influenced the Leeds installation, both as regards the size and design of these latest machines. Indeed, such are the possibilities in this direction further north, i. e., Sunderland, that the borough electrical engineer in that city has drawn up a scheme for a wholesale municipal supply of current for power purposes pure and simple, his report being quite naturally followed by objections made by persons opposed to municipal trading. As typical of what may be considered the latest practice in England, I give a couple of views of the interior of the new Leeds works.

The opening of the large Stuart Street station of the Manchester corporation, is, for the time being, at any rate, the climax to one of the most eventful struggles in the whole history of municipal trading. The Stuart Street station, which feeds no less than 10 sub-stations from its first equipment of 15,000 horsepower, supplies three-phase alternating currents generated at what is now becoming known as another addition to electrical nomenclature, viz., "extra high pressure," at 6,500 volts, which is carried direct into the sub-stations, from whence it is supplied at 500 to 550 volts for traction, and at 410 and 205 volts pressure for lighting and power purposes. Some 20 sub-stations will altogether be supplied from these works.

The development of the City of London Electric Lighting Company's undertaking is an object lesson in the divergence of opinion concerning the efficiency of continuous currents and their advantage over alternating currents for distribution purposes. Originally this company spent an enormous amount of capital in alternating-current machinery, but during the last three years, continuous-current machines have gradually replaced the older ones, and all extensions have been on this system. In February a new generating station was added to the existing one, and in this building 7,000 kilowatts was installed, made up of three 1,000-kilowatt sets and two 2,000-kilowatt sets. The former are Allis-Westinghouse sets, and the latter Musgrave-Westinghouse sets.

In London, also, the other companies have continued to find increased patronage, which has necessitated increased plant. Land values, however, border on the prohibitive for a trading concern, and the example set many years ago by the London Electric Supply Corporation in having its generating station some 10 miles outside the supply area has been followed by several other companies in a modified form. In no less than three other instances is this being done, two of the stations being now well toward completion. The Shoreditch Borough Council (London) has also found it necessary to augment its means of supply, and a second generating station on a large scale has been erected. Other comparatively large stations have been opened, such as that at Bristol, where the exigencies of space necessitated the newer one being placed on the top of the old one, and at Sunderland, where, as previously mentioned, a large development is taking place among the shipyards, which are gradually throwing out their obsolete plant, and using electricity.

Coming to the smaller works, which have been put into operation during the year, the same uniformity of practice obtains as usual, viz., three-wire continuous-current distribution, generation being at the distribution pressure. Messrs. Edmundson's Electricity Corporation has put into service a large number of such stations, scattered all over the country, and for small affairs, the financial results have been good. It is significant, as well as complimentary to the Westinghouse company, that at Walthamstow, in London, where very steady and brilliant street lighting is to be found, a net profit, quite above the normal for small municipal undertakings, has been gained by the use of gas engines. Likewise, at King's Lynn, the gas engines continue satisfactory, although at Belfast the old original gas-engine station has been shut down.

The combination of refuse destructors with electricity works, pioneered at Shoreditch, has not brought forth the good results prophesied, and although a number of such combined stations have been erected, higher authorities are inclined to advocate their disuse as a profitable and clean method of raising steam. One of the greatest difficulties in the way of their success at municipal stations is the difficulty of adequately allocating the cost of the fuel so obtained to the satisfaction of electric-lighting committees. Very few joint-stock companies have invested in them. The financial results show a steady improvement, at any rate, as regards those stations which have been running a few years, although it must be confessed that the companies appear to have the best of the argument as regards dividends, the London companies mostly paying a healthy return to their shareholders. As regards lighting, things remain very much in statu quo. The Nernst lamp is being largely used for indoor lighting, while the Bremer, Flame and "Knewe" arc lamps are being introduced for street lighting.

Telegraphy.

The outstanding feature here, of course, is the opening of the all-British Pacific cable, with which most of us are now familiar. This, and the construction of further underground cables to the north of England and Scotland, constitute the chief matters of progress.

Wireless Telegraphy.

Here again the sphere of progress is limited by reason of the fact that the workers in this field are limited. Everyone is familiar with Marconi's work, but the recent publication of certain messages by "eavesdroppers" will probably tend toward exerting him to perfect his syntonic methods, unless in the particular instance, no care was taken to syntonize. But it would seem to be damaging his own cause, if no definite statement is made upon this point. The cable companies will seize upon such points as this, and the idea is gaining ground on this side that "interferences" can be secured by anyone setting up private apparatus. The Marconi station is in Cornwall, and Holyhead and Manchester are two places mentioned in which private persons with wireless-telegraph outfits have been "interfered" with.

Power Transmission.

The year has seen another "supply in bulk" undertaking inaugurated, i. e., the Midland Electric Corporation for Power Distribution, which operates over a large area in the Midlands. Legislatively, this concern works under somewhat different conditions to the more recent promotions, but, of course, its engineering is on very similar lines. The power house is situated on the Birmingham Canal, and at present houses eight boilers and two 800-kilowatt alternators and one 1,000-kilowatt alternator. Of course, this is only a very small proportion of its ultimate capacity, the station being at present only run temporarily to supply a tramway load. The alternators generate 7,500 volts, two-phase, both dynamos and engines being of purely British make.

Dealing generally with these "bulk" supply schemes, it is satisfactory to note that the complaint hitherto so common, viz., that a large number of small local bodies secured provisional electric-lighting orders and promptly shelved them because they were not in a sufficiently flourishing financial condition to carry out the undertaking, and at the same time objected to a private trading concern making a profit out of their particular municipality, largely disappears, as the favorable terms promised by the majority of these large supply concerns to such small municipalities has resulted in many of them arranging for the current to be delivered to a sub-station, and themselves to undertake the distribution. Among the schemes in a well-advanced state are the South Wales and Durham, while parliamentary powers have been granted for similar undertakings in the east, west, southwest, midlands and northeast of Great Britain, and one each in Scotland and Ireland. While the Board of Trade is no doubt duly thankful that this state of affairs relieves it of the unpleasant task of revoking a large quantity of provisional electric-lighting orders, the advocates of electricity for power purposes reciprocate these thoughts, inasmuch as this department is seeing fit to relax the regulations concerning the use of overhead wires for this purpose, and among the few instances may be noted the town of St. Helens, where this method of transmission has been permitted recently under special conditions. This has been a sore point for many years, the cost of laying a large network of underground mains in open country being prohibitive as well as unnecessary. Altogether, a marked improvement is taking place in the application of electrical driving in workshops and factories, an improvement which will be tenfold when the numerous power schemes get into full swing. At present, however, out of some 15 such undertakings which have been authorized only two or three are actually at work.

Colonial Progress.

Outside Great Britain, and especially in South Africa since the conclusion of the war, signs are not wanting that the colonies do not intend to be

ELECTROLYTIC ALKALI WORKS IN ENGLAND.

VAT ROOM IN ELECTROLYTIC ALKALI WORKS.

beaten by the mother country in the application of electrical power to various uses. In Australia a new electric-lighting works has been put into operation at Melbourne, and in this particular instance, as, indeed, is most noticeable in a large amount of work being done in the colonies, British machinery is well to the fore. In these latter works nearly all the heavy plant is British. In fact, Mr. Arnot, the engineer, visited England in order to formulate his ideas and opinions on the matter. At Sydney, too, in connection with the tramway system, which has been designed by British engineers, the tenders by British firms were accepted after keen competition. Willans engines in plenty for small and large installations find their way to South Africa, and Parsons turbo-pumping sets have been ordered for New South Wales mines. In fact, the year has been a most prosperous one for home manufacturers, and it is not altogether without significance that the design of a large percentage of colonial work finds its way into the hands of British consulting engineers. It may or may not influence to some extent the increase of home manufacture, but the imports of electrical machinery has steadily declined in value during the last three years. In 1900 it was £967,223, in 1901 £736,781, and for the first nine months of 1902 it had shrunk to £565,294.

MISCELLANEOUS.

Before concluding such a record of the year's work as this, there are a number of matters of general interest which deserve mention. In any comparison between Great Britain and any other of the great countries of the world there is one department of the allied electrical industry in which we compare badly, viz., the electrolytic alkali industry, our sole representatives in this branch being but two, viz., the Electrolytic Alkali Company, which operates at Northwich, in Cheshire, and the Castner-Kellner Company, which has two works, and the output of all these is not by any means extraordinary. By reason of the scarcity of such works perhaps, the two views of the Northwich factory of the Electrolytic Alkali Company, which has been enlarged this year, will be interesting. Financially these two isolated concerns are in good position.

There is a growing tendency in favor of steam turbines for the driving of electrical generators, and we have now several stations in which these are installed and giving great satisfaction. At Newcastle there is one; at Sheffield large-size machines of this type are being put in, and in a number of other places trials are being made. The more dissatisfied of our station engineers allow their thoughts to wander still further ahead and dream of the gas turbine, but one and all seem agreed that they do not know how to set about designing such a machine.

Another matter, too, concerning central-station practice is the fact that the possibilities of double-current generators have been recognized probably more this year than heretofore, and an application of this machine has been made at Alloa, Scotland, in a manufacturing electrical engineering works which supplies current for public lighting. There is also a strong possibility of their being adopted at the new Willesden works near London, whose engineer is actively interested in them.

In the electrical motor-car industry not much headway has been made in spite of the shows, which, however, have chiefly catered for the oil and steam types.

Among a number of other matters fraught with great possibilities for the industry is the decision of his majesty's government to inquire into the whole question of electrical legislation, which was made the subject of a deputation on the part of the Institution of Electrical Engineers. When, in addition, to all this, it is mentioned that the large proportion of our manufacturers are full up with work, despite the new works of the British Thomson-Houston company and the Westinghouse company, which have both started operations, it will be seen that we of the electrical industry in Great Britain have not much cause for grumbling. W.

Quick Work in Telegraphy.

A Wall Street telegraph office recently sent a seven-word message of inquiry to San Francisco and received a five-word reply, all within two minutes and 18 seconds. The time was taken by a stop watch, and was reckoned from the act of handing the message to the telegraph operator in New York to his handing over the reply written out. This is said to have come very near being the record for written messages. It is asserted that a broker once executed a New York trade in wheat on the Chicago Board of Trade which was just 15 seconds going from Wall Street to Chicago, being made, and coming back.

Regulation of Multi-circuit Generators.

An invention which relates to a method of regulating electric generators of the multi-circuit type—that is, where two or more working circuits, such as series arc-lamp circuits, are supplied from different sets of brushes which take current from a single armature, has been patented by H. H. Wait of Chicago. In an arc machine, where the armature necessarily has a very high reaction, a movement of the brushes supplying one circuit to compensate for a change of load in that circuit will change the circumferential distance on the commutator between these brushes and the brushes belonging to the other circuit, so that if constant current is maintained

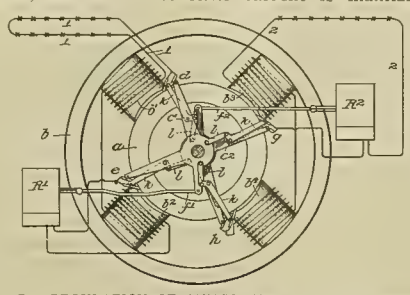


FIG. 1. REGULATION OF MULTI-CIRCUIT GENERATORS.—DIAGRAMMATIC REPRESENTATION OF INVENTION.

the armature reaction will be varied, causing a variation in the intensity and distribution of the magnetic flux threading the coils undergoing commutation. The result will be that this change in the reversing field acting on the coils undergoing commutation will cause a variation in the current flowing through these short-circuited coils, such that serious and destructive sparking may be produced.

Mr. Wait's invention has for its object more particularly to prevent such sparking as the brushes of one circuit are shifted to compensate for change of load; and it consists, briefly, in maintaining the currents in the coils undergoing commutation at their proper predetermined values by varying the components which go to produce such currents—that is, by varying the ampere-turns on the field-poles or varying the number of turns of the armature winding which are short-circuited by the brushes—in proportion to the changes caused by the unequal distribution of the armature reaction. The preferred method of doing this is to vary the span of each brush to increase or diminish the number of turns of the armature winding short-circuited thereby in inverse ratio to the change in magnetic flux threading the short-circuited coils as the brushes of one circuit or the other are shifted.

Fig. 1 is a diagram illustrating a multipolar generator with two pairs of brushes, each pair supplying an individual circuit, the machine being constructed so that the span of each of the four brushes will be varied when either pair of brushes is shifted independently of the other pair to compensate for change of load on the corresponding circuit. Fig. 2 is a view in elevation of such a generator.

The armature (a) is arranged to rotate within the influence of the field magnet (b), which is provided with four poles (b′) (b^2) (b^3) (b^4). Two pairs of brushes which are provided for taking the current from the armature, are carried by the independently movable rocker-arms (c′) (c^2). The rocker-arm (c′), which carries the pair of brushes (de), is arranged to be swung about its axis by the regulating device (R′) to shift the position of the brushes as the load on the circuit (1), supplied from the brushes, is varied, the regulating device (R′) being mechanically connected with the rocker-arm (c′) by the link (f′). Similarly, the rocker-arm (c^2) is connected by a link (f^2) with the regulating device (R^2), whereby the other pair of brushes (g) (h), supplying the other circuit (2), is shifted in accordance with the change of load on the latter circuit. Each brush consists of a stationary member fixed upon an arm of the rocker and a movable member carried by a lever (k), pivoted so that the movable member of the brush may be moved closer to or farther from the stationary member thereof by rocking the lever (k) about its pivot, whereby the span of the brush may be adjusted to increase or decrease the number of turns of the armature winding short-circuited thereby.

The movable arms (k′) (k′) of each rocker are connected, through cam-and-lever mechanism, with the relatively stationary member of the other rocker in such a way that when either rocker is moved independent of the other, the span of all four brushes (c) (d) (e) (f) will be automatically changed, the mechanism being such that if either the two brushes (c) and (e) or the two brushes (d) and (f) are brought nearer together, the span of each of the two brushes so brought nearer together is reduced, while the span of each of the two brushes which are moved apart is increased.

The operation of the machine is as follows: When the load on the circuit (1) is increased, the regulator (R′) rotates the rocker which carries brushes (c) and (d) in a clockwise direction. Similarly, if the load on circuit (2) is increased, the regulator (R^2) shifts the rocker carrying brushes (e) and (f) in a clockwise direction. A decrease of the load on either circuit causes the regulator to move the corresponding rocker in a contra-clockwise direction. In Fig. 2 the brush-adjusting mechanism is shown in the condition it would be with no load on the circuit (1) and full load on the circuit (2). Whenever either rocker is shifted independent of the other in such a way that the two brushes (c) and (e) are brought nearer together, as would be the case if the rocker (p) were moved in a contra-clockwise direction to compensate for a decrease in the load on circuit (2), the number of turns of armature winding between the brushes so brought together would, of course, be decreased.

The current being maintained practically constant, there would thus be a decrease in the armature reaction between the points where the brushes take off the current, because the number of ampere-turns on the armature between the brushes, and, consequently, the reactive magnetic field set up thereby, would be reduced. The magnetic flux from pole-pieces (b′) and (b^2) produced by the field winding would thus be increased. This would tend to produce sparking, owing to the increase in the magnetic flux threading the short-circuited coils which are undergoing commutation; but by means of the invention the increase in the magnetic flux threading the short-circuited coils is compensated for by a

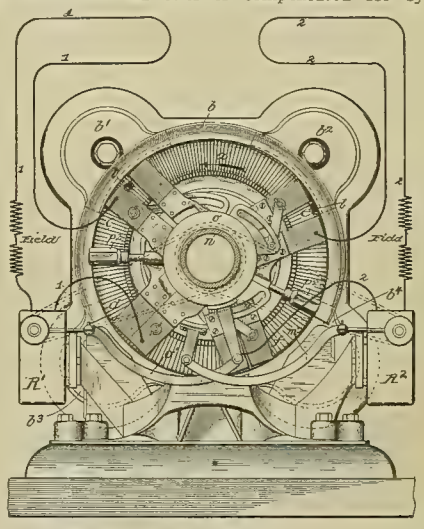


FIG. 2. REGULATION OF MULTI-CIRCUIT GENERATORS.—ELEVATION OF GENERATOR.

decrease in the span of the brushes. As the brushes (c) and (e) are moved toward one another the cam-and-lever mechanism automatically brings the movable member of each of the brushes closer to the fixed member thereof, so that the number of commutator segments spanned by each brush—that is, the portion of the armature winding short-circuited by the brush—is reduced. Similarly, whenever brushes (c) and (e) or (d) and (f) are moved away from one another the consequent increase in the armature reaction between such brushes is compensated for by an increase in the span of each brush.

Large Contracts for Hudson River Power.

The Albany Electric Illuminating Company and the United Traction Company of Albany, N. Y., are said to have entered into contracts with the Hudson River Water Power Company for all the power that the latter company is capable of generating in its several plants on the upper Hudson River, except that power heretofore sold to the General Electric Company for transmission to Schenectady, which latter amount does not exceed 10,000 horsepower daily. This is claimed to be one of the biggest deals involving a purchase of electrical power ever consummated, and means that the Albany and Troy companies will be able in the near future to furnish a large amount of additional power to local manufacturers. The Hudson River Water Power Company has under construction and in use several dams along the upper Hudson, the largest being at Spier Falls. Its daily output will be 60,000 horsepower. Its capital was recently increased $3,000,000, making the total $5,000,000. It is backed by Boston and Glens Fall capital. The contract was negotiated on behalf of the local electrical companies by Anthony N. Brady, and on behalf of the power company by Eugene L. Ashley of Glens Falls, its president.

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DATES AHEAD.

Master mechanics of street-railway companies (meeting for organization), Cleveland, O., January 12, 1903.

Northwestern Electrical Association, Pfister House, Milwaukee, Wis., January 21, 22 and 23 1903.

MATERIAL prosperity and extension in all directions, rather than any striking technical advance, characterized the electrical history of the year 1902. This statement needs to be modified, however, to the extent of noting that the prosperity referred to did not embrace the continent of Europe, and that, while no great point of departure in the science or art of electricity stands to the credit of the year, the study of electrical problems has been extraordinarily active and fruitful.

In pure science the examination of the theory of electrons has proceeded with undiminished energy and has been, perhaps, the most interesting feature of the work of the physicists. In applied science much has been accomplished of electrical interest, particularly in electrochemistry and the study and development of new forms of lighting, as the Nernst lamp, the Bremer arc lamp, the osmium lamp, the gas-vapor lamp and others. In space telegraphy, too, the year has been one of marked development, while in electric-railway design the most momentous announcement has been that the single-phase motor is about to be used for driving cars. The steam turbine appears to be coming to the front as the prime mover for alternating-current generators, while the gas engine has also made progress, although less in the public eye. Power transmission shows constantly increasing voltages and lengths of transmission, and during the year important extensions at Niagara have been undertaken and the great American plant at Sault Ste. Marie has been opened. Telephony has fairly kept up its marvelous rate of growth, and more attention is paid to the possibilities of automatic systems. Electric heating shows hardly any progress, while little that is new is reported in relation to the storage battery, the Edison cell being still in abeyance. The all-British Pacific cable was laid during the year, and the laying of the American Pacific cable was begun. All of these subjects, however, are considered more at length in the comprehensive reviews of the year's progress in the United States, on the Continent and in Great Britain, prepared, respectively, by Professor Brooks, Mr. Drake and an English correspondent, to which the reader is referred.

There was no retrogression in the activity of the electrical manufacturers in the United States in 1902, which has added another to a succession of "fat" years. As is shown by the carefully prepared estimates on the opposite page, the volume of manufactures in the United States directly dependent upon electricity increased nearly 15 per cent., comparing the totals of 1901 and 1902. The total for the year reached over $220,000,000. The figures given for the various branches of the industry are especially valuable, because they are approximations of the value of the actual output, not a mere summation of the capitalization of manufacturing or operating companies. They represent things done in the electrical industry during the year, not the amount of stocks and bonds issued in the name of electrical companies. These New Years estimates of the Western Electrician have steadily increased in value since the first effort was made in that direction and may be accepted as a true indication of the value of electrical apparatus put out during the year.

Advance is also shown in the electrical exports of the United States, the total representing an increase of nine per cent. over that of 1901. On another page is given a table showing the exports of electrical machinery and electrical appliances by months, with December estimated. The excellent showing of the year is the more gratifying in view of the slight falling off last spring. But the increase of the latter half of the year was enough to make up for this and more.

The death list is always too long, but last year it contained the name of only one man of international prominence among electricians—Sidney Howe Short.

Mention should be made, perhaps of the great activity of the technical and semi-technical societies. The American Electrochemical Society and the Interstate Independent Telephone Association were formed, and the American Institute of Electrical Engineers, the National Electric Light Association and others displayed renewed vigor in increasing membership and in doing useful work.

The year 1902 has been a very successful one to the electrical men of the United States. May 1903 equal or surpass it!

MR. BION J. ARNOLD has enhanced his already fine reputation as an engineer, and has rendered a service to the city of Chicago which his fee of $10,000 inadequately represents, by his admirable and exhaustive report on the engineering and operating features of the Chicago transportation problem. Mr. Arnold was retained for this service, through the local transportation committee of the City Council, of which Alderman Frank I. Bennett is chairman, on July 19th last, and his letter of transmittal, with the report, is dated November 19th. After that the printing and map-engraving consumed the time until December 30th, when the report was made public. On that day the report was given out by the committee, which also complimented Mr. Arnold on his work by a unanimous vote of thanks. Prior to that date, however, on Christmas Day, to be exact, Mr. Arnold, with the sanction of the committee, gave out copies of the letter of transmittal and the summary of his conclusions, as a misleading forecast of the report had appeared in one of the Chicago daily papers. This letter and summary are published in this issue of the Western Electrician. They give the gist of Mr. Arnold's findings, but one must inspect the whole document, with the accompanying maps and plates, to realize the magnitude of the work. In a future number we hope to give a further insight into Mr. Arnold's recommendations, as expressed in the report.

In commenting on this strong report one is tempted to employ terms of extravagant praise. The author seems to have studied and discussed every possible aspect of the street-railway situation in Chicago—and all in a space of four months. For instance, he has, in his consideration of future population, evolved "the law of decreasing rate of annual increase" by which future growth will be affected, in all human probability. Thus, if the growth of Chicago were to average in the future exactly as in the past, the population in 1952 would be 13,250,000, which is improbable. Assuming the average rate of growth of European cities, the figure would be 5,250,000 in the year given. But, applying the law of decreasing rate, the population of Chicago in 1952 may be expected to be 7,750,000. This is a simple statement, and, of course, every engineer in planning for future municipal service, must estimate future population with care and intelligence; but the thorough manner in which Mr. Arnold has worked out his law and applied it to street-railway earnings, with graphical methods of demonstration, evokes the warmest admiration. In like manner every phase of the subject is critically examined and discussed, with a summary for the busy man of affairs, and exhaustive information, including maps, plates, diagrams, illustrations and a copious index, for the student. Mr. Arnold has planned a new, reorganized and unified combined surface and subway street-railway system, as shown by the summary published this week, and has gone so thoroughly into details that the essential engineering for such a system may be considered as already accomplished, if the city authorities, in their wisdom, choose to make use of it. The work shown in this and other features of the report is monumental in character, and the city of Chicago is to be congratulated in having thus equipped itself for consideration of the pressing problem of transportation.

STATISTICS OF ELECTRICAL MANUFACTURES.

The Western Electrician's estimates of the value of electrical and auxiliary manufactures in the United States in the year 1902, more accurate and complete than those in any former table, it is believed, are presented herewith, the figures of former years being given for comparison. The total estimate, $221,165,000, shows an increase of almost 15 per cent. over the $192,470,000 of 1901. These estimates are prepared with much care and effort, with the assistance of a large number of the leading authorities in the electrical and allied industries. They are not the result of guesswork, but are based on figures supplied by men who, as experts, can give very close approximations of the value of the output under the various entries. As the years go by, constantly growing interest is taken in the Western Electrician's effort to present this statistical information, more collaborators are secured, and the figures presented become increasingly accurate and authoritative. Figures showing the extent and growth of electrical manufactures and manufactures dependent upon electricity are not available elsewhere and can be secured in no other practicable way, from year to year, than that selected by this journal. The publication of the United States census report on the manufacture of electrical apparatus and supplies during the year ended June 30, 1900, which was made in August, 1902, enabled a comparison of some value to be made between the Western Electrician's figures for the calendar year 1900 (published January 5, 1901) and the government's report. The periods covered by the two sets of figures were only coincident for the first half of 1900, of course, but, as was pointed out in an editorial in the Western Electrician of September 6th, the striking agreements between the timely estimates and the carefully collected census returns show that the former were substantially accurate. And substantially accurate, to an even greater degree, we feel confident the figures here presented for 1902 are. The amounts stated are no more than they pretend to be—estimates; but they afford a valuable insight into the extent and relative proportion of the branches of electrical manufacturing.

As in former years, the largest single item is "dynamos and motors," $48,000,000, but if all classes of electrical wires and cables are considered together, the total is larger, over $53,000,000. The third largest item is telephone apparatus, $21,000,000. Nearly every class of apparatus shows a healthy increase. It is fair to say, however, that the increases in the valuations of cars and trucks and of rheostats, car controllers and motor starters are due in part to more exact estimates in 1902. In like manner the decrease in water-tube boilers may be partially accounted for. Three new entries of exceptional interest make their appearance this year—Nernst lamps, valued at $350,000; space-telegraph apparatus, $200,000, and steam turbines, $500,000. The classification is not as minute as might be made, but there is a sufficient number of entries to make a formidable list, and further division might lead to confusion.

Not included in the table, which relates exclusively to new machinery and apparatus marketed during the year, are estimates of the trade in second-hand appliances. It is interesting to note, however, that an authority in this line states that there was probably $3,000,000 worth of second-hand electrical machinery sold by dealers and possibly $1,000,000 additional sold directly by electric power plants disposing of old material.

Another interesting side-light on the state in the art is contained in the following statement of a gentleman in a position to speak with knowledge: "The nature of the apparatus used by electrical plants has changed to such an extent that comparatively a small amount of shafting and pulleys is now being used. Many plants which were formerly equipped with transmission machinery are now belted direct or coupled direct to the engine, doing away with all intermediate shafts. The introduction of the high-speed engine coupled direct to a generator or dynamo for small plants has done away with the necessity of shafting, and, of course, the high-speed engine belted direct requires no shafting."

The greatest activity at the present time in the electrical business is shown in the electric-railway and telephone fields. Regarding the former a collaborator makes the interesting statement that a low estimate of the value of motor equipments sold in 1902 would be $10,000,000.

WESTERN ELECTRICIAN'S ESTIMATES OF THE VALUE OF ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

Articles.	For the Year—			
	1899.	1900.	1901.	1902.
Arc lamps, enclosed	$ 800,000	$ 1,200,000	$ 1,600,000	$ 1,800,000
Arc lamps, open	150,000	125,000	125,000	135,000
Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc	1,250,000	1,500,000	1,850,000	2,000,000
Bells, buzzers, push-buttons, call-boxes, annunciators	500,000	600,000	720,000	815,000
Belting used in electrical plants	550,000	550,000	600,000	615,000
Boilers for electrical plants (water-tube)	3,000,000	4,000,000	6,000,000	5,100,000
Boilers for electrical plants (other than water-tube)	700,000	1,100,000	1,850,000	2,400,000
Cables, underground, aerial and submarine	12,500,000	15,000,000	18,000,000	18,650,000
Carbons for lamps, batteries, brushes or other electrical purposes	1,350,000	1,625,000	1,985,000	2,300,000
Cars and trucks for electric railways	2,000,000	3,000,000	3,700,000	7,500,000
Circuit breakers	.....	.....	230,000	300,000
Conduits (underground) and similar material	1,200,000	1,600,000	1,700,000	1,925,000
Conveyors, coal and ash, used in electrical plants	200,000	350,000	650,000	750,000
Cranes and hoists, electrically operated	1,600,000	2,400,000	2,730,000	3,500,000
Dynamos and motors, including parts of machines, boosters, rotary converters, etc., and all motor applications, such as automobiles, not specifically enumerated in this list	28,000,000	36,000,000	41,500,000	48,000,000
Electroplating and other electrolytic apparatus not elsewhere specified	250,000	250,000	325,000	275,000
Electrostatic machines, induction coils, medical sets, etc	150,000	150,000	250,000	325,000
Elevators, electric (mechanism only)	2,000,000	2,500,000	1,800,000	2,000,000
Engines, gas, gasoline or oil, used to drive electrical machinery	700,000	900,000	950,000	1,300,000
Engines, steam, used to drive electrical machinery	16,000,000	15,000,000	16,425,000	17,000,000
Fans, electrically operated and direct-connected	900,000	1,100,000	1,350,000	1,500,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc	550,000	700,000	800,000	950,000
Fixtures for electric lighting	3,500,000	3,850,000	4,200,000	4,100,000
Fuses	.....	.....	175,000	185,000
Glassware, electrical	.....	.....	.....	500,000
Heating and cooking apparatus, electrical	200,000	225,000	285,000	330,000
Incandescent lamps	2,700,000	3,400,000	4,150,000	5,000,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc	1,500,000	2,500,000	3,250,000	3,750,000
Insulating material, fiber, tape, etc	1,100,000	1,200,000	1,135,000	1,250,000
Insulators (glass and porcelain)	1,100,000	1,325,000	1,600,000	1,750,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc	500,000	850,000	1,050,000	1,000,000
Lightning arresters	225,000	310,000	390,000	425,000
Nernst lamps	.....	.....	.....	350,000
Poles, cross-arms, brackets and pins	800,000	2,900,000	3,875,000	4,350,000
Primary batteries	375,000	450,000	550,000	685,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc	600,000	950,000	1,575,000	2,150,000
Rheostats, car controllers, motor starters, etc	525,000	775,000	1,050,000	3,200,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	550,000	500,000	475,000	425,000
Sockets, switches, cut-outs	1,200,000	1,500,000	1,850,000	3,500,000
Space-telegraph apparatus	.....	.....	.....	200,000
Steam turbines used to drive electrical machinery	.....	.....	.....	500,000
Storage batteries, including those used on automobiles	2,700,000	3,500,000	4,500,000	4,500,000
Telegraph instruments and apparatus	125,000	115,000	120,000	200,000
*Telephones and telephone supplies, including telephone switchboards	15,000,000	17,500,000	18,750,000	21,000,000
Third rail for electric railways	.....	.....	300,000	500,000
Transformers, stationary	1,850,000	2,600,000	3,250,000	4,200,000
Waterwheels, used to drive electrical machinery	700,000	850,000	1,125,000	1,300,000
Wire, bare	6,500,000	7,250,000	16,200,000	17,500,000
Wire, rubber covered	2,200,000	3,100,000	5,750,000	6,425,000
Wire, weatherproof	5,500,000	6,250,000	8,500,000	8,750,000
Wire, all other electrical	.....	1,250,000	1,725,000	2,000,000
Miscellaneous, including switchboard panels, sign flashers, automatic stokers for electrical plants, wire guards, electrical tools and toys, projectors, solenoids, etc	.....	200,000	1,500,000	2,000,000
Total	$ 123,800,000	$ 153,000,000	$ 192,470,000	$ 221,165,000

*Telephone estimates are divided as follows: 1900—Bell, $13,500,000; Independent, $4,000,000. 1901—Bell, $13,000,000; Independent, $5,750,000. 1902—Bell, $14,500,000; Independent, $6,500,000.

The Year's Electrical Exports.

For the first time, the Western Electrician is enabled to present a detailed monthly report of the electrical exports of the United States for the expiring year in a New Year's number. The government's fiscal year closes on June 30th, and, as reported in the Western Electrician of August 9th last, the total electrical exports of the United States for the year ended June 30, 1902, amounted to $9,011,505, divided as follows: Electrical machinery, $5,379,746; electrical appliances, including telegraph and telephone instruments, $3,631,759.

What is wanted just now, however, is a statement of the electrical exports of the country for the calendar year just ended. This is given in the following table, the figures being official in the case of every month except December, where they are estimated:

MONTHLY STATEMENT OF ELECTRICAL EXPORTS IN 1902.

	Machinery.	Appliances.	Total.
January	$ 409,476	$ 419,098	$ 828,574
February	591,078	255,163	846,241
March	440,031	235,686	675,717
April	538,118	296,948	835,066
May	443,345	464,382	907,727
June	402,182	310,541	712,723
July	512,195	323,470	835,665
August	558,826	262,231	821,057
September	502,604	685,987	1,188,591
October	677,191	372,860	1,050,051
November	431,338	280,822	712,160
*December	450,000	300,000	750,000
Total	$5,956,384	$4,207,188	$10,163,572

*Estimated.

Thus, with a low estimate for December, the total valuation of exports of electrical machinery and apparatus from the United States in the year 1902 is $10,163,572. This is considerably in excess of the amount for the fiscal year ended June 30th, owing to the heavy exporting business of the late summer and early fall. It is seen that this year (with official reports lacking for December) September and October were the best months for the electrical exporter and November and June the poorest.

In the calendar year 1901 the electrical exports amounted in value to about $9,300,000 (see Western Electrician of February 8, 1902, page 96), showing that the electrical export trade of 1902 exceeded that of 1901 by the comfortable margin of over nine per cent. The present classification of electrical appliances has obtained in the Treasury Department only since July 1, 1901, so that exact comparisons between 1902 and former years are impossible. It is probable, however, that, with the possible exception of the year 1900, the year 1902 has witnessed the largest volume of electrical exports in the history of the United States. The following figures for electrical machinery only afford some basis of comparison: 1900, $5,286,224; 1901, $5,623,442; 1902, $5,956,384.

Electrical Exports for November.

Electrical exports from the United States for the month of November, 1902, sum up in value to $712,160, as compared with $552,670 for the corresponding month last year (1901). October of this year reached a valuation of $1,050,051, however. It is seen that the electrical exports for the month of November show an increase over those of the same month last year amounting to $159,490. On the other hand, November did not equal the total of the preceding month by $337,890.

"Electrical appliances, including telegraph and telephone instruments," show the following figures: November, 1902, $280,822; November, 1901, $204,364—an increase for the present year of $76,458. "Electrical machinery" gives these figures: November, 1902, $431,338; November, 1901, $348,306. Here an increase is seen of $83,032.

Classified according to destination, the exports of electrical machinery in November, 1902, to some of the heaviest buyers, were as follows: United Kingdom, $168,349; British North America, $77,921; Mexico, $45,386; Africa, $40,106; British Australasia, $30,701; Brazil, $20,118; Japan, $14,592; Philippine Islands, $7,125; Cuba, $5,049.

A patent for a steam turbine has been granted to Charles E. Sargent, a mechanical engineer of Chicago, who assigns one-half of the grant to W. L. Abbott of the Chicago Edison Company. The turbine, as described in the patent claims, is of the outward-flow type. The mechanism comprises a frame or case and a wheel journaled therein and provided with a series of blades, a valve ring, a nozzle therein comprising substantially an arc-shaped recess in the ring, one side of which terminates in a substantially straight line, a port connecting therewith and an arc-shaped valve-slide within the recess having a straight face opposed to the straight face of the recess and movable circumferentially in the recess to vary the angular relation of the straight faces.

Death List of 1902.

Unlike previous years, happily, the death roll of 1902 contains the names of but few men who have been prominent in the advancement of electrical science. The most conspicuous—from an electrical point of view—of those who have passed away during the year is Sidney H. Short, whose name has been indelibly recorded in the electrical annals of both America and Europe. A man of different classification, but yet a power among electrical business men, was John W. Mackay, who founded a great land-telegraph system and caused two oceans to be spanned by telegraphic cables. Other well-known decedents were David R. Walker, Henry Morton, Frank R. Colvin, Charles T. Child, John Van Horne and John J. Dickey.

A list of men identified in some way with electrical industries, either in this country or abroad, who have died within the year follows:

January—Herbert D. Bennett of Columbus, Ohio, president of the American District Telegraph Company and the Illinois District Telegraph Company, aged 34 years.

February 8th.—Daniel W. Baker of Newark, N. J., a gold and platinum refiner and smelter, aged 45 years.

February 9th.—Andrew Shillinglaw of Chicago, formerly a prominent manufacturers' agent and supply dealer, aged 46 years.

February 21st.—Captain Francis Pavy of London, England, representative of the Westinghouse company in England and identified with English electric railways.

March 19th.—Edward R. Crolius of Chicago, manager of the electrical department of Siegel, Cooper & Co., and formerly an electrical supply dealer, aged 40 years.

April 3d.—George Senf of San Francisco, Cal., the oldest active telegrapher on the Pacific Coast, aged 75 years.

May 8th.—David R. Walker of Philadelphia, chief of the city electrical bureau of Philadelphia for 25 years, aged 70 years.

May 9th.—Henry Morton of New York city, president of the Stevens Institute of Technology for 32 years and a scientist of world-wide reputation, aged 66 years.

May 9th.—Frank R. Colvin of Roselle, N. J., electrical newspaper man, telephone engineer and patent expert, aged 43 years.

May 11th.—Del H. Goodrich of Omaha, Neb., secretary of the Omaha Street Railway Company.

May 11th.—John H. Emerick of New York city, an old-time and military telegrapher.

May 15th.—Clarence E. Stump of New York city, an electrical newspaper man, aged 45 years.

May.—Col. C. C. Howell of Knoxville, Tenn., vice-president and general manager of the Knoxville Traction Company and the Knoxville Electric Light and Power Company.

June 23d.—Charles Tripler Child of New York city, technical editor of the Electrical Review, an accomplished electrical engineer and journalist, aged 35 years.

June.—Edward H. Jenkins of San Antonio, Texas, president of the Southwestern Gas, Electric and Street Railway Association, the San Antonio Gas and Electric Company and the San Antonio Traction Company.

June 27th.—Albert C. White of Providence, R. I., general manager of the Providence Telephone Company, aged 61 years.

July 21st.—John William Mackay of London, England, and New York city, president and founder of the Postal Telegraph-cable Company and president of the Commercial Cable Company and the Commercial Pacific Cable Company, aged 70 years.

July 25th.—Charles Louis Yorston of New York city, president of the Pernaux Electric Company, aged 39 years.

September 6th.—Sir Frederick Augustus Abel of England, honorary secretary of the Imperial Institute and one of the leading scientists of England, aged 75 years.

October 5th.—A. M. Patitz of Milwaukee, Wis., a mechanical and electrical engineer, aged 33 years.

October 6th.—A. S. Roseberry of Cincinnati, Ohio, chief electrical engineer of the Cincinnati Gas and Electric Company.

October 21st.—Sidney Howe Short of Cleveland, Ohio, and London, England, technical director of the English Electric Manufacturing Company of Preston, England, and an American electrical engineer of wide reputation, aged 45 years.

November 12th.—Professor Ogden Nicholas Rood of New York city, head of the department of physics in Columbia University for 38 years and through his research and experimental work known as the "Father of American Experimental Physics," aged 72 years.

November 22d.—Sir William C. Roberts-Austen of London, England, honorary general secretary of the British Association for the Advancement of Science, aged 59 years.

November 25th.—Thomas Orton of Chicago, an old employe of the Western Union Telegraph Company, aged 46 years.

December 13th.—John Van Horne of Pewee Valley, Ky., a pioneer telegraph man and former vice-president of the Western Union Telegraph Company, aged 75 years.

December 29th.—John J. Dickey of Omaha, Neb., a district superintendent for the Western Union Telegraph Company and one of the pioneer telegraph men, aged 63 years.

Bion J. Arnold's Report on the Transportation Problem in Chicago.

As the readers of the Western Electrician are well aware, the city of Chicago, through the local transportation committee of the City Council, retained Mr. Bion J. Arnold last summer to study and report on the technical features of the problem presented by the complicated transportation problem in this city. Mr. Arnold has prepared an exhaustive and very valuable report, which was made public on December 30th. Pending the publication of the full report, which makes a volume of 310 printed pages, with 14 maps, 15 plates and 50 figures, Mr. Arnold gave to the press a summary of his conclusions and recommendations, together with his letter of transmittal. This action was taken because a garbled forecast of the report had appeared in one of the daily papers. The letter of transmittal and the summary are given herewith. It is expected that in a future issue the Western Electrician will be able to lay before its readers some of the material in the complete report.

LETTER OF TRANSMITTAL.

To the honorable chairman and members of the committee on local transportation of the City Council of the city of Chicago:

Gentlemen: I have the honor to present herewith my report on the several questions relating to the city's local transportation situation submitted to me by your honorable body, as set forth in the agreement between the city of Chicago and myself, bearing date of July 19, 1902.

The situation has been thoroughly canvassed. The operating statistics of the Chicago City Railway Company and the Chicago Union Traction Company have been willingly submitted, and an exhaustive study of them has been made. All facilities have been extended to me by the officials and departmental heads of these companies, and the officials of the several elevated-railroad companies, as well as the several companies controlling the underground utilities, all of whom have very kindly, and with considerable trouble to themselves, furnished me with the data required in my investigation. The officials of several railway companies operating roads in other cities have courteously furnished me with valuable statistics.

All recorded information contained in the several bureaus of the city government and the personal knowledge on all subjects pertaining to the transportation matter possessed by the several bureau chiefs has been freely placed at my disposal, for all of which assistance rendered and courtesies extended I desire at this time to express my thanks and appreciation.

I have not assumed it my place to take sides in the report one way or the other on questions of municipal policy concerning which there may be differences of opinion, except where the questions are in their nature clearly engineering or transportation questions. The franchise policy of the city with reference to these matters I have conceived to be outside of my province. The plans for a comprehensive system of street railways suited to the needs of the community, as set forth in the report, would be the same whether the system be owned and operated by a private corporation, or owned and operated by the city, or owned by the city and operated by a private corporation under lease. So far as engineering features alone are concerned, it is immaterial whether the subway systems as outlined be owned by the city or by a private corporation.

In connection with my investigation of this problem, I have considered many plans, such as movable sidewalks, elevated sidewalks, sub-sidewalk railways, and elevated structures for carrying railways, pedestrians, and the present underground utilities, some of which plans originated with me and some with others, but, after a careful study of the situation, the magnitude of the problem as evidenced by the great number of passengers which must be taken in and out of the business district in very short periods of time, night and morning, has forced me to abandon some of my preconceived ideas, and it is my opinion that a full realization on the part of others of the exact conditions which must govern a comprehensive solution of this problem would show the advocates of the other plans the inadvisability of their adoption. It is possible, however, that some of the suggestions relating to super-surface structures may some day prove advisable to adopt in Chicago, but probably not until the capacities of the systems recommended in this report, or other similar systems have been reached.

The question of the utilization of the waterpower of the Sanitary District Canal for generating electricity and transmitting it to Chicago for the operation of its street railways has also been considered, but inasmuch as a decision regarding it need not be made at present, and from the further fact

that the question was not involved in my commission, I have not submitted a discussion of it.

I have endeavored to outline not only one plan but several plans, some of which, if adopted, would give to the citizens of Chicago the best surface-railway-transportation facilities capable of attainment under the conditions. These facilities cannot be attained at once, and the transition will probably be gradual. In order to make it possible to get immediate relief a plan of surface tracks, which could ultimately become a part of a combined system, has been outlined. This plan provides for ample facilities on the surface for the present needs, permits of through traffic between all divisions with the joint use of tracks, and makes it possible immediately to abandon the river tunnels for street-car purposes, thereby permitting the river channel to be immediately deepened for the accommodation of lake traffic, and portions of the tunnels to be still retained for future subway uses.

In closing, I desire to acknowledge the valuable assistance rendered me by Messrs. Charles V. Weston, C. E., Augustine W. Wright, C. E., Oren Root, Jr., and George C. Sikes, in the preparation of this report, and to thank the respective office forces of Mr. Weston and myself for faithful and efficient services rendered.

I also wish to acknowledge the consideration shown me by the chairman and each member of your honorable committee for allowing me to perform my duty unhindered by suggestions, and I trust that the information contained in the report will be found sufficiently exhaustive and of sufficient merit to enable your committee to formulate a line of action which will lead to practical results.

Respectfully submitted,

BION J. ARNOLD,
Consulting Electrical Engineer.

Chicago, November 19, 1902.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

I. The One-city-one-fare Idea.—Chicago, with respect to transportation, as well as other things, should be regarded as one city, not three. Divisional lines ought to be obliterated, as far as possible. A street-car passenger should be carried over the most direct route between any two points within the city limits for a single fare. Complete unification of ownership and management is the best plan for realizing the one-city-one-fare idea. The same end can be accomplished, however, but in a less satisfactory manner, under divisional ownership, by a plan of through routing of cars, joint use of tracks and interchangeable transfers. To a still less satisfactory degree the same end can be accomplished by the interchange of transfers between companies without joint use of tracks.

II. The Through-route Principle.—Routes through the business district ought to be substituted for downtown terminals, wherever possible. Outside the business district, too, the best results would follow from connecting together the detached lines now found on several streets, and operating cars over such lines from end to end on the through-route principle.

III. Subways.—A system of subways should be, and eventually must be, built to accommodate the street-car traffic of Chicago and relieve the street-surface congestion in the business district. Galleries should be provided in connection with such subways for the accommodation of present and future underground utilities. Two subway plans are outlined in the report. One plan, referred to as Subway Plan No. 1, calls for three north and south subways, from Fourteenth Street on the south to Indiana Street on the north, and two subways entering the business district from the West Side, utilizing the present Van Buren and Washington Street tunnels and looping back at Clark Street. This is a system of high-level subways throughout, with no dips. Its estimated cost is $16,000,000. The other subway plan, known as Plan No. 2, calls for practically the same north and south high-level subways in combination with three or more low-level subways from the West Side, passing under the north and south subways, and reaching Michigan Avenue, and, should future developments warrant, under Lake Front Park, as far as it may be extended. The low-level subways would require the use of elevators. The estimated cost of subways built according to this plan is $20,000,000. Plan No. 2 is recommended as best for the city, from an engineering and transportation point of view, but in case this plan is deemed inadvisable for business or other reasons, a system of single-decked high-level subways, as outlined in Plan No. 1, can be constructed, which will, to a large extent, accomplish the results. No subways should be built in such a manner as to preclude the operation of cars through them on the through-route principle. Under either of the plans as outlined, the whole system of subways need not necessarily be constructed at once. One or more of the subways could be built at a time, and utilized separately, but with a view to their ultimately forming a part of a comprehensive system. The subway plans as submitted do not necessarily call for the removal of all tracks from the street surface in the business district, and Subway Plan No. 1 necessitates some surface loops. Under either plan there could be a street-surface system connecting the depots and designed to accommodate short-haul traffic in the business district. Under Plan No. 2 there could also be a low-level subway system for connecting all depots, and by using it in connection with this subway all tracks could be kept off from the surface of the streets in the business district for some years to come.

IV. The Present River Tunnels.—It is inadvisable to attempt to lower the present river tunnels and at the same time retain them for surface-railway use, for the reason that lowering the tunnels to a sufficient depth to accommodate future river traffic would involve extending the tunnel approaches at least a block further into the business district. In the interest of navigation, therefore, the tops of the tunnels ought to be promptly removed, leaving the lower parts of one or perhaps two of the tunnels for utilization later as parts of a future subway system.

V. Plan for a Unified Combined Surface and Subway Street-railway System.—A plan is presented for a new, reorganized and unified combined surface and subway street-railway system, comprising the lines of the City Railway Company, the Union Traction Company, the Chicago General Railway Company and the Chicago Consolidated Traction Company within the city limits, and new lines necessary to connect properly the now disconnected parts of the system. The total single-track mileage of this system, as outlined, would be about 745 miles, and its estimated cost, if constructed new, with everything first-class throughout, but exclusive of subways, would be $70,000,000. Adding $20,000,000, the cost of the subways constructed according to Plan No. 2, would make the total cost of the new system complete $90,000,000. With Subway Plan No. 1 instead of Subway Plan No. 2, the total cost of the new unified system would be $85,800,000.

VI. Plans for Immediate Improvement of Terminals and Service.—Plans are presented for the rerouting of surface terminals in the business district (1), under the present divisional ownership and operation, (2) under the joint use of tracks in the business district under divisional ownership, and (3) under unified ownership and management. Immediate improvement of Chicago's local transportation facilities may be effected by substituting electric for cable power and routing cars according to any of the plans outlined, all cars from the West and North Sides to enter the business district over bridges until such time as subways shall be constructed.

VII. Electric Underground-conduit System.—The operation of cars in Chicago by the electric underground-conduit system is practicable and feasible. Overhead-trolley construction should be prohibited within the area bounded by Twelfth Street on the south and the river on the north and west. Outside of the district named the objections to the overhead trolley are esthetic in nature, and it is for the city authorities to say—after a balancing of financial against esthetic consideration—how much, if any, underground-conduit construction should be required. The cost per mile of single track (track alone, including feeders) of electric-conduit road construction would average $81,300 for a system covering the entire city, including feeder wire, but exclusive of the cost of power, rolling stock and paving of right-of-way. All conduit construction, however, within the business district would cost about $100,000 per mile, due to the numerous curves, large amount of special work required, and the extra cost of labor, due to the congestion within the district in which the work must be prosecuted. To either of the above figures should be added the cost of paving, as follows: Brick, $12,650; asphalt, $12,880; dressed granite, $18,400. Overhead-trolley road construction would cost $20,836 per mile of single track, using the same weight of rail. It would cost nearly as much to convert the Chicago cable roads into electric-conduit roads as to build new electric-conduit roads.

VIII. Grooved Rails.—A grooved girder type of rail, of special design, is recommended for well-paved streets upon which cars operate often enough to clear properly the groove of dirt and ice. On outlying streets and on poorly paved and poorly maintained streets the girder type of rail should be maintained as best for team traffic and the railway companies.

IX. Electrolysis.—The destruction of underground utilities from electrolysis is now well in hand by the city, and if the present ordinance governing the subject is enforced, no serious difficulties may be anticipated from this source, and when the underground-conduit system is adopted, there should be no further injury from electrolysis in the area served by the conduit system, because this system uses a complete metallic circuit.

X. The Financial Aspect of the One-city-one-fare Plan.—A unified company could afford to conduct the transportation business of Chicago on the basis of a single fare for a continuous ride anywhere within the city limits. The present divisional companies, by the interchange of transfers, could afford to do the same thing, provided they were properly protected against the fraudulent use of transfers, but it would be at a somewhat greater cost to themselves, and with greater inconvenience to passengers, than would be the case under unified management.

XI. Growth of Population and Traffic in the Past and Estimates as to the Future Increase of Street-car Traffic.—The population of Chicago has increased since its incorporation in 1837 to 1902 at the rate of 8.6 per cent. per year compounded, and is now increasing at the rate of 7.7 per cent. per year. For the nine years from 1892 to 1901, inclusive, the number of revenue passengers carried by the Chicago surface and elevated lines combined, has increased at the rate of five per cent. per annum compounded. The increase for the surface lines during the same period has been at the rate of 1.5 per cent. per year compounded. The increase for the combined surface and elevated lines from 1894 to 1901, inclusive, a period of seven years, has been at the rate of 6.3 per cent. per year compounded. The increase for the surface lines alone during the same period has been at the rate of 3.9 per cent. per year compounded, and the increase for the elevated lines alone has been for the same period at the rate of 2.6 per cent. per year compounded. The population of Chicago has increased more rapidly than that of any other city in the world, but it is improbable that this rate of increase should continue indefinitely. Figures and curves are presented showing the past growth of Chicago as compared with other cities; also the future results if present rates of increase should be maintained, but as this is improbable, curves are shown representing the increase in population and gross receipts that may reasonably be expected for the combined surface and elevated railways during the next 50 years.

XII. Estimated Cost of Reproduction and Present Value of Existing Plants.—The cost to reproduce the following properties complete with new construction and equipment throughout would be: Chicago City Railway Company, about $17,200,000; Chicago Union Traction Company (not including the Consolidated Traction Company), about $22,200,000. The actual present value of the physical properties for railway purposes of the following companies, taking into consideration the obsolete equipment and construction, which must be discarded, but not taking into account any franchise rights or earning capacity of the properties, is estimated as follows: Chicago City Railway Company, about $12,000,000; Chicago Union Traction Company (not including Consolidated Traction Company), about $15,000,000.

XIII. Need for Regulation of Team Traffic.—At the present time team traffic interferes with street cars to an unwarrantable extent. A reasonable regulation of team traffic is essential to the improvement of street-car service.

XIV. The Union Elevated-loop Problem.—The junction points are the ultimate limiting factor of the capacity of the Union Elevated Loop. At the present time, however, the platform stations are the limiting factor. The first and simplest way to increase the capacity of the loop is to lengthen the station platforms, so that two trains can load and unload at a station at the same time. When the capacity of the junction points is reached, added facilities can be provided by building stub-end terminals just outside the loop. The terminal capacity of the loop could be increased by dividing the present loop into four smaller loops, but, presumably, there would be public objection to such a plan, because it would involve encumbering more downtown streets with elevated structures, and it is, therefore, not recommended. The ideal solution of the elevated-loop problem would be to utilize the loop structure as sections of through routes between the different sections of the city.

Chicago Institute Meeting.

A meeting of the western members of the American Institute of Electrical Engineers was held in the rooms of the Western Society of Engineers in Chicago on December 30th. The meeting was presided over by R. H. Pierce, local honorary secretary, and there was a fair attendance. The papers on the general subject of "Braking and Traction Brakes" which were presented at the New York meeting of the Institute on December 19th were read. B. J. Arnold read J. D. Keiley's paper on "Some Brake Tests and Deductions Therefrom" and R. A. Parke's paper on "Railroad Braking" was read in abstract by T. P. Gaylord. A brief discussion was participated in by B. J. Arnold, R. H. Pierce, J. R. Cravath and E. B. Clark, the principal subject discussed being a magnetic device for increasing traction, which has been recently demonstrated in Chicago.

The next meeting of the Institute in New York city will be on January 23d, when the subject of "Telephone Exchanges" will be considered, the principal paper, on "The Evolution of the Telephone Switchboard," being presented by Thomas D. Lockwood, electrical engineer and advisory electrician of the American Telephone and Telegraph Company. Discussion will be opened by J. J. Carty, chief engineer of the New York Telephone Company, and will be continued by representative telephone men. The Chicago meeting for the consideration of the same subject will be held on February 3d, and the local committee intends to have a large number of men who are prominent in the telephone manufacturing and operating business present to discuss the paper.

Germany is reported to be planning the laying of a submarine cable from the Azores to Dutch Guiana.

American Association for the Advancement of Science.

Washington, D. C., December 29.—Only twice before in the history of the American Association for the Advancement of Science have its meetings been held in Washington, and it is expected that the present meeting—the fifty-second—will be one of the largest and most important in the history of the association. The plan, as laid down, is that a general meeting will be held each morning at 10 o'clock, followed by meetings of all the affiliated societies at places and times designated by the official programme. The members of the council for the Washington meeting include a large number of past-presidents, vice-presidents and members from the association at large and from the affiliated societies.

The opening session was called to order to-day at 10:15, Dr. Ira Remsen of Baltimore presiding. With him on the platform were Past-presidents E. W. Morley, A. B. Prescott, Professor C. D. Walcott, Dr. C. H. Needham, Dr. W. J. McGee, N. B. Ward, general secretary, N. A. Weber, N. T. Newcomb, S. Culin, C. C. Nitting, John J. Flather, H. S. Jacoby, C. J. Herrick, L. O. Howard, premanent secretary, Marcus Benjamin, local secretary, Commissioner MacFarland, and others. Dr. Remsen introduced Commissioner MacFarland, who made a brief address of welcome.

This was followed by a speech by Assistant Secretary of State Hon. David J. Hill, in the course of which he brought to the attention of the assembled delegates the fact that the government of the United States is of the people, that it exercises no paternalism and that it is for these reasons the home of science as no other country of the world can be. Only in those countries in which scientific research is cultivated and fostered is there any great advancement made, and in proportion to its encouragement of science, scientific research and development do the nations of the world rise or fall. While scientific research has been carried on in European countries, it has been more for the purpose of upholding the government, while in the United States there is no such thing as official science, but, on the other hand, there are many scientific officials who give to the country the best of their knowledge and experience. One point specially alluded to was that it is on account of the fact that the initiative in science is with the people that the government work has become of such a scientific character. This has led to an assemblage of a group of scientific experts in Washington of the very highest type, men who are not held in office by any political influence, but who are recognized the world over as first authorities in the particular lines in which they are engaged. The other point emphasized was that it has come to be an accepted fact that no one should hold a public office unless specially equipped for the work.

Professor Charles D. Walcott was next introduced, and welcomed the visitors on behalf of the Washington Academy of Science and the scientific societies affiliated with it. He said in part: "We have heard it expressed that the employment of scientific men in the government service would be detrimental to scientific research. I think this fear is groundless. A large part of the government work consists in the application of the results of scientific research for the benefit of mankind, rather than in using it for the development of scientific theorists who would investigate merely for selfish purposes. * * * * I would not convey the idea that scientific research of the highest type is neglected in government laboratories; on the contrary, a great amount of time is expended in purely scientific research by well-trained men. I have found, as the result of a decade of administration, that co-operation with universities and research organizations has been most helpful to the work under my charge, and men from all sections of the country declare that great benefit has accrued to the institutions which have co-operated with the government."

Dr. Charles W. Needham followed, and called attention to the blessings of and necessity for co-operation between scientists and institutions of learning, and extended a welcome to the association on behalf of the educational institutions of Washington.

President Remson gave a very brief talk, in which he called attention to the fact that this was the first time the association had met in the winter season, and expressed his certainty that this would be the most successful meeting in the history of the association.

After the adjournment of this meeting a luncheon was served at the Arlington Hotel, and during the afternoon a number of addresses were made on varying subjects.

Among the members of the association noted in attendance on the opening day were C. Knisley, Chicago; Herbert Osborn, Columbus, Ohio; Ernest F. Nichols, Hanover, N. H.; George F. Stradling, Philadelphia; Alexander Graham Bell, Washington, D. C.; Edward R. Taylor, Penn Yan, N. Y.; Dayton C. Miller, Cleveland, Ohio; John J. Flather, Minneapolis, Minn.; Henry S. Jacoby, Ithaca, N. Y.

The Hartford Electric Light Company of Hartford, Conn., has had plans prepared for the erection of a five-story building, to be used for purposes demanded by its increasing business.

Modern Tendencies in the Utilization of Power.[1]

By John Joseph Flather.

It has been stated that to the construction and perfection of her machinery, more than to any other cause, may be ascribed the present commercial supremacy of the United States. Be that as it may, the economical production of her manufactures and the convenient adaptations of time and labor-saving devices in all the various lines of constructional work have certainly exerted a wonderful influence in the upbuilding of her industries.

Specialization in the manufacture of machine tools and labor-saving devices has followed closely the segregation of processes in other lines of industry, and thus there has been created a multitude of special machines, each designed to perform some single, and often very simple, operation.

Among other significant features the present tendency in the development and use of this class of machinery is marked by the adaptation of compressed air and the application of electric power to machine driving. In the use of compressed air, the facility of adaptation to various requirements which are in many cases additional to the supply of motive power is a valuable feature peculiar to this system and one which is susceptible of extension along many lines.

The labor cost in most machine shops and other works is so much greater than the cost of power, that any expedient by which the labor cost may be appreciably reduced is justified, even though the efficiency of the agent itself be low.

Engineers have recognized for some time past that there is a very great percentage of loss due to shaft friction, which, in railroad and other shops, where the buildings are more or less scattered, may be as great as 75 per cent. of the total power used. In two cases known to the speaker these losses are 80 and 93 per cent., respectively. In the ordinary machine shop this loss will probably average from 40 to 50 per cent.

In view of these facts, we find a general tendency to introduce different methods by which a part of this loss may be obviated. Among these are the introduction of hollow and lighter shafting; higher speeds and lighter pulleys; roller bearings in shaft hangers, and the total or partial elimination of the shafting.

Independent motors are often employed to drive sections of shafting and isolated machines, and among these we find steam and gas engines, electric motors, compressed-air and hydraulic motors, although the latter have not been used for this purpose to any great extent in this country. More recently, the electric motor has superseded the steam engine for this work, as its economy and convenience over the latter is now thoroughly recognized.

The introduction of the electric motor in machine shops and factories was at first looked upon with disfavor and was opposed by many manufacturers, but the innovation obtained a foothold, and advantages which were at first unforeseen were found to attend its use, so that now it is being very generally adopted for a wide variety of work. A considerable difference of opinion exists as to whether individual motors should be used with each machine, or whether a number of machines should be arranged in a group and driven from a short line shaft. There are well-defined conditions to which each system is best adapted, but there are wide limits between which there appears to be no general rule, and we find both methods occupying the same field.

For isolated machines and for heavy machines that may be in occasional use the individual motor is particularly well adapted, as it consumes power only when in operation. It is, however, necessary that each motor thus connected shall be capable of supplying sufficient power to operate its machine under the heaviest as well as lightest loads. Fortunately, with electric motors, the rated capacity is usually less than the safe maximum load, which is determined either by the heating of the conductors tending to break down the insulation, or, by excessive sparking at the brushes.

In many cases with individual motors, owing to wide variations in power required, the average efficiency of the motor may be very low; for this reason a careful consideration of the conditions governing each case indicates that for ordinary machine driving, especially with small machines, short lengths of light shafting may be frequently employed to good advantage and the various machines, arranged in groups, may be driven from one motor. By this method fewer motors are required, and each may be so proportioned to the average load that it may run most of the time at its maximum efficiency. When short lengths of shafting are employed, the alignment of any section is very little affected by local settling of beams or columns, and since a relatively small amount of power is transmitted by each section, the shaft may be reduced in size, thus decreasing the friction loss. Moreover, with this arrangement, as also with the independent motor, the machinery may often be placed to better advantage in order to suit a given process of manufacture; shafts may be placed at any angle without the usual complicated and often unsatisfactory devices, and setting-up room may be provided in any suitable location as required, without carrying long lines of shafting through space. This is an important consideration, for not only is the running expense reduced thereby, but the clear head-room thus obtained free from shafting, belts, ropes, pulleys and other transmitting devices, can be more easily utilized for hoists and cranes, which have so largely come to be recognized as essential to economical manufacture.

As far as the efficiency of transmission is concerned, it is doubtful whether in a large number of cases motor-driving per se is any more efficient than well-arranged engines and shafting.

As already pointed out, the principal thing to be kept in mind is a desired increase in efficiency of the shop plant in turning out product, with a reduction in the time and labor items, without especial reference to the fuel items involved in the power production.

One serious obstacle to the use of connected motors with machine tools is the difficulty of obtaining speed variations, which is so necessary with a large proportion of the machines in common use. In many of the larger sizes of metal-cutting machine tools it is probable that marked changes will be produced in the immediate future, and the indications are that direct-connected motors with wide variations of speed and power will be incorporated in the new designs.

The recent improvements in the manufacture of certain grades of tool steel have shown indisputably that the present designs of machine tools are not sufficiently heavy to stand up to the work in order to obtain the economy of operation which results from the use of such steels. Higher speeds, heavier cuts and greater feeds may be obtained if the machines will stand the strain, but in most cases the capacity of the machine is not commensurate with the ability of the tool to remove metal.

With cutting speeds of 100 to 200 feet per minute, it is evident that the power requirements will be much greater than for the ordinary machines of to-day, which have a cutting speed of from 10 to 30 feet per minute.

As an illustration of what can be done with these new tool steels, the speaker was recently shown some steel locomotive driving wheels which had been turned up in two hours and 40 minutes, whereas the regular time formerly required was not less than eight hours. In this case even better results could have been obtained, but the belts would not carry the load.

Here, then, we find an interesting field for the direct-connected motor with ample power and speed variation for any work which it may be called upon to perform.

Reference has been made to the use of compressed air and its facility of adaptation to various requirements, but it is evident, from an inspection of some of the devices in use, that enthusiasm for new methods rather than good judgment has controlled in many of its applications.

For some years compressed air was used only in mines, where it produced marked economies in underground work. Later, compressed air was introduced into manufacturing lines, and to-day its use in railroad and other machine shops, boiler shops, foundries and bridge works is being widely extended. In the Santa Fe railroad shops at Topeka there are over five miles of pipe in which compressed air is carried to the different machines and labor-saving appliances throughout the works.

New applications of compressed air are constantly being made, and each new use suggests another. This has a tendency to increase the number of appliances which are intended to be labor-saving devices, but in many cases the work could be done just as well and much more cheaply by hand.

A case in point is seen in an apparatus which was at one time in use on one of our prominent western roads. It was a sort of portable crane hoist, which could be fastened to the smokestack of a locomotive, whereby one man could lift off the steam-chest casing. The hoisting apparatus weighed about twice as much as the steam chest and took three men to put it up. When piece work was adopted two men easily lifted off the steam chest, and this "time and labor-saving device" was relegated to the scrap heap.

The success and economy which has attended the use of compressed air in so many lines of work has led to its adoption in fields which are much better covered by electrically operated machines. While compressed air has been used under certain conditions very satisfactorily to operate pumps and engines, printing presses, individual motors for lathes, planers, slotters, dynamos and other work, it does not follow that it is always an economical agent under these various uses, or that other methods could not be used even more satisfactorily in the majority of cases.

It has been proposed to use individual air motors in machine shops and do away with all line shafting, except possibly for some of the heavier machinery. This use of compressed air seems entirely outside the pale of its legitimate field; the general experience thus far indicates that rotary motors are not at all economical and generally are not as satisfactory as electric motors.

While the field is to some extent limited, yet the uses of compressed air are certainly not few, and

1. Vice-presidential address delivered before Section D, Engineering and Mechanics, of the American Association for the Advancement of Science, at Washington, D. C., on December 29, 1902. Mr. Flather is professor of mechanical engineering at the University of Minnesota.

in many lines of work marked economy results from its use.

In most cases no attempt has been made to use the air efficiently; its great convenience and the economy produced by its displacement of hand labor have, until recently, been accepted as sufficient, and greater economies have not been sought.

In the matter of compression, we still occasionally find very inefficient pumps in use, but manufacturers generally have found that it pays to use high grade, economical compressors. The greatest loss is that in the air motor itself. In a large number of cases it is impracticable, or, at most, inconvenient to employ reheaters, and we find very generally that the air is used at normal temperature for the various purposes to which it is applied.

To obtain the most satisfactory results, the air must be used expansively, but usually where the demand for power is intermittent, no attempt has been made to reheat the air, and as a result the combined efficiency of compressor and motor is quite low, varying in general from 20 to 50 per cent. While low-working pressures are more efficient than high, the use of such pressures would demand larger and heavier motors and other apparatus, which is undesirable.

While it may be impracticable to reheat the air in certain cases, yet there are many situations where a study of means to overcome the losses referred to would result in still greater economies.

The greater adaptability of compressed air to various purposes causes its use to increase along with that of the electric motor, for it has a different field of usefulness, independent of power transmission; at the same time, when the requirements are properly observed in its production and use, its economy as a motive power in special cases compares favorably with other systems. With a better knowledge of the principles involved, we may expect much better results than have yet been attained.

But compressed air possesses so many advantages that however inefficient it may be as a motive power its application to shop processes will be continually extended as its usefulness becomes better known.

We have already stated that compressed air, as now used without reheating, is not at all efficient as a source of motive power, since the combined efficiency of compressor and motor, even under favorable conditions, is not more than 50 per cent. of the available energy put into the compressor. In other cases the efficiency is as low as 20 per cent.

In the transmission of air, within reasonable limits, the loss in transmission, if the pipes be tight, need not be considered, for although there is a slight loss in pressure due to the frictional resistance of the pipes, yet there is a corresponding increase in volume due to drop in pressure, so that the loss is practically inappreciable.

There should be no comparison between the cost of power by compressed air and its brilliant rival, electricity, since each has its own field of usefulness, yet it may be interesting to note for our present purposes the efficiency of electric power. A modern shop generator, belted from an engine, will have an efficiency of about 90 per cent. when working under favorable conditions, but as the average load is ordinarily not more than two-thirds full load, and often much less, the efficiency will not usually be more than 85 per cent. Since the engine friction was added to the losses in compression, so also it should be considered here, in which case the efficiency of generation will lie betwen 75 and 80 per cent. With a three-wire, 220-volt system, which is very suitable for ordinary shop transmission, when both light and power are to be taken off the same dynamo, the loss in transmission need not be more than five per cent., so that the efficiency at the motor terminals will not be far from 75 per cent. With motors running under a nearly constant full load, the efficiency of motor may be 90 per cent.; but with fluctuating loads this may fall to 60 per cent. at quarter load.

Where cheap fuel is available, it is found in most cases that electric power can be generated at the works more cheaply than it can be purchased from a central station; especially is this the case if the exhaust steam be used for heating purposes. In isolated plants the cost of transmission is very small as compared with the total cost of generation; whereas in the average central station the cost of transmission, which includes interest and depreciation on pole line, usually constitutes a large percentage of the operating cost.

In those localities where the cost of fuel is high electric power can often be purchased more cheaply from a central station which obtains its power many miles distant and transmits it electrically to a convenient distributing center where it is used for power and light.

The possibility of electrical transmission thus permits of the utilization of available sources of power at great distances from the center of distribution; but while it is interesting to know that a certain amount of power may be transmitted a given distance with a high degree of efficiency, it is more important to know whether the same amount of power could be obtained at the objective point more economically by other means.

It has been suggested that the future of long-distance transmission depends largely upon the development of oil as a fuel; but at the present time the outlook for oil fuel in general competition with coal or long-distance transmission is not encouraging; while the development of the Texas and Southern California oil fields has increased the visible supply and brought about increased activity in the use of liquid fuel, yet it is doubtful whether the advantages would be sufficient to cause it to come into general use as a fuel, since with a limited production and an increased demand for this and other purposes, the cost would be correspondingly increased.

A number of railroads contiguous to the oil-producing centers have equipped their locomotives to burn this fuel, and it is used to some extent to fire marine boilers, and with great satisfaction, since its displacement for a given heating value is only about one-half that of coal, and the labor cost is materially reduced. It is also used quite extensively in certain sections of the country as a steam producer in power plants, but it is hardly probable that liquid fuel will be a serious competitor of coal, notwithstanding its many advantages.

At the present time, as far as power for manufacturing plants is concerned, it is largely a question of transportation, whether oil can be laid down and handled at a given point more cheaply than coal. It is probable, however, that oil fuel will supply a local demand in certain sections where transportation charges will permit its use at a low cost, and it is in this connection that it may become a competitor of electrical transmission.

One interesting phase of the power problem which forcibly presents itself to the engineer at the present time is the vast possibilities possessed by the modern combustion engine, which includes the various types of gas and oil engines. While its use as a motor in industrial establishments has been somewhat limited, yet there is a marked tendency to employ the gas engine in manufacturing works, and a consideration of its advantages and cost of operation, together with its high thermal efficiency and possibility of still further improvement, indicates that for a great many purposes both steam engines and electric motors may be ultimately replaced by gas engines.

That the gas engine, in both large and small sizes, has reached a point in its development where it can fairly rival the steam engine in reliability and satisfactory running qualities there can be no question. In point of fuel economy, a gas engine of moderate size is on a parity with the largest triple-expansion steam engines, and it will give a horsepower on one pound or less of fuel.

The high price of gas in this country has contributed largely to those causes which have prevented a more common use of the gas engine as a motor. For this reason the gas engine has generally been used, not so much because of its high efficiency as a thermodynamic machine, but rather on account of its convenience and saving in labor. It is true that natural gas is cheap, but it is equally true that natural gas is not generally available.

It is to producer gas that we must look for any marked increase in the use of the gas engine. Fortunately, the manufacture of producer gas has reached a high state of development, and there are now in successful use several processes by which power gas can be made from cheap bituminous coals as well as anthracite and coke. The leanness of such gases renders them less effective per cubic foot of gas, as compared with the richer coal gas or even water gas; but this difference is more than compensated for by the low cost of production. It is upon such power gas that the commercial future of the gas engine as a general motor depends.

The producers are very simple in operation and furnish a convenient and economical means of obtaining power at a much lower rate than with the ordinary city lighting gas. Generally, small anthracite coal or coke is used, but several methods employ bituminous coal, lignites or wood. With bituminous coal, means must be provided for removing the tar and ammonia, and other products of distillation.

The gas-engine industry received a signal impetus when it was discovered that blast-furnace gases could be readily utilized direct in combustion engines without the intervention of boilers and without any special purifying processes. A still more important circumstance which is far-reaching in its results is the fact shown by Professor Hubert of the Liege School of Mines that the superior economy of the gas engine enables equal power to be obtained with 20 per cent. less consumption of furnace gas than was formerly used in the generation of steam.

The successful employment of large combustion engines in this way utilizes vast sources of power which a few years ago were allowed to go to waste or at most were used very inefficiently.

The high thermal efficiency of the gas engine has long been recognized, and the possibility of further development is a promising factor in this field.

Efficiencies of 30 per cent. or more have been obtained with blast-furnace gases, which contain a very small percentage of hydrogen, and this, with the high rates of compression which can be carried, has led to the advocacy of non-hydrogenous mixtures in large engines. Certainly, very high rates of compression may be had with a non-hydrogenous producer gas without fear of premature ignition, and it has the additional advantage of economical production.

The practice of making the cylinder in combustion engines act alternately, first, as air compressor, then as motor, has the advantage of greater simplicity, but it means immensely larger engines for the same power, since the number of effective impulses is thus cut in two.

The danger of pre-ignition and consequent severe shock on the engine also necessitates very heavy construction in the smaller engines, in order to obtain a reasonable degree of safety in operation. Moreover, the smoothness of action is greatly retarded with this form of engine, especially if the governing is controlled by the "hit and miss" method, in which the regulation is affected by varying the frequency of the explosions, thus causing great variations in the driving torque.

Various expedients have been employed to overcome these defects, such as the use of multi-cylinders and different methods of control, but the size and cost of engines have been increased rather than decreased. Notwithstanding these well-recognized defects in the four-cycle type of engine, it constitutes by far the largest class in use to-day of what may be called successful gas engines.

More recently, very satisfactory results have been obtained in the construction of two-cycle engines. In some of these we find separate pumps employed to compress the charge of gas and air, which ignites and burns as it enters the cylinder. Higher compression is thus obtained without fear of pre-ignition, and this permits smaller clearance spaces, with attendant advantages.

If the engine is single-acting, an impulse is obtained every revolution, which thus insures better speed regulation, as well as double the power for a given-sized cylinder.

The highest thermal efficiency yet attained, namely, 38 per cent., has been secured with a two-cycle type of engine, but whether these engines will be as satisfactory for small motors remains to be seen. It is possible that the greater complication of details in the two-cycle type, as compared with the simpler four-cycle engine, will cause the latter to continue to give the greater satisfaction, at least for the smaller sizes.

At the last meeting of the British Association, Mr. H. A. Humphrey gave some interesting data concerning recent gas engines, and the record is both remarkable and significant. The limiting size has rapidly grown during the last two years, as shown by the fact that one manufacturer is now constructing a gas engine of 2,500 horsepower, and is prepared to build them up to 5,000 horsepower.

In August of this year (1902) two leading English manufacturers had delivered, or had under construction, over 50 gas engines, varying in size between 200 and 1,000 horsepower; but we have to look across the channel for still greater achievements in this direction.

Neglecting all engines below 200 horsepower, we note that a classified list of gas engines in use or under construction shows the remarkable total of 327 gas engines capable of supplying 182,000 horsepower. This gives an average of 560 horsepower per engine. As compared with this, we find from the last United States Census Report that during the census year 1899, there were constructed in the United States 18,500 combustion engines, having a total capacity of 165,000 horsepower, or only about nine horsepower per engine.

Although this country has lagged somewhat behind Europe in adopting large gas engines, there is evidence that this state of affairs will not exist very long, since a number of enterprising firms are already in the field prepared to build gas engines up to any required size. One firm has already sold over 40,000 horsepower of large engines, most of them of 2,000 horsepower and several of 1,000 horsepower, for coupling to electrical generators.

The uses to which these large engines are put is about equally divided between the operation of blowing engines for blast furnaces and the driving of dynamos for general power distribution. While the gas engine in the larger sizes is thus used extensively for the generation of electric light and power, a growing tendency is observed to use it direct as a motor.

A number of railroad and other machine shops have been equipped with small gas engines, suitably located about the works, and, in addition, thousands of horsepower are used in the smaller sizes for a wide variety of purposes, including village waterworks, isolated lighting stations, and manufacturing plants of all kinds.

With the possibilities of high thermal efficiencies we may look with much hope upon the still higher development of cheap fuel-gas processes that will bring the gas engine into very general succession to the electric motor for many purposes, for it will doubtless be found that gas transmitted from a central gas-making plant at a manufacturing works into engines located at points of use will effect a material saving in the utilization of power over any existing methods.

It is not to be presumed that the gas engine will displace either the electric motor or the steam engine; each has its legitimate sphere of usefulness, and each will be more highly developed as the result of direct competition. Yet, the economies already obtained are at least suggestive of important developments that may take place in methods of obtaining and using power.

CHANGES AND PROMOTIONS.

E. C. Noe.

Elzer C. Noe, one of Chicago's well-known electrical engineers, has been appointed successor to Frank Hedley as general superintendent of the Lake Street and Northwestern elevated-railway systems of Chicago. Mr. Noe has been connected with the General Electric Company since its organization, and has long filled, with well-recognized ability, the position of engineer for the district controlled by the Chicago office. He is thoroughly conversant with all branches of electrical work, and his wide and varied experience in practical engineering should stand him in good stead in his new position. Before the days of the General Electric Company, Mr. Noe was connected, successively, with the old Western Edison Light Company of Chicago, the United Edison Manufacturing Company and the Edison General Electric Company. His experience covers a space of 20 years and has been gained almost entirely in Chicago. He has had to do with railway, light and power plants and has done work that has been recognized as of high grade. Mr. Noe has a wide circle of friends and acquaintances who will congratulate the management of the Lake Street and Northwestern properties on its selection.

E. C. NOE.

Bernhard A. Behrend.

Bernard A. Behrend has recently been made chief engineer of the Bullock Electric Manufacturing Company of Cincinnati. The compliment thus bestowed upon Mr. Behrend is one to which he is justly entitled, as the character and volume of the engineering work he has done during the two years he has been with the Bullock company justifies the belief that he is destined to rank with the ablest of engineers.

Mr. Behrend was born in Pomerania, Germany, May 9, 1875, and received his elementary education from a tutor at Varzin. The father of Mr. Behrend was a man of rare engineering ability, a quality that is reflected and augmented in the talent of his son. In spite of the strong bent of mind toward pure science, which was shown at the Berlin Polytechnical Institute and University, he finally decided to follow the more practical side and studied engineering under such eminent professors as Helmholtz, Kundt, Slaby, Riedler and a short time under Kapp. Entering the employment of the Oerlikon company at Zurich, Switzerland, he soon became assistant chief electrician.

He has contributed liberally to the scientific and engineering press of the world, and was the first to give a simple proof and to explain the application of the circle diagram now so generally used for the calculation and testing of induction motors. The question of a simple determination of the drop in alternators working on an inductive load received an extensive investigation at his hands, the results having been published in the leading German, French and English publications.

Mr. Behrend left the Oerlikon company in 1899, coming to the United States to live with his parents and to recuperate his health, which had been undermined by overwork. In 1900 he was engaged by the Bullock Electric Manufacturing Company as chief engineer of its alternating-current department, where in two years' time, he has produced a line of machines ranging in size from the half-horsepower induction motor to the ponderous 5,000-horsepower generator. His work has been uniformly successful, and his designs bristle with the cleverness that is characteristic of the man.

Extensive Improvements for New York Edison Company.

The constant growth of the demands for power has made it necessary for the New York Edison Company to make arangements for new generators, rotary converters and transformers. The largest machines specified in the contract, which has been let to the Stanley Electric Manufacturing Company, are four 2,000-kilowatt rotary converters. The transformer equipment to accompany the same consists of 12 800-kilowatt static transformers of the air-blast type and four auto-regulators. As is generally known, the largest rotaries hitherto built are the 1,500-kilowatt units in the Manhattan Railway sub-stations, and therefore the construction of those of 2,000-kilowatt capacity marks a distinct advance in the art. In addition, the contract calls for 10 1,000-kilowatt rotary converters, with 30 400-kilowatt static transformers of the air-blast type and 10 auto-regulators. The above apparatus is to be placed in various sub-stations of the Edison system. Three new generating units, consisting of 3,500-kilowatt, 25-cycle, three-phase, alternating-current generators, direct-connected to engines working at 75 revolutions per minute, are to be furnished for the Waterside station of the New York Edison Company.

The Electric-railway and Lighting Franchises for Manila.

The Bureau of Insular Affairs of the War Department has received from Manila the full text of the enactment of the Philippine Commission providing for the granting of a franchise to construct an electric street railway on the streets of Manila and its suburbs and a franchise to construct, maintain and operate an electric-light, heat and power system in the city of Manila and its suburbs, after competitive bidding. The bureau was advised by cable from the civil governor during the latter part of October of the salient features of this enactment, and announcement was immediately made in many of the newspapers throughout the country that after December 1st complete information would be available in that office.

The present street-car system in Manila is entirely inadequate; the cars are small and drawn by the native Filipino ponies; the service is infrequent, and then only along a very few of the more important thoroughfares. It is at present the practice of all classes to hire public cabs called carronatas or quilezes, in going from one point to another in the city. The charge for the use of these cabs is from 15 to 20 cents for the course. The demand for these public vehicles is such, however, that, despite the fact that licenses have been issued to upward of 4,000, the number is entirely inadequate to meet the demands, and it is practically impossible to secure public transport during certain hours of the day. This forces many, in fact, all who can afford it, to purchase and maintain private vehicles for use in going to and returning from their regular duties, and the number of such vehicles is believed to be almost as great as the number of public licensed vehicles.

Recently an effort was made by some private parties to introduce the jinricksha into Manila, which has been found such a satisfactory means of street transportation in the Japanese and Chinese coast cities. The ricksha is a light two-wheeled vehicle capable of accommodating one passenger and drawn by a coolie. But with the climatic conditions and the distances in Manila against it, it is not believed that it will afford any relief to the present congested transportation facilities.

With an American and European population of more than 20,000, and a native and Chinese population of upward of 300,000, living in a city covering an area of 20 square miles, it will be apparent that there is a broad field for the installation of a suitable and adequate street-railway system. The climatic conditions during the greater part of the year are such as to render walking difficult and unpleasant, and it is believed that the percentage of the population that will have recourse to a properly conducted street system of transportation will be greater than in the average American city. Manila is in a country where coolies ride. An analogous condition formerly existed in the City of Mexico, and the installation of an electric-tramway system there some three or four years ago, it is understod, has been eminently successful to the investors.

The route of the proposed system, as fixed by the Philippine Commission, is 35 miles long, and is so arranged as to furnish a satisfactory system of transportation from any part of the city to any other part, and, without passing through any territory which would not regularly contribute its quota of passengers, takes in two racecourses and the baseball park. The interest of the population, both American, European and native, in horse racing, due to the fact that many forms of recreation resorted to by residents of the United States are impracticable, is such that meets are held during one or two days of each week practically all the year round, except during a short period at the height of the rainy season. This traffic in itself, it is believed, would contribute much to the revenues of the street-railway system.

As to that portion of the franchise relative to the furnishing of light, heat and power, Colonel Edwards states that there is at present an electric-light company in Manila which furnishes street arc lamps and incandescent lamps to the city of Manila, and a limited number of incandescent lights and power for the propulsion of electric fans to private individuals. It is understood, however, from persons returning from Manila, that the service is inadequate to meet the demands upon it. There is no coal-gas system of illumination, and it is thought, in view of climatic conditions, if furnished at a permissible rate, electric lights would supersede practically all acetylene and petroleum-oil methods of illumination; and, further, that as a motive power it would be found more economical to consumers than the present power generated by wood and coal, particularly in view of the heavy demands of the shipping for coal.

The points of competition for bidding are the duration of the franchise, not to exceed 50 years, the rate of fare on the street railway, not to exceed 7½ cents gold for first-class passengers and five cents gold for second-class passengers, and the compensation to be paid the city of Manila for the franchise, not less than 1½ per cent. of the gross earnings. Construction must begin within six months after awarding the bid and be completed 20 months thereafter.

The franchise for the electric railway specifies an overhead-trolley system, with standard 60-pound T-rails laid on standard gauge. At least two miles of the tracks shall be laid with 70-pound grooved rails. The grantee shall pave and keep in good and permanent repair the street between its rails and for 18 inches on each side of the tracks. The trolley wires may be suspended by span wire or brackets and shall have double insulation. Feeder wires shall be triple-braid weatherproof, and no overhead wire shall carry a potential greater than 550 volts. Two classes of cars shall be run, and at least 60 per cent. of the cars shall be second class. A reasonable transfer system shall be adopted, and outside of the city additional fares may be charged at the rate of five and three cents for each two miles. At any time after 25 years the city of Manila may purchase the property.

The electric-lighting system specified includes the erection of the necessary poles, wires, cut-outs, transformers and other appurtenances and overhead structures. The alternating-current system shall be used, but direct current may be furnished for heat, power or arc lighting. Feeder wires shall be triple-braid, weatherproof, and all construction shall comply with the rules and regulations of the National Board of Underwriters of the United States. The Municipal Board, with the approval of the Advisory Board and the commission, shall fix the prices at which current shall be furnished to private persons or corporations and to the city and the insular government. A deposit of $175,000 is required as security for the compliance with the franchises.

The Bureau of Insular Affairs is now in a position to furnish the full text of the enactment of the Philippine Commission to intending bidders. A map showing the proposed route of the street railway may also be consulted in that office. The bids are to be filed in Manila before the fifth day of March, 1903, on which date they are to be opened.

New Institute Members.

At the most recent meeting of the American Institute of Electrical Engineers the following-named gentlemen were elected associate members: Paul Leon Battey, Chicago; James Rowland Bibbins, New York city; William Augustus Bucke, Toronto, Canada; Julius C. Calisch, Buffalo, N. Y.; Aaron Franklin Chamberlain, Pittsburg, Pa.; Frank Conrad, Pittsburg, Pa.; Arthur Leroy Cook, Worcester, Mass.; Charles Anthony Cora, Buffalo, N. Y.; Jack Randall Crawford, Erie, Pa.; James Roger Crocker, Lockport, N. Y.; Harold Platt Daniels, Schenectady, N. Y.; Louis Charles Dornbusch, Brooklyn, N. Y.; Proctor L. Dougherty, Washington, D. C.; Herbert William Drake, Buffalo, N. Y.; Walter Herman Eisenbeis, Pittsburg, Pa.; Howard Shreve Fisher, Pittsburg, Pa.; Frank Fuller Fowle, New York city; Paul Mac Gahan, Pittsburg; Charles Frederick Gray, New York city; Percy Le Roy Griffith, New York city; William Hallock, New York city; Beecham Harding, Pittsburg, Pa.; William Smith Horry, Niagara Falls, N. Y.; James Carleton Howe, Boston, Mass.; John Russel Jeffrey, Cincinnati, Ohio; Charles Sheppard Johann, Pittsburg, Pa.; George Harvey Jones, Chicago; John Bartleman Klumpp, Philadelphia, Pa.; Frederic Kirk Knowlton, Rochester, N. Y.; Herbert Markle, New York city; Charles Michael Masson, Los Angeles, Cal.; George McQuilkin, Jr., Elkton, Md.; Charles Holland Moritz, Niagara Falls, N. Y.; George W. Nistle, Chicago; Grover Chester Noble, Berkeley, Cal.; Harry Mitchell Palmer, Pittsburg, Pa.; Charles Huntington Porter, Boston, Mass.; Karl Chandler Randall, Pittsburg, Pa.; Charles W. Regester, Chicago; Thomas Mayo Roberts, Boston, Mass.; George Henry Sampson, Jr., Pittsburg, Pa.; Quincy Adams Scott, Pittsburg, Pa.; Albion Walker Shaw, Malden, Mass.; Hayden Hobart Smith, New York city; Charles Edward Speirs, New York city; George Tatum Street, Ithaca, N. Y.; William Andrew Treadway, Fayetteville, Ark.; George Mason Tripp, Victoria, B. C.; Lucius Otto Veser, Ithaca, N. Y.; Alonzo Sabine Wattson, Pitsburg, Pa.; Edgar Morris Wilkins, Brooklyn, N. Y.; George Wrigley, Schenectady, N. Y. Francis V. T. Lee, San Francisco, Cal., and Henry Noel Potter, New York city, were transferred to full membership.

Large Cars for St. Louis.

The extensive reconstruction work in which the St. Louis and Suburban Railway Company of St. Louis, Mo., has been engaged since October, and which has cost nearly $800,000, is almost completed, and the 30 new cars are now in operation. Eight miles of double track has been relaid, the greater part being with 80-pound T-rail, while the portions in the downtown district are 95-pound girder rail. The new cars are of the latest type for city service and were built by the St. Louis Car Company. The bodies are 47 feet six inches over all, and the electrical equipment consists of four Westinghouse 49 motors, rated at 30 horsepower each. Westinghouse air brakes and Hunter fenders are used. An order has been placed for 20 more of these cars, and the old ones will be remodeled as rapidly as possible. The improvements will ultimately cost over $1,000,000.

Municipal Telephony in Canada.

Two towns in Canada, Port Arthur and Fort William, Ontario, have ventured into municipal telephony, establishing exchanges in opposition to the old company. While each exchange is distinct and owned separately by its respective town, they were both established under the supervision of a joint committee, representing both towns. The exchanges are of the same capacity and equipped with similar apparatus.

The plant at Port Arthur is constructed with the lines occupying poles jointly with wires of the electric-light plant, and the power circuits of the electric street-railway system. The lighting and power circuits are eight feet below the telephone wires. Both exchanges are built with an ultimate capacity of 1,000 subscribers or even more, if required.

A large part of the outside construction material was secured from Canadian concerns, the principal line wire from Germany and the telephones and central-office equipment from the United States. The line-construction work and the connecting of the instruments with the central office was done by the towns under the supervision of the Electric Light and Power Commissions. The telephones, switchboards and central-office apparatus were manufactured and the central offices installed by the International Telephone Manufacturing Company of Chicago.

Fig. 1 shows the exchange switchboard at Port Arthur. It is a strictly central-energy, lamp-signal trunking switchboard, with double-supervisory clearing-out signals, pilot lamps, etc. It is built in a regular multiple-switchboard frame and cabinet and so arranged that when the number of subscribers increase and extensions are required above the number that two operators can handle, necessary multiple jacks may be installed and the board readily made into a full multiple switchboard without discarding the original installation. The board shown is equipped with 280 subscribers' lines, with 140 to each position. It is arranged so that 60 lines, or

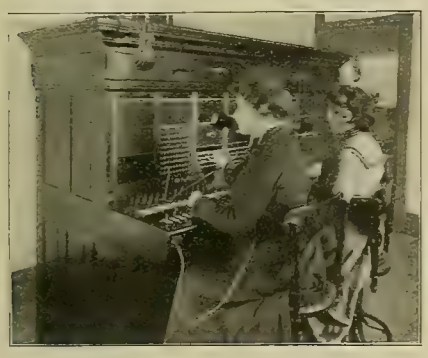


FIG. 1. MUNICIPAL TELEPHONY IN CANADA.—SWITCHBOARD IN PORT ARTHUR EXCHANGE.

even more, may be added to each operator's position and additional positions or sections added at any time.

Fig. 2 shows a section of the board and the parts more in detail. The key-shelves (one of which is shown turned up) are made of a veneer of five layers of wood, securely glued together. The ringing and listening keys are mounted on the bottom of the shelf with the levers extending through nickel-plated swivel escutcheons mounted on the top. As all terminals of the key are at one end, it is possible to have all wires made up in one cable form, leaving the platinum contact points free and open for inspection.

On the closed key-shelf is shown one of the line-signal lamps and holder. The holder is an opaque insulating tube with an opal set in a brass cap. It is provided with slots at the opposite end from the opal, leaving the terminals of the lamp exposed when inserted. The opaque tube with lamp is very easily placed in the bank of lamp jacks direct from the front of the board, as is shown in the top left bank. The lamp, being enclosed, confines all the light to the one opal and prevents any possible chance for a mistake in knowing the right signal.

The line lamps are mounted in jacks built in strips of 10. The springs of the jacks are made of the best sheet spring german silver. They are provided with a formed projection, so that they make a good point connection with the base of the lamp when inserted. The springs are set into a hard-rubber strip and firmly clamped with a brass strip insulated with mica. The spring block is fastened to the front piece with heavy brass studs. The front

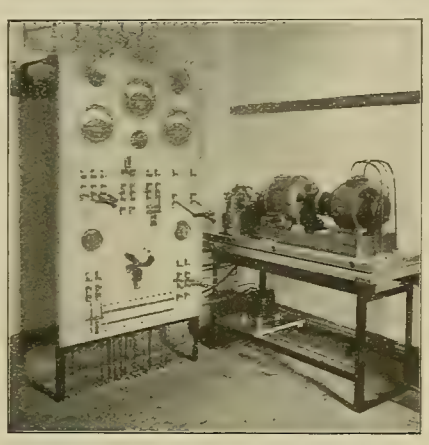


FIG. 4. MUNICIPAL TELEPHONY IN CANADA.—POWER PLANT OF PORT ARTHUR EXCHANGE.

piece is a heavy brass rail, faced with hard rubber, with the proper holes for receiving the lamps with holders. Each end of the front rail forms a flange, which is set into the iron switchboard frame, and to which the banks are clamped from the front with a bolt and nut.

The spring-jacks, which correspond in number with the line lamps, are also mounted in strips of 10. The front piece of the bank of jacks is made of a veneer of hard rubber, front and back, with a brass rail for its center. The holes in the brass rail are of sufficient size to receive a hard-rubber bushing before inserting the jack ferrule. The brass rail provides a means for firmly clamping the banks of jacks to the iron frame and also makes the banks strong and durable.

A pair of supervisory signals are placed in the plug board directly in front of each pair of cords. The clearing-out lamps are mounted in tubes similar to the line-lamp holders. These tubes are provided with an opal-holding cap on which is placed a small arched wire guard, which prevents the opal being broken by impact from the plugs and also serves as a means for conveniently taking the tube, with lamp, from the socket. These are removed

FIG. 5. MUNICIPAL TELEPHONY IN CANADA.—BATTERY PLANT IN PORT ARTHUR EXCHANGE.

from the top of the plug board, as is shown in the second pair at the right.

The plug board and the pilot-lamp panel, located back of the plugs, are covered with heavy belt leather. In the center of the board, between the two operators' positions, are mounted the trunk signals and trunk jacks, connecting the two exchanges. The board is provided with a key, so that at night, when but few calls are received, the battery-power ringing generator may be switched on at any time and operated only when required.

Fig. 3 shows the relay rack and the combination distributing and lightning-arrester rack, with heat coil and carbon arresters. On the relay rack are mounted all the line relays, supervisory and pilot relays and coils. The relays are securely mounted on iron strips, supported on an angle-iron rack. The relays are securely enclosed in a dustproof brass shell.

In Fig. 4 are shown the power switchboard, the charging machine with alternating motor, the main ringing machine with alternating motor and the auxiliary ringing machine. The auxiliary ringing machine is operated from the storage batteries. The marble power board is supplied with a charging-

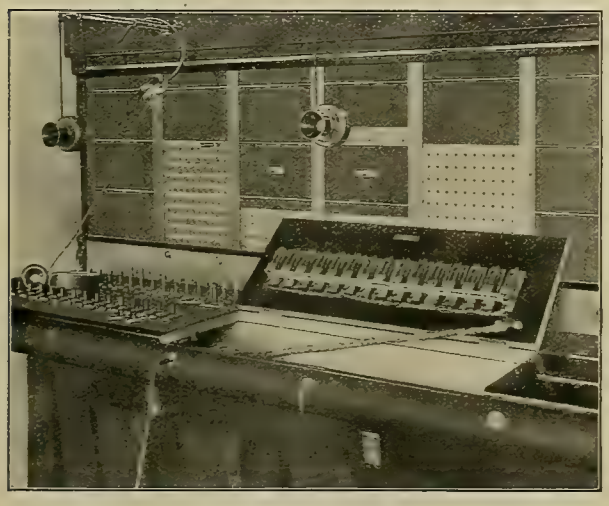


Fig. 2. Section of Switchboard.

Fig. 3. Relay Rack and Distributing Frame.

MUNICIPAL TELEPHONY IN CANADA.—EXCHANGE AT PORT ARTHUR.

circuit ammeter, a discharge-circuit ammeter, a voltmeter, voltmeter switch, starting boxes, field rheostat, circuit-breaker, bus-bars and all necessary copper-knife switches for properly controlling the entire system. The power tables are made from angle iron and are strong and rigid. The top is a thick maple slab, supported on soft rubber balls, set in a maple frame and mounted on the top of the iron rack.

Fig. 5 shows the storage-battery plant. The plant consists of a set of 12 cells of Chloride accumulator, in duplicate. The 12 cells supply all the battery current for the operators' instruments, line, supervisory and pilot lamps and all the subscribers' instruments. The battery rack is constructed of architectural iron and is strong and well braced. The shelves are heavy slate slabs.

The telephones in this system are of the International regular long-distance central-energy type. These telephones are equipped with transmitters that are very sensitive to sounds coming in direct contact with the diaphragm, and are exceptionally powerful in transmission, but take up very little side tone.

The telephones are so constructed that there are no exposed metal parts forming a part of the circuit at any time. All terminal screws and connecting wires are entirely concealed. The receiver has its working parts self-contained and is completely enclosed in a hard-rubber shell and cap. The working parts do not depend on the shell for their adjustment.

The switch in the wall instrument is of the long-lever gravity type, and has a restoring spring five inches in length, made of heavy spring-sheet german silver. It is so designed that it has no rubbing or scraping parts excepting at the contact points, which form good, positive connections at all times.

The desk instrument has a restoring spring, consisting of three inches of sheet-spring german silver, and is so constructed that it has a heavy tension, making the hook live and lasting. All the springs are of proper length and are firmly clamped in a hard-rubber insulating block. The spring binding screws pass through the rubber and are threaded into metal washers and do not depend on threaded rubber. The desk-set switch forms sliding contacts on the same principle as the wall-instrument switch.

Independent Exchange in Buffalo.

W. H. Johnstone, assistant general manager of the Frontier Telephone Company of Buffalo, states that the new exchange in that city will be in operation about the middle of January. "During the process of installing the different telephones, an important invention in the manner of ringing subscribers' stations was made," said he. "The device is exceptionally clever and will be a surprise to subscribers. The city authorities have aided us remarkably in our work, and have done everything possible to facilitate and expedite the entry of the company into Buffalo. We have experienced very little trouble in securing rights-of-way for the extension of our pipes, both through public and private property. We are placing telephones in the homes of subscribers at the rate of 160 a day, and at the present time have more signed contracts by 3,500 than any other Independent telephone system ever started in any of the big eastern cities. We have completed the installation in approximately 2,500 stations." About 50 operators will be used at the opening of business, but ultimately this number may reach 250.

TELEPHONE MEN.

George Cornwall has resigned as manager of the Harrison Telephone Company, in the Black Hills, with headquarters at Deadwood, S. D., and is succeeded by C. D. Cook.

T. B. Murphy, manager of the Douglass County Telephone Company at Superior, Wis., left the first of the year for a position with the Northwestern Telephone Exchange Company in Minneapolis. John McKenna succeeds him.

James B. Brailey, Jr., of the Central Construction Company, Wauseon, Ohio, has completed the financing of the Independent Telephone Company at Kansas City, Mo., and a company to take care of the long-distance business in the Southwest. This latter company has a bond issue of $800,000, which will be underwritten by the St. Louis Trust Company.

LeRoy W. Stanton, the well-known consulting telephone engineer of Cleveland, Ohio, was in Chicago last week. Among the contracts recently closed by Mr. Stanton was one with the LaCrosse Telephone Company, for which he will act as consulting engineer in the installation of a new telephone exchange. Mr. Stanton also has been retained by the United Telephone Company of Bellefontaine, Ohio, as consulting engineer.

Indiana Telephone Items.

The New Telephone Company of Indianapolis claims to have broken all records on Christmas Eve, in the number of messages handled in the main exchange. During the day there were put through 83,794 calls. During the hour between four and five o'clock a. m. there were put through 8,266 calls. This work was done by 38 operators and was an average of 217 calls to the operator. During that busy hour the operator having the highest number made 433 connections, an average of 7.2 per minute.

The Central Union Telephone Company has placed a new switchboard in the private telephone exchange of the Indianapolis News. Owing to the immense amount of business done over the toll lines of the Central Union, the company, in many places, has given a minute rate, instead of a three-minute, as formerly, and the rate has correspondingly been reduced. Nearly every point in the United States and the principal places in Canada can be reached by this company. The company has built many new circuits during the last year.

Figures are always interesting, though sometimes surprising. For example: Comparing the directories just issued by the two telephone companies (the Bell and the New company) doing business in Indianapolis, the first shows about 7,200 subscribers in the city and the second about 6,000 subscribers, making a sum total of 13,200 for both companies. Of this total number, only about 13 per cent. subscribe to both telephones, or only 1,716 subscribers of the sum total have both telephones, leaving 11,484 subscribers who cannot communicate with each other. These are some of the evils of a dual system.

At its annual meeting at Bluffton, on December 22d, the United Telephone Company decided to issue bonds to the amount of $500,000—five per cent. first-mortgage bonds. Of this amount, $100,000 will be used to take up indebtedness of the plant, and $400,000 will be used in repairs and further extension of the company's large and growing business. The company now operates 40 toll stations and has exchanges at Bluffton, Marion, Montpelier, Hartford City, Huntington, Upland and Geneva. Hugh Dougherty was re-elected president, Charles H. Plessenger and L. C. Davenport, secretary and treasurer, respectively.

The Gas Belt Construction Company, a corporation composed of Fort Wayne telephone capitalists, and organized to build telephone plants and lines, has been in existence only about 10 months, but the stockholders received a 10 per cent. dividend as a Christmas present. The company will turn over the Muncie and Alexandria Independent telephone exchanges on New Year's Day to their local owners. A contract has also been taken to construct an exchange at Eaton and for the stringing of a new metallic circuit on the toll lines connecting the principle cities of the gas belt. The profits of the toll lines in some cases have reached 50 per cent. The officials of this company say the prospects for the incoming year are astonishing, and they shall have more than they can do.

In a resume of the electrical progress during the last year, Professor Charles P. Matthews of the engineering department of Purdue University says: "In no line of human achievements has greater advance been made during the year now drawing to a close than in the science and arts connected with electricity. Developments in the telephone field during the last year have been little short of marvelous. The capital invested in telephone exchanges in the United States alone is estimated by a competent authority at 470 millions of dollars. The rapid rise in the Independent telephone companies is shown in the fact that nearly one-third of this amount has been invested by Independent companies within the last six years."

It is said that the mayor and city attorney of Evansville recently returned from Chicago, where they met several supply men who agreed to take stock in the municipal plant. It is estimated that it will take $200,000 to build it. Work will be begun on it as soon as the sum of $125,000 has been subscribed. F.

Ohio Telephone Notes.

The Cleveland Telephone Company is arranging to build a two-story brick exchange building in Lakewood, a suburb of Cleveland. The village is having a very rapid growth, and the demands for telephone service are increasing daily.

The Oxford Telephone Company, Oxford, has one of the most complete services of any small-town plant in the state. It has instruments in nearly all the homes and business houses of the town, as well as in most of the better farm houses in the surrounding country. In addition, its lines have connections with most of the villages in the county about it and with the long-distance lines. The management has been particularly fortunate in this respect.

The Tuscarawas Telephone Company, New Philadelphia, has 2,500 telephones in service and operates six exchanges. The largest ones are at New Philadelphia, Uhrichsville and Canal Dover. The company is increasing its business all the time, and will eventually cover more territory.

For years the City and Suburban Telephone Company of Cincinnati has made it a practice to give its employes Christmas presents. The men in the employ of the company this year each reecived a fine turkey and oysters, between 350 and 375 of them being thus supplied. The 300 girls employed in the exchange received six per cent. dividend on their salaries, which amounts to an extra month's wages. It is said that the business of this company has increased 40 per cent. in the last year.

The Toledo police force attempted to stop the stringing of the United States Telephone Company's wires to connect with the Toledo Home telephone plant, but the matter was settled in a satisfactory manner. The United States will reach Michigan and Indiana through this plant, and it, in turn, will reach all outside cities where the United States has stations at this time.

The Lancaster Telephone Company, Lancaster, will establish an exchange at Thornville, where 100 subscribers have been secured already. The Lancaster exchange will also enlarge its switchboard facilities and prepare for a more extended business than it has ever done in the past. Noah Yenrich is the manager of the company's business.

The Muskingum Valley Telephone Company of Relief, Muskingum County, has been incorporated with a capital stock of $5,000, to operate a plant at that place. Amos Lawrence, W. M. Fisher and others are interested. O. M. C.

Telephone News from the Northwest.

The exchange at Park Rapids, Minn., is nearly completed. It is a new system to replace the old, which has been about all removed.

The annual report of the state auditor of South Dakota shows that 11 new telephone systems have been completed in the last year.

The application of the Twin City Telephone Company for a franchise to conduct a local exchange at Fargo, N. D., was indefinitely postponed. The Northwestern and the Twin City Telephone Companies have sent checks to the state treasurer of Minnesota for their tax on their gross earnings for the year ended November 30th. Both show good increases. The Northwestern paid $25,002, as against $23,323 in 1901. The Twin City paid $5,553 for this year and $1,507 for last.

The court at Rockwell City, Iowa, holds that a telephone company is exempt from damages for injuries caused by collision with telephone poles placed where they will not interfere with ordinary travel. In the case in question, a coasting party ran into a pole set within four feet of the highway, on the side of an embankment.

Sloan, Iowa, has voted a franchise for a local exchange to the Sloan Telephone Company.

W. G. Francis of Kansas City and C. M. McNeill of Beatrice, Neb., have been granted a franchise for a local exchange at Hebron, Neb.

B. H. Gardner of Vermillion, S. D., has been granted a franchise for a local telephone exchange at Lake Park, Iowa.

It is understood that a plan of reorganization is in view for the Mutual Telephone Company of Des Moines, and will be presented at the annual meeting in January. R.

GENERAL TELEPHONE NEWS.

The New York Telephone Company has certified to the secretary of state of New York an increase of capital stock from $30,000,000 to $50,000,000.

William M. Hamilton and J. P. Rorick of Meridian, Miss., have obtained a franchise for a telephone system in that town, and will build an exchange soon.

The daily papers state that the Iowa (Bell) Telephone Company has assumed control of the Cedar Valley telephone system. The Cedar Valley is one of the strongest Independent systems in Iowa, having exchanges in 15 counties.

Plans have been practically concluded for the consolidation of the Richmond (Va.) Telephone Company and the Southern Bell Telephone Company in Richmond. The conditions involved are that the majority of the subscribers of the former company shall consent to the consolidation, and that the City Council shall acquiesce, which it is believed will be done.

Articles of association have been filed by the Northeastern Telegraph and Telephone Company of Bay City, Mich. This company was organized several months ago to build lines of telephone from Bay City to Mackinaw, via the Detroit and Mackinaw Railroad. The line is about half completed. The general office of the company will be at Bay City and the line will work in connection with the Michigan (Bell) Telephone Company.

The Geneva Telephone Company, which is associated with the Consolidated Telephone Company, recently opened its new office in Geneva, N. Y. The company was burned out last September and in rebuilding a central-energy manual system was installed to supplant the automatic system previously used. F. S. Bronson is the manager, and S. F. Dey assistant manager. At the time of the fire the company had about 180 subscribers, while the new exchange opens with about 500 patrons. Among those who attended the opening were the following-named officers of the Consolidated Telephone Company of Buffalo: Burt G. Hubbell, R. R. Hefford, William G. Warren, Edward B. Guthrie, William A. Rix, Dr. Fronczak, Arthur D. Bissell, Theodore S. Fassett, Walter P. Cooke, Martin Carey, Charles E. Austin.

Death of John J. Dickey.

John J. Dickey, superintendent of the third district of the western division of the Western Union Telegraph Company, one of the oldest and best known telegraph men of the day, died at his home in Omaha, Neb., on December 29th, of pneumonia. His sickness was of but few days' duration; in fact, so sudden was his death that none of his children was able to reach his bedside before the end. On Christmas Day Mr. Dickey was taken down with the grip, which developed into pleuro-pneumonia. His condition became worse rapidly, and he lost consciousness early Monday afternoon, from which state he never rallied.

J. J. DICKEY.

Mr. Dickey was born in Rushville, Ill., April 11, 1839, and was a son of Hon. T. Lyle Dickey, once chief justice of the Supreme Court of Illinois. His entrance into the telegraph world was first made in the private office of Judge J. D. Caton of Chicago, where he learned to be a skillful operator. In 1859 and for five years thereafter, he filled the position of chief bookkeeper with the Illinois and Mississippi Telegraph Company with headquarters at Ottawa, Ill. When this company became a part of the Western Union Telegraph Company, Mr. Dickey was transferred to the office of the superintendent of the latter company in Chicago, where he filled the position of chief clerk. In August, 1869, he was promoted to the superintendency of telegraphs of the Union Pacific railroad, that company's telegraph system belonging to the Western Union company. His duties in this position took him to Omaha, Neb., where he has since resided. In his connection with the Union Pacific, he was ex-officio superintendent of the Atlantic and Pacific Telegraph Company, and held that title until the company consolidated with the Western Union.

During 1880 and 1881, Mr. Dickey personally directed the construction of all the telegraph lines of the American Union Telegraph Company west of Chicago, and, after the company's merger with the Western Union, he became superintendent of the former company's lines and system in 1881. In 1887 Mr. Dickey was appointed western superintendent of the Western Union Telegraph Company, and as such he personally supervised the construction of nearly every mile of the company's lines west of the Missouri River. His territory at that time was considerably larger than under the company's present regimé. He had under his control Colorado, Nebraska, Kansas, Wyoming, Utah, Idaho, Arizona, New Mexico, Oklahoma and parts of Iowa, Missouri, Washington, Oregon, South Dakota and Texas.

In 1876, when the telephone was first appearing on the market and people were inclined to be skeptical as to its future, Mr. Dickey recognized the value of the great invention, and accordingly organized a telephone company in Omaha after much difficulty. On the development of the telephone, his company broadened out and became owners of large telephone properties in Nebraska, Utah, Wyoming, Idaho and Montana. At the time of his death he was vice-president of the Nebraska Telephone Company and largely interested in the Rocky Mountain Bell Telephone Company and the American District Telegraph Company.

Electric Terminal Road for Cincinnati.

The Cincinnati International Railroad Company of Cincinnati, Ohio, has been incorporated with a capital stock of $1,810,000, to construct an electric railway in Cincinnati for the purpose of transferring cars from both steam and electric railways to their proper destination in the city. In other words, the new road will do a terminal business, and it is stated that it will not ask to do a passenger business, with the exception of transferring sleepers from one road to another. The incorporators are J. H. Woodard, J. S. Trevor, J. Gano Wright, Charles B. Wing and William C. Rogers. Under the conditions, as set forth in asking a franchise, the entire railroad shall revert to the city without cost at the end of 30 years and the city shall have the right to purchase the entire property at any time. The maximum rate which shall be charged for transferring cars from one railroad to another or anywhere within a distance of two miles shall not exceed 10 cents per ton of the car capacity, and the maximum charge for switching coal shall not exceed five cents per ton of the car capacity. The line would place a freight depot in front of every business house on its tracks. It would reduce the cost of drayage about 75 per cent. on all classes of goods. The terminal company would locate small depots at convenient places all over the territory covered by its line and receive all kinds and quantities of freight and give through bills of lading to destination. The plan is to build a large depot or warehouse for the convenience of produce dealers, so that they will save all drayage between the cars and their salesrooms.

Parke-Davis Power Plant in Detroit.

The work of rearranging and extending the power plant of Parke, Davis & Co., the large drug and chemical manufacturers of Detroit, Mich., is now approaching completion. The added equipment at this time consists of a brick chimney seven feet in internal diameter by 175 feet high; three Heine safety boilers of 1,000 horsepower, to which Dorrance improved furnaces are to be applied; two Reeves vertical-compound engines of 325-horsepower capacity, each direct-connected with one Crocker-Wheeler 200-kilowatt, 125-volt direct-current generator, and a suitably arranged seven-panel switchboard. A 1,500-horsepower Webster feed-water heater and filter, Webster steam and oil separators, also suitable steam traps, vacuum pumps, and other associated apparatus complete the new equipment.

The boiler plant when completed will consist of two Wickes horizontal water-tube boilers, having a combined rating of 500 horsepower, three Heine water-tube boilers of 1,000 horsepower combined, and five horizontal return-tubular boilers of 575 horsepower combined, making a total boiler capacity of 2,075 horsepower. There will be two stacks, the one mentioned and another six feet square and 125 feet high. In the engine room will be located one Westinghouse 70-kilowatt dynamo, direct-connected to an Ideal nine and 16 by 12-inch horizontal-compound engine; two Crocker-Wheeler 125-kilowatt machines direct-connected to Ball 12 and 20 by 16-inch horizontal-compound engines, and the two new units, already mentioned, thus making a total of 720 kilowatts.

Direct current of 125 volts having been previously installed and applied generally throughout the manufacturing plant for power and lighting purposes, it was decided to retain the direct-current system at 125 volts and extend it to suit the increased requirements, the switchboard being correspondingly enlarged. The contract for this portion of the work, as well as the connections from the generator terminals, and the various instruments mounted on the panels was awarded to the American Electric Company of Detroit.

Adequate hot and cold-water service is provided not only for the power plant but also for the manufacturing plant at large. With respect to the hot water a 750-horsepower Berryman heater, forming a part of the old equipment, will be used subordinate to a 1,500-horsepower Webster feed-water heater and filter. In connection with the operation of these there are four duplex pressure pumps, the pumps and piping being so arranged as to admit of the pumps and service being interchanged. A point in this connection is that while the Wickes and Heine boilers are for 125 pounds working pressure, the five horizontal tubular boilers are for 80 pounds or less. The occasion of this is that throughout the manufacturing plant steam is required for various heating and boiling processes incidental to the manufacture of drugs and chemicals, and for such purposes low-pressure steam is sufficient, the relatively high-pressure steam being used for operating the generator engines.

It is the intention to use exhaust steam for heating and also in the many instances where boiling is required under a vacuum or at temperatures less than 200 degrees F. To facilitate this process the Webster vacuum system of heating will be applied. The direct result of this will be a reduction in the quantity of live steam required and a consequent reduction in the operating charges for cost of coal; and in addition to this appreciable advantage, the ability to return to the boilers the water of condensation and use it over and over again, purified and without cost.

Another feature to be considered in this particular case is the fact that each day's work in the process of drug making results in the production of from 26,000 to 30,000 pounds of dregs, which are the refuse of the various materials used in the process of drug manufacture. This material, damp and sodden, containing, in some instances, 65 per cent. moisture, is not the most desirable form of fuel for use under steam boilers; and yet it is confidently expected that by using the Dorrance furnace with its shaking grate and semi-circular arch, in association with the high draft of the new chimney, this discarded material will be found to yield a positive value as a fuel and steam raiser.

The brick chimney, six feet square and 125 feet high, forms a part of the old equipment, and this will be retained in service in conjunction with the new brick chimney. The flue of the new chimney will connect with the flue to the old one, so that the increased draft capacity of the new stack may be applied, in part, to the old boilers. The connection, however, will be controlled by a damper so arranged that, if desired, the operation of the new boilers and new chimney may be entirely independent of the old conditions.

The floor of the boiler room is about seven feet below the railroad tracks, and this fact is taken advantage of in the matter of providing a coal bunker of about 300 tons capacity. This bunker faces the boilers and extends the full length of the boiler room, and by suitable doors at the base of the retaining wall the coal falls by gravity practically to the shovel of the firemen. This provides an exceedingly simple, direct, and inexpensive method of handling coal to the furnaces, and involves a minimum of charge for operation and maintenance.

The retaining wall of the coal bunker is further used to give support to a dreg runway, over which the dregs will be transported and dumped in front of any one of the 10 boilers. The same wall also gives support to an ash conveyor, upon which ashes are to be transported to the ash elevator, situated at the east end of the boiler room. This elevator is so arranged that ashes may be deposited in a cart, or railroad car.

The work of rearranging and extending this plant, which is one of appreciable size, necessitated the consideration and solution of several problems not ordinarily found in power plants, and these have been happily dealt with. When completed the rearranged power plant of Parke, Davis & Co. will present a pleasing appearance. Donaldson & Meier, Detroit architects, have charge of the building extension, and the engineering work is being done under the direction of George Welsby Scott, consulting engineer, of Chicago.

Alphaduct Flexible Conduit.

A fireproof fiber conduit, known as Alphaduct, has been brought out which is said to be meeting with marked favor. The interior of the tube is of heavy canvas duck, thoroughly fireproofed by an approved process. This is covered with a slow-burning flexible, weatherproof compound, over which is spirally wound hard-twisted cable cord, thoroughly fireproofed. All intersections between the cord are then filled with a special compound or cement, the whole forming a wall which, it is claimed, is impossible to carry fire from any inside connection. Over this a protecting jacket of cotton, fireproofed as above, is then braided, and finally coated with a slow-burning

ALPHADUCT FLEXIBLE CONDUIT.

flexible weatherproofing compound and dusted with a powder to prevent adhesion. The interior of the conduit is the smooth, hard finish of the cotton duck, which is very easy to "fish," but to make it perfect in this regard it is dusted with powdered soapstone, which acts as a lubricant, rendering the surface very smooth for the wire to pass by. The construction of the conduit is illustrated herewith.

Alphaduct is claimed to be the only fiber conduit made that will not carry fire. It is manufactured by a patented, new and original process, especially designed to combine all the most highly approved and up-to-date ideas as to what is desirable and essential in a conduit of this class for electric wires. The make-up of Alphaduct is carefully restricted to approved substances, so there may be no deterioration in the manufactured article. The duct is manufactured by the Alphaduct Manufacturing Company of 522 West Twenty-second Street, New York city.

BUSINESS REVIEW.

Reports from a number of electrical manufacturers and dealers and from business houses in allied lines show that the year 1902 was an entirely satisfactory one to electrical business interests. The volume of trade was very large and prices were maintained at a remunerative level in most lines. The expansion of the electrical export trade continues to be a gratifying feature of the situation. The business of the old year and the outlook for the new are canvassed in the following statements:

American Vitrified Conduit Company, New York (Underground and Interior Conduits): The year now closing has been the banner year in the history of the conduit business. In August last we manufactured and shipped 1,500,000 feet of conduit, our shipments during the other months of the year ranging between that amount and 1,000,000 feet. We anticipate that the remarkable activity of the year now ending will be duplicated in 1903, and we are multiplying our capacities to meet all demands. We are pleased to say that the tendencies are less toward "any conduit at low price" and are pronouncedly in favor of a higher standard in quality. We have already made several important contracts for 1903 delivery.

F. B. Badt & Co., Chicago (Manufacturers' Agents): As western agents for the Weston Electrical Instrument Company, the Ward Leonard Electric Company, and of the Osburn Flexible Conduit Company, we can only say that the business for the last 12 months has been unprecedented, at least as far as this office is concerned. To judge from our sales here, the amount of the electrical business generally must have reached the top notch during 1902, and there does not seem to be any reason why 1903 cannot be just as good or better. The companies we represent evidently think so too, as they have enlarged their factories and are prepared for a still larger amount of business.

Bishop Gutta-Percha Company, New York (Wires and Cables): Rubber-covered wires and cables have sold during the past year in larger quantities and at better prices than since 1898. All of the factories are very busy, and several are working nights, and we think that there is no prospect of an immediate slack, except that business is usually dull for a time after holidays.

Charter Gas Engine Company, Sterling, Ill. (Gas Engines): Our business in the gas and gasoline engine line for the year 1902 has been very satisfactory indeed. In fact, we have broken the record for sales, and many of our engines have gone out for the purpose of running electrical machinery. At this writing (the middle of December) we have five carload orders upon our books, which is very satisfactory for this time of year. Our expectation is that our record for 1902 will be exceeded in 1903, for everything indicates the continuance of the good times and continued call for gas and gasoline engines in greater quantities.

Fitchburg Steam Engine Company, Fitchburg, Mass. (Steam Engines): There are so many hungry for the electric light and power plants that we have devoted our energies to getting work in other directions with less competition; still, about one-third of our product for the last year has been for electrical purposes; approximately one-half for direct-connected and one-half for belted work, the elasticity of belted units appealing to many. We find also that the tendency is steadily to larger average engines, because of the increased use of motors taking the place of smaller engines, so that where our average was formerly 75 to 100 horsepower it is now 300 or more, running from 1,200 horsepower down. We have noted a constant growth in electrical demands, and, as we see the business, we look for a steady increase in the year that is to come, with first-class business both in electrical and engineering lines.

Fort Wayne Electric Works, Fort Wayne, Ind. (Electrical Machinery): The past year has been to us one of progress, both in the manufacturing line and in a business way. The amount of new business secured has been very largely due to extension of facilities of manufacture and has covered general installation of systems of electric power generation and distribution for manufacturing plants and industrial enterprises of various kinds. The prospect for future business is fully as encouraging as has been the past year's business. Meters, transformers and arc lamps have been very much in demand, and if the amount of business done in the past year can be relied upon as a criterion of future business, the next year will certainly be the "high-water" mark. There has been a considerable increase in the number and capacity of direct-current generators and motors, with their accompanying station equipments. This has become a very important factor in our business. We can agree with other manufacturers that the past year has been a very prosperous one, and also that the prospect for the future warrants the belief that this state of affairs will continue.

J. Holt Gates & Co., Chicago (Contractors): From an experience of 15 years in this line, we have never seen such a generally prosperous year. Everybody has made money and had money to extend their business. Electricity is now being used in branches of business that were not dreamed of 10 years ago, particularly with regard to the production of articles electrochemically. This is a branch of the business that will take giant strides in the next five years. Enormous capital is already invested in these lines, and reduction and refining companies are now looking into the question of electrolytic plants. The foreign business of the country will receive a great impetus during 1903, as the new countries opening up will feel the energy of the American invasion. The installation of electric power plants in textile factories is now being done as a matter of course, where a few years ago great persuasion was necessary to dispense with long lines of shafting and belting. We believe the year 1903 will be even more prosperous than 1902.

Gregory Electric Company, Chicago (Second-hand Electrical Machinery): We have had a phenomenal year, our sales having been fully 35 per cent. larger than any previous year, and business is still improving. We have now more large deals pending than at any time in our history, and we think the outlook for 1903 remarkably bright. People throughout this country are becoming better educated and realize that there is nothing that equals electric light and power; and the march toward improvement is irresistible. There is an enormous demand for modern apparatus, and we think that during 1903 the burning question will not be "How can we sell the stuff?" but, on the contrary, "How soon can we deliver," the same?

Incandescent Electric Light Manipulator Company, Boston (Specialty): This year (1902) we have more than tripled our business over last year, and we have had hard work to fill our orders anywhere near promptly.

Marinette Iron Works Manufacturing Company, Marinette, Wis. (Gas Engines): We have experienced a very prosperous year, during 1902, in our gas and gasoline engine department, and particularly engines installed in connection with electrical work, in private as well as municipal lighting plants. We have installed a great many power plants ranging from 20 horsepower to 450 horsepower, both belted and direct-connected to generators, furnishing power and light for factories, office buildings, large stores, hotels, etc. We are also finding an active market in municipal lighting plants for our engine. While the past year has shown a large increase over the preceding year, from present indications we anticipate doing a much larger business during 1903, and particularly for electric plants, as present indications never looked brighter in that field. The gas engine is being recognized as an important factor in the generation of power, and as possessed of considerable merit from the standpoint of economy and convenience, and is fast supplanting steam engines in that field.

Mica Insulator Company, New York (Insulation): We are very happy to say that the amount of our sales during the year 1902 has been very gratifying. The demand for the insulating specialties which we manufacture has steadily increased; in fact, to such an extent that in order to meet this demand we have made an addition to our works at Schenectady which will give us floor space sufficient to increase our output at least 50 per cent. We feel that prospects are very bright for the year 1903, and we look forward to an increased business.

New Haven Novelty Machine Company, New Haven, Conn. (Specialties): We occupy a unique position in the telephonic field, having the honor of bringing to the attention of telephone managers mechanical devices that strike at the root of construction, and that by simple mechanical means, which do not require skilled labor. We are way behind with our orders and are now increasing our facilities, and the outlook for the year 1903 is more than promising.

E. J. Noblett Company, Chicago (Tools and Supplies): The season opened a trifle late, but business steadily increased in volume until the first of November, when outside construction for the season practically closed. However, there is a very fair demand for cross-arms, pins and brackets for this time of the year. The demand for cabinet work, switchboards, monitor cabinets and special work is about as usual. One peculiarity, this season, has been the increased demand for cable and terminal boxes or houses. The Independent telephone companies show a growing tendency to buy better grades of material, showing, at least in our opinion, that they have begun to realize that they cannot build too well. The better the equipment the better the service, with a decided decrease in cost of repairs, as poor equipment always necessitates an unusual expenditure to keep up. The outlook for next season, at the present time, appears very good. However, we are of the opinion that it will not exceed this season's business, but hope that it will.

Northern Electrical Manufacturing Company, Madison, Wis. (Electrical Machinery): We are glad to say that our business for 1902 has been the largest in the history of our firm, and each month brings us more and more business. We are doing our utmost to take good care of the patronage so generously bestowed upon us. We have just completed one addition of 100 feet to our plant and are now completing two other additions, one 100 feet by 90 feet, and the other 100 feet by 50 feet. With the aid of these we hope to be able to keep pace with the growth of our business, but we have plans in view for further extensions at the beginning of the year should trade conditions continue as good as they are now. The general character of the business coming to us is first class; payments are being made promptly by nearly all of our customers, and at present we are unable to see any weakness anywhere along the line.

Replogle Governor Works, Akron, Ohio (Waterwheel Governors): We are too busy to say anything further than that we have sold twice as much machinery this month as in any other December of our existence, and the outlook for the future is good.

Shelby Electric Company, Shelby, Ohio (Arc and Incandescent Lamps): We look for a steady increase in the demand for electrical appliances of all descriptions. We are pleased to note the demand for American goods in foreign countries and expect a prosperous year. Referring to the lamp business, we believe the year just closed has been an unusually good year to most of the old companies, and has shown a healthy increase over the preceding year. The outlook in the lamp business this year is, we believe, very prosperous and gratifying.

Sprague Electric Company, New York (Electrical Machinery): The year 1902 has been one of the best years the Sprague Electric Company has ever had, and the outlook for business next year is very encouraging, as we expect even a larger trade than during 1902.

Standard Pole and Tie Company, New York (Poles): The year of 1902 has, we feel, been a very successful year from the standpoint of the pole manufacturer and dealer. We base this statement on the volume of business which we have been able to do. As a rule, in view of the fact that the majority of the construction work which is now being done is in the northern or central states, the operations do not begin until the early part of March, but from that time until the present writing we have had all we could do to meet the demands of our customers. The demand for good, sound crossarms has become so great we have been forced to enter a new territory, in order to get the proper material. We now have at Brooksville, Fla., a large crossarm plant, consisting of a sawmill with a capacity of 20,000 feet a day, and a complete set of crossarm machinery. The crossarms which we manufacture at this point are of Florida heart pine. Our prospects for 1903 are exceptionally bright. There is a good demand for the material and all the supply men seem to be in a good position to handle their business.

Standard Underground Cable Company, Pittsburg (Wires and Cables): Our business this year was the largest in the history of the company and considerably exceeded that of last year, both in lead-covered cable and rubber-covered wire. It is rather difficult to foretell the business for next year, but we believe that it will not show any material, if any, decline from the year 1902.

Triumph Electric Company, Cincinnati (Electrical Machinery): Our own particular business for the past year has been something over 50 per cent. in excess of any previous year, and the outlook for the coming year is extremely promising. We make this assertion not only from the number of inquiries that we are having at this time and the prospective sales that we have in view, but from orders that we already have booked which are far in excess of what they were this time a year ago, so that we firmly believe that the coming year's business will be in excess of any previous years. The above refers to our own particular business. From the reports that we have from other manufacturers the majority of them are of the same opinion as ourselves.

G. A. Wilbur & Co., San Francisco (Manufacturers' Agents): The electrical business in California has been exceptionally good during the year that is now drawing to a close. All the principal manufacturing companies and most of the supply houses have had a large trade. Complaint has been made of the slow delivery of goods by even the largest manufacturers, particularly of generators and motors of exceptionally large sizes. Owing to the low price of oil that has prevailed here for some time past that commodity is coming into general use for fuel, and the result has been that many new manufacturing plants have been and are being built in this city and the surrounding territory. These plants are arranged for being operated by electric power and a number of old ones are being equipped with electric motors to be driven by generators located in the different plants or supplied by the local electric companies. The completion of the Standard Oil Company's pipe line from the oil fields to tidewater gives assurance of a continued low price of oil, so that California will become more and more a great manufacturing state. The waterpower plants have also done a large business, and it is now more a question with the long-distance transmission companies where they will find a supply of water for increasing their output than it is where to find a market for their current. All of the principal streams reaching into the Sierras have been experted, and most of the desirable water rights have been taken up. Arrangements are being made for developing these waterpowers so as to get a large increase of the already immense amount of power being generated by nature's forces far up in the

Sierra foothills. The completion of the Standard Electric Company's lines into San Francisco is an event in a direction that will doubtless soon be followed by other long-distance power companies. A project for building an electrical trunk line through the center of the state, from Butte to Fresno Counties, has been inaugurated, and plans and data are now being made by Mr. Sidney Sprout, an electrical engineer of this city, who is familiar with waterpower development throughout this entire region. These plans contemplate the uniting of all the smaller waterpower plants in the counties through which the trunk line will run, and bringing a large portion of this power into San Francisco over one trunk line. It is estimated that fully 100,000 horsepower can thus be gathered up and brought to this city for commercial uses, while branches from this trunk line could supply current to all the interior cities and towns. The project when completed will be a very large factor in the matter of supplying power throughout the more thickly populated parts of the state. The outlook for business in this section for 1903 is very bright, and it is confidently believed that a larger number of generators and motors will be sold next year than in any previous year.

Marshall-Sanders Improved Socket Lining.

The accompanying illustration shows a new improvement in socket construction, which has to do particularly with the insulating lining. Considerable difficulty has been experienced, and complaint made heretofore from the fact that linings could not be removed from the socket shells for refinishing the shells. From this certain manufacturers went to the other extreme, and made the linings so loose that they dropped out, a decided inconvenience when the wireman was on top of a high step-ladder wiring up a socket, and a decidedly bad fire risk when the careless wireman left out the linings which dropped out and put the shells back without any lining at all. It is said that attempts have been made to get between these two difficulties by various makeshifts, such as nicking the bottom of the shell, rolling beads in the lining, etc., all of which have fallen short of the results desired.

The Marshall-Sanders Company of Boston has recently brought out the lining described, which is made from a special elastic fiber by a patented process, which makes the lining expansible, so that it can readily be forced into the socket shell by the fingers, and as easily removed; but it exerts sufficient friction against the shell so that it cannot be shaken or dropped out, thus accomplishing the desired results in a workmanlike and entirely satisfactory way. The Marshall-Sanders Company already reports a remarkable inquiry and many large orders for its well-known sockets with this style of lining, which is furnished without extra charge.

MARSHALL-SANDERS IMPROVED SOCKET LINING.

The Edgartown (Ohio) Electric Light Company, E. A. Geaugue manager, is in the field for the following material: One 1,100-volt, 40 to 50-kilowatt, alternating-current generator; one rheostat; 300 incandescent lamps; 6,000 to 8,000 feet of wire; 30 to 35 transformers, 400 insulators, and one boiler.

Operation of Engine and Electric-motor Stops.

Stop mechanisms for steam engines and electric motors providing against danger or accidents involving life and property have and are still performing good and valuable services. It is a fact, however, that there have been a number of instances where stop mechanisms have failed to perform their duty, chargeable, in many cases, to inattention and the exhaustion of batteries, but traceable in the main to imperfect methods of wiring. The necessity and importance of stop mechanism for engines and motors is abundantly emphasized by the extended recognition given them by manufacturers and property owners, and any system of wiring is of interest and importance which will increase its efficiency or assure a greater certainty of its successful operation.

Illustrated herewith is a system of wiring designed by F. S. Palmer, 100 Broadway, New York city, which, it is stated, will obviate difficulties and make more sure the operation of stop mechanisms. Fig. 1 shows a slate board upon which is mounted a double-throw switch. There are also shown a single-throw switch, operated by electricity, a high-resistance bell, a small single-throw switch, and binding-posts indicated by (1) (2) (3) (4) (5) in Fig. 2. The board may be located at any convenient place. The double-throw switch is used to test all the wires and ring the high-resistance bell without operating the stop mechanism. The small switch is used to operate the motor switch or stop mechanism as often as desired, thus keeping it in active use.

Fig. 2 is a detail drawing of the method of wiring any engine stop mechanism, showing circuit-closers on three floors. To operate the engine stop or open the motor switch, any circuit-closer (CC) is used, say that on the third floor. The current passes from battery to binding-post (5), engine-stop magnets or electric switch for motors, to post (4), post (A) on test switch to (B), to post (3), circuit-closer (CC), third floor, to post (2), to battery or from battery to post (5), to stop or switch, as above to post (4), to circuit-closer (CC), to post (2), to battery. Thus it will be seen that should one or both wires connected to circuit-closer (CC) on third floor be cut, the closer will remain operative.

To test the wire and battery the test switch may be thrown so that the blades rest in knives at (E) and (F). The wires are then in series with the magnets of the stop or motor switch blade, post (D), post (1), section wire, post (2), and battery. Several hours before the failure of the battery current to operate the stop or motor-switch magnets by the use of any circuit-closer, the battery will fail to ring the bell, while should there be any break in the wires the bell will fail to ring at test.

The apparatus is so simple that it would seem that the operator in charge of it would be very negligent if he permitted it to get out of order. The attendant can use the small switch for stopping either engine or motor every day, if he chooses, thus assuring himself that everything is in readiness for stopping the same from any floor in the building. Arrangements can easily be made to notify outside parties if any shutdown is desired.

This system of operating stop magnets is also arranged with annunciators to indicate the floor or section in which the circuit-closer has been operated, also to make record of all tests. The method of wiring is fully covered by letters patent, and has been in use for several years.

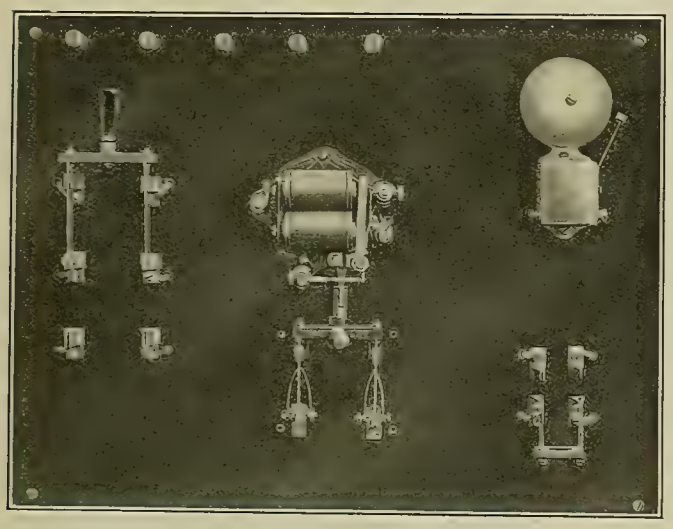


Fig. 1. Switchboard.

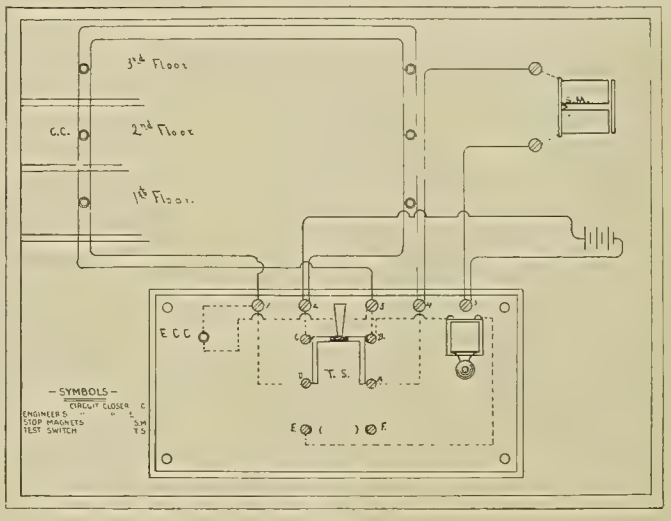


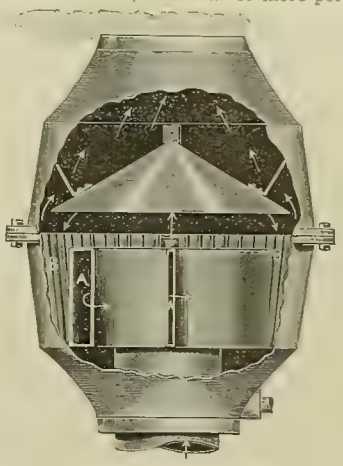
Fig. 2. Diagram of Connections.

OPERATION OF ENGINE AND ELECTRIC-MOTOR STOPS.

The Toledo, Port Clinton and Lakeside Railway Company of Toledo, Ohio, has been incorporated with a capital stock of $10,000. The incorporators are H. P. Klauser, P. McEvory, L. E. Flory, H. S. Landis and D. H. James. The company purposes to build an electric railway having Toledo, Ohio, and Lakeside, Ohio, for termini, and passing through Lucas, Wood and Ottawa Counties.

Sims Steam-exhaust Head.

The Sims improved exhaust head that is illustrated herewith is being put on the market by its manufacturer, the Sims Company of Erie, Pa. It is a substantial light cast-iron structure and, it is claimed, will not leak or wear out. In the lower section of the head is a deflector, with four or more ports (according to the size of the head) shown at (A) (A). These ports being on a circle gives centrifugal motion to the steam, throwing it against the ribs (B) where the moisture and grease are intercepted. A part of the exhaust steam passes out at the top of the deflector into a cone-shaped deflector with considerable force, as indicated by the arrows. This drives the water from the ribs into the well below from which it is piped off.



SIMS STEAM EXHAUST HEAD.

Elevated Road in St. Louis.

St. Louis, Mo., is, just at present, besieged by sundry railway organizers who submit proposition after proposition to the City Council, containing requests for franchises on rights to construct elevated railway systems from the downtown district to the World's Fair site. The fifth application for a franchise for an elevated system of this kind was presented to the City Council last week by the Metropolitan Elevated Rapid Transit Company. The main line of the system is to have five or six branch lines running to various parts of the city, and the life of the franchise is to be 100 years.

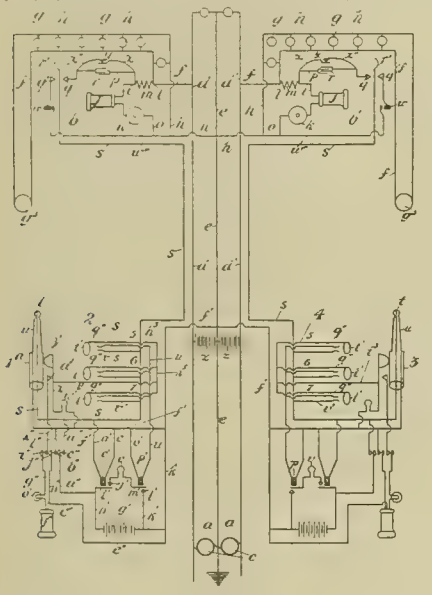
The main line of the proposed system would commence at Ninth and Market Streets, running north on Ninth to Franklin, to Fourth, to Market, to the junction made with Market and Laclede to the east line of Forest Park, thence over the right-of-way of the Wabash railroad to point near the northwestern corner of the park. The first branch from the main line is to begin at Ninth and Franklin Strets, and go west to the city limits; the second branch would commence at Jefferson and Market Streets, and go to West Jefferson, to Chouteau, to Ohio and to Broadway; the third branch is planned to begin at Euclid and Laclede and run north on Euclid to Delmar, thence to the western limits of the city; the fourth begins at Euclid and Laclede, west to King's Highway, to the southeast corner of Forest Park, to Berthold, and then over private right-of-way to the western city limits. The fifth branch begins at Jefferson and Franklin and reaches to the northwestern limits over an undecided right-of-way, and the sixth branch, should it be built, would begin at Ohio and Gravois Road and go over Wyoming, King's Highway and Tyler to the western city limits.

The city is offered $5,000 annually, beginning in 1910, and for five years after $10,000 yearly during the remaining life of the franchise.

Combined Telephone, Telegraph, Electric-light and Power System.

A novel system by means of which a subscriber is furnished with electric light, power and communication over the same circuit at the same time has been invented by Alexander McMartin Stark of Toronto, Canada, and patented in the United States. In carrying out the purpose of the invention Mr. Stark uses a power current transmitted over a main power circuit and distributed at each subscriber's station to the subscriber's main circuit to furnish him continuously with current for his lamps, motors, and communication instruments and maintain this power current at constant tension by storage battery bridged across the main power circuit between the generator and subscriber's station. The accompanying drawing represents a diagrammatic view of a complete system of distribution.

In the drawing (a) is the generator station, which may contain any number of switchboards, and (b) (b′) the subscribers' stations. Connecting the generator station with the subscriber's station is a three-wire circuit consisting of two main conductor wires (d) (d′) and a main return wire (e). Tapping



COMBINED TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER SYSTEM.

the main-conductor wire (d) and leading to the subscriber's station (b) is the subscriber's conductor wire (f), in circuit by means of the subscriber's return wire (h) with the main return wire (e). Connected in parallel with the subscriber's conductor and return wires are a series of lamps (g) and a motor (g^2). The electric current continuously circuits over the main-conductor wire (d) to the subscriber's conductor wire (f), through the lamps (g), subscriber's return wire (h), to the main return wire (e). Tapping the subscriber's conductor wire (f) is the telephone conductor wire (i), leading to the telephone receiver (j), in circuit with the telephone transmitter (k), which is connected with the subscriber's return wire (h) by the telephone return wire (o), and interposed in the circuit between the tap (l) and receiver (j) is a resistance (m). The telephone hook (r′) is connected to the line wire (s), leading to the tip (t) of the plug (u), and connected to the line wire (s) is the conductor wire (a′) of the signal-lamp relay (c′).

The subscriber's signaling device (w) is tapped on the subscriber's return wire (h) by the wire (w″), and when the receiver is on the hook (r′) the circuit for the current is established over the line wire (s) from the central station through the hook (r′), contact point (q), subscriber's signaling device (w), and wire (w″) to the main return wire (e). Connected with the condenser conductor wire (p) are the wires (x) and (x″), forming the telegraph circuit, in which is interposed the usual telegraph instruments (y). Interposed on the condenser conductor wire (p), between the telegraph-circuit wires (x) and (x″), is a condenser (r), the purpose of which is to prevent the interrupted current of the telegraph instrument being transmitted to the receiver of the telephone instrument. When the receiver has been removed from the telephone hook (r′), the circuit from the central station is from the tip (t) of the plug (u), line wire (s), telephone hook (r′), contact point (q), condenser conductor wire (p), telephone conductor wire (i), receiver (j), and transmitter (k) to the telephone return wire (o) and main return wire (e), and also over the telegraph circuit, the telegraphic messages being received and transmitted over the telephone circuit when the telephone hook is in this position. A similar system of circuits is installed in the subscriber's station (b′).

Bridged on the main power circuit is a storage battery (z) to aid in maintaining constant pressure of the current as it circuits from the generator to the subscribers' stations and to remove the effects of the imperfect commutation of the generator and destroy the individual vibrations of the current by a neutralization of the same. At the subscribers' stations the current continuously passes over the subscriber's conductor wire (f), through the electric lamps (g) and motor (g^2), to the return wire (h) and main return wire (e). The current through the lamps and motor is not interrupted to any noticeable or appreciable extent by the cutting in of the telephone or telegraph instruments, or, in other words, the circuit of the current from the generator through the lamps and motors is continuous and of a sufficiently high potential to perform the work required of it. At the tap (l) sufficient current is taken off the power circuit to operate the telephone and telegraph instruments and passes through a resistance (m) to protect the telephone and telegraph instruments against its high potential. The current circuits continuously from the resistance (m) through the telephone conductor wire (i), receiver (j), transmitter (k), telephone return wire (o), to the main return wire (e). In the case of the telephone, the circuit of the current is constant through the instruments, while in the case of the telegraph instrument, the circuit of the current is interrupted until the telephone hook (r′) engages the contact point (q).

Assuming that subscriber's station (b) desires to communicate with subscriber's station (b′), the receiver is removed from the telephone hook (r′), when a circuit from the generator (a) is established over the subscriber's conductor wire (f), resistance (m), condenser and telegraph circuits to the contact point (q), hook (r′), and line wire (s) to the signal lamp (v). The operator at the central station, after the lighting of the signal lamp, brings the contact points (i″) (j″) into engagement with the contact points of the branch wires (k″) (l″), respectively, forming a circuit from the line wire (s) through the operator's instrument at the central station and line return wire (f′) to the main return wire (e), putting the operator's instrument into communication with the instrument at subscriber's station (b). The generator current from subscriber's station terminates in the tip (t) of the plug (u), and the operator on being requested to connect subscriber's station (b) with subscriber's station (b′), inserts the tip (t) of the subscriber's plug (u) into the jack (t′) of the subscriber's station (b′).

On the removal of the receiver from the telephone hook at subscriber's station (b′) the circuit of the current through the signaling device is broken and is established over the condenser conductor wire and through the condenser to the telephone instrument and also over the telegraphic circuit and then over the telephone return wire to the main return wire (e). The subscriber at station (b) is now in communication with the subscriber at station (b′), the generator (a) continuing to furnish the current for the operation of the instruments, as well as for the operation of the lamps and motors at both stations. When the plug (1^a) is inserted in the jack (4) the calling subscriber's spring (x′) moves against the contact point (a^3), and establishes a circuit from the generator (a) over the line wire (s) through the disconnect lamp (w′), to the line return wire (f′), the spring (x′) and contact point (a^3), forming part of the plug switch. When the generator circuit from the subscriber's station (b) is broken by the receiver being hung on the telephone hook (r′) at subscriber's station (b), the circuit through the disconnect lamp (w′) is broken and the operator is signaled that the instruments are no longer in use, and the plug (1^a) is then disconnected from the jack (4) and returned to its socket.

Experiments with High Potentials at Low Frequencies.

Professor Harold B. Smith, head of the department of electrical engineering of the Worcester Polytechnic Institute, Worcester, Mass., has concluded a long series of experiments with low-frequency electric currents of very high potentials. New principles have been evolved, which will be of great importance in the transmission of power over great distances, it is asserted. The Iron Age says: "Professor Smith has made these experiments with a transformer which has developed 500,000 volts, which is the highest voltage ever obtained by a low-frequency current in a single transformer. The principles involved, which will be given in detail to the scientific world next spring, are these: Potential, or electrical pressure, and distance of transmission of power are not alone the causes of loss of power in transmission. The size of the conductor, or wire, has a great deal to do with loss of power, due to leakage between the conductors; the larger the conductor the less the loss. Iron wire is a good and practical conductor, to replace copper, for high-potential currents over long distances under certain conditions. Professor Smith asserts that the generally accepted theory of electrical engineers, that in power transmission over a distance the loss of power due to leakage between conductors increases as the voltage is increased, is not sound. The experiments have shown that the commonly accepted statement of a great electrical engineer, that, in his opinion, from 50,000 to 70,000 volts is the limit for power transmission, is incorrect. Experiments with insulators, which accompanied the study of high-potential currents, gave results which were of advantage to the Standard Electric Company of California, which is conveying power a distance of 200 miles from waterpower to Oakland and San Francisco. Insulators were made which withstood a pressure of 235,000 volts."

CORRESPONDENCE.

London Letter.

London, England, December 17.—One of the most interesting legal cases in connection with electric tramways which has taken place on this side of the Atlantic has been going on for some time between the Dublin United Tramways Company and the driver of a cart for injuries sustained in consequence of an upset of his vehicle on this company's lines. The whole argument has turned upon the liability of the company to sand its tracks properly. In this country the ordinary courses open to anyone challenging the decision of the judges in the first instance is the Appeal Court, and finally the House of Lords. Inasmuch, as in all three instances, the tramway company lost its case, the question of the sanding of tramway tracks may be said to have been finally settled. The House of Lords decided that, despite the company's charter under the tramways act of 1870, it had no exclusive right to the use of the roads, but the part over which its cars ran was placed under its immediate superintendence, and it was the duty of the company to secure the public convenience over that part.

The next session, and, indeed, all future sessions of Parliament, is likely to witness a diminution of applications for provisional electric-lighting orders consequent on the rapid development of electric power supply over large areas. Orders which have lain idle for many years are frequently being taken up by the companies which already have powers, while many local authorities contemplating the erection of their own works, have stayed their hands in anticipation of obtaining a supply from these wholesale companies at a much cheaper figure than they themselves could generate at. In the next session of Parliament new "bulk" companies are proposed for the north of Ireland, North Wales, Shropshire, Somersetshire and Cheshire, and at present there does not appear to be much prospect of serious opposition. In addition, quite a number of local governing bodies already giving a supply of electricity, are seeking powers to provide current for districts lying well outside their authorized area, so that a very few years should now see the number of undeveloped provisional orders brought down to the irreducible minimum.

The advantages of the underground-conduit system of electric traction for the facilitation of traffic inside towns, which has already been recognized by the London County Council, is also being taken up by other municipalities. Thus, at Bournemouth, a large south coast watering place, a fairly extensive system of combined conduit and trolley traction is being installed and is well on the way toward completion. The contractors are the American firm of J. G. White & Co., and the trolley will only be used on districts outside the actual town. Several municipalities are also inquiring into the possibilities of the surface-contact system, and a recent offer of the Dolter Company, which has a system in operation in Paris, to pay the expenses of the Bath council on a trip to inspect this, is likely to bring about a certain amount of confidence.

The Westinghouse company's new works at Manchester are now practically complete. Some 3,000 men are at work and all orders will, in future, be executed there. The growth of the company's business in Great Britain may be judged from the following: Orders received during year ended July 31, 1899, £279,000; to July 31, 1902, £932,000; since July 31, 1902, £825,000. W.

New York Notes.

New York, December 29.—The Board of Estimate and the New York Central have finally reached an agreement on the question of the improvements contemplated by the railroad company, whereby the city is to pay for its share in these improvements an amount not to exceed $600,000. This amount is to be spent in the erection of bridges and viaducts over the railroad tracks, as they will be depressed by the proposed scheme. For the increased privileges allowed the company, the city will receive an annual rental of $25,000. This point of remuneration was the stumbling block in the way of all the former plans. A further stipulation concerning the Park Street tunnel through which all trains, in the near future, will be run by electricity, was to the effect that in case of a breakdown of power only through trains shall be allowed to proceed by using steam. All cases of breakdown or emergency are to be decided upon by the Mayor before a steam locomotive is to enter the tunnel.

Traction troubles are slowly clearing away and the railway systems are doing all in their power to improve their facilities for handling the traveling public. The Manhattan system has answered Mayor Low's call, and has promised all that could be expected from such a corporation. The Brooklyn Rapid Transit Company also made answer to the mayor, and seemingly satisfied him that its cars would run on a better and more regular schedule. A rumor is afloat that, at the finishing of the Pennsylvania tunnel, the Brooklyn Rapid Transit Company will be leased by the railroad company on much the same basis as the Manhattan deal was closed recently. Whether this be true or not could not be determined, but the comment along this line is very strong here.

Arrangements have been completed by which the steamship Deutschland will in the future make use

of an electric-signal system in place of the old-style flasher and lantern systems now in use. This scheme employs letters and figures 10 feet high, and it is said that by the aid of a night glass these will be visible up to between six and seven miles. Another feature of the new system is that it records any signal sent, thus avoiding a possibility of an argument on that point. The system is the invention of Mortimer Norden, an electrical engineer of this city.

The European Rothschilds are reported to have invested $10,000,000 in the Interborough Rapid Transit Company's work. This is a greater holding than that of any other one interest in the combination. The Rothschilds are represented in the United States in all their railway investments by August Belmont, president of the Interborough company. Frank Hedley of Chicago, the new superintendent of the company, will begin his new duties by the middle of next month.

A mortgage and deed trust of $2,000,000 to the Guaranty Trust Company of New York city has been filed by the Queen's Borough Gas and Electric Light Company of Rockaway, L. I., to secure bonds for that amount. Part of the proceeds derived from the mortgage will be used to retire two mortgages now standing, one for $250,000 and one for $150,000. Four hundred thousand dollars more is to be used for the acquiring of property by the company, and the remainder will be issued as needed. O.

New England News.

Boston, Mass., December 26.—The Boston and Northern Street Railroad Company is to build a large car barn at Reading, Mass., and a large power house at Gloucester, Mass.

The Old Colony Street Railway Company has prepared plans for large power houses at Taunton, Quincy, and Fall River, Mass.

The Massachusetts railroad commissioners have granted the United Electric Light Company's petition for an issue of stock amounting to $145,000. The company is located in Springfield, and will use the proceeds to pay its floating debt and build additions to its underground lines. During the last two years the company has spent over $395,000 for improvements and additions to its plant.

At a recent meeting of the New England Railroad Club Robert L. Warner, the Boston sales manager of the Westinghouse Electric and Manufacturing Company, read a paper on "Electrically Driven Shops," illustrated by stereopticon views, showing many examples of the application of direct-current and induction motors to the driving of machine shops, tools, etc.

Westinghouse, Church, Kerr & Co. have moved their Boston office from the Exchange Building to the new Board of Trade Building, 131 State Street.

At the Massachusetts railroad commissioners' hearing on improved electric-car fenders, models and drawings of fenders were shown and explained by Louis Pfinget, whose fenders are largely in use in Boston; William B. Collins of North Dartmouth, Mass.; Obe Cullison of York, Pa.; Thomas H. Sherman, exhibiting a model of a fender invented by C. M. Moore; C. B. Forward of Cleveland, with a drawing of a wheel-guard fender; J. M. Galvin of Boston and E. L. Hern, representing the Hipwood-Barrett fender; G. B. Dovey of Cincinnati, representing the Hunter automatic fender, and F. A. Osborn, Jr., representing the J. H. Thayer platform fender. B.

Canadian Intelligence.

Toronto, December 27.—The Great Northwestern Telegraph Company of Canada is seeking an order to compel the town of Oshawa to remove from the company's poles all the electric lights, wires, attachments and supports of the municipal plant. The company also asks for an injunction to restrain the town from transmitting current along the company's wires. A great deal of interest attaches to this case, and it will doubtless be fought through all the courts, as it will be taken as a precedent for all other towns which have granted permission to telegraph and telephone companies to erect poles and string wires on the streets, and then demanded the right to use the same because the poles were on the public streets, which belong to the city.

The Niagara-Welland Power Company is making application to the Parliament of Canada for an act increasing its capital stock, changing the name and bonding powers of the company, authorizing the issue of paid-up stock for certain purposes, changing and defining the powers of the company as to appropriating and entering on lands and the purposes thereof. This company was chartered in 1894, and was authorized in May last by an order of the governor-general in council to proceed with its work. Its plans are to tap the Welland River east of the Welland Canal, and by means of a cut to carry the water of the Niagara and Welland Rivers to the high bluff near St. Catharines, where a fall of over 180 feet is obtained, and thence waste into Lake Ontario. This route also gives three other falls of 33 feet and 56 feet below the bluff, or a total of over 300 feet.

The property owners of Nelson, B. C., have voted an electric-light by-law for $150,000. The money is to be spent in putting in a power plant and extending the city's electric-lighting system, on which $75,000 has already been spent.

The Canadian Niagara Power Company's wheelpit at Niagara Falls will be extended to double its size. The total length of the pit will be 540 feet, and will then accommodate 11 turbines totaling 110,000 horsepower.

Owen Sound, Ont., by an almost unanimous vote carried two by-laws involving an expenditure of $75,000 for taking over the gas and electric-light plants of the town. The lighting plant will be enlarged.

Banker Paine, manager of the Ontario Power Company, has guaranteed the delivery of electrical energy from Niagara Falls to Toronto by January 1, 1904. At the expiration of a year from now, he says the company will be in a position to furnish Toronto with 15,000 horsepower, and if more is needed it can be had. A double pole line will be built from the Falls to Toronto, so that in the event of one line being disabled from any cause the second will be available.

Sherbrooke, Que., is considering a scheme for a municipal electric-lighting system, and the elections in January will hinge to a very large extent on the question of the purchase of an electric plant. A waterpower out at Westbury, 18 miles distant, has already been bought by the city, and it is the avowed intention of the municipal-ownership party to develop this power and transmit the electrical energy to Sherbrooke. Application is being made to the Legislature to appropriate right-of-way for a pole line from the plant to the city. The Gas and Electric Light Company has a splendid plant on the Magog River, in the heart of the city, and the municipal-ownership party asserts that, if the company will sell at a reasonable price the city will buy the plant and drop the Westbury power scheme. H.

Southern Developments.

Charlotte, N. C., December 27.—Interesting developments are in progress at Chattanooga, Tenn., in the municipal lighting field. The board of public works has decided to ask that $115,000 be included in the proposed bond issue for municipal lighting, there being some opposition to the present lighting service. On the other hand, the Chattanooga Light and Power Company has begun a large addition to its plant which, together with the new machinery purchased, will represent about $200,000. The company proposes to improve its service.

The town of Lewisburg, Tenn., has voted $5,000 electric-light bonds for building an electric-light plant.

The Macon (Ga.) Railway and Light Company has executed a mortgage for $1,000,000 to the North American Trust Company of New York as trustee on all of its properties. The bonds are five per cent. gold coupons, running for 50 years. This will perfect the consolidation of the street railways.

A fine waterpower at Furman's Shoals, on the Oconee River, near Milledgeville, Ga., will probably be developed soon. Litigations have so far checked the developments, but the question of ownership has been settled, and the company's plans will be announced in the near future.

The W. T. Weaver Power Company of Asheville, N. C., proposes to furnish the city with electrical power from the plant now being erected on the French Broad River. It is expected that the plant will be in operation by July 1st. A minimum of 3,000 horsepower is available.

The Birmingham Railway, Light and Power Company of Birmingham, Ala., has completed a second electric line to Ensley. The capacity of the power plant is being doubled, a total of about $2,000,000 in improvements, now being under way or completed.

The council of Atlanta, Ga., has extended to March 16th the time limit allowed to the Atlanta Electric Company for accepting its franchise. The work specified to be done on certain streets, however, was not modified. L.

From the Buckeye State.

Cleveland, Ohio, December 27.—W. H. Ford is promoting a company to build a line from Lindale to Cleveland. The distance is five miles, but at the present time it costs passengers 10 cents to make the trip. Mr. Ford will make a five-cent fare, and if the city puts through certain streets he says he would not object to a three-cent fare.

Dr. Dukel of Toledo and several other capitalists of that city and Adrian, Mich., are behind a scheme to connect Cincinnati and Chicago with an electric line. Their plan is to use the present lines between Cincinnati and Toledo, or at least those being built, and also the line betwen Toledo and Adrian, and to build a line from that point to Chicago. They believe they can make their arrangements and get their line in operation before the first of January, 1904.

The officers of the new Toledo, Port Clinton and Lakeside Railway Company of Toledo are as follows: President, P. McCrory; vice-president, L. E. Flory; secretary and attorney, D. H. James; treasurer, H. R. Klauser.

C. M. Thomas has been granted a franchise to build an electric line from Paris, Ky., along the Paris and North Middleton, Paris and Flat Rock, North Middleton and Plum Lick and Cane Ridge and North Middleton Pikes. C. C. Clark and Webb Bratton are also interested in the plan.

The Stark Electric Company of Canton is having the survey of the line from Sebring to Salem made. It will be 12 miles in length. This company has lines from Canton to Alliance almost completed, and the line from Alliance to Sebring is in operation.

It is reported that the Mandelbaum-Pomeroy people have purchased a franchise held by Fred Jones for an electric railway between Galion and Marion. Such a line would connect the Central Ohio Traction lines with the Columbus, Delaware and Marion road, but M. J. Mandelbaum has denied that his syndicate has purchased such a franchise.

It is reported that a survey is being made from Andersons Ferry into the heart of Cincinnati, and that it is supposed that the Cincinnati, Lawrenceburg and Aurora is seeking to build its own lines into the city, but nothing definite can be learned in regard to the matter.

H. L. Smith, a wealthy man of Smithfield, W. Va., has made application to build an electric railway in Ravenswood, that state. It is his intention to cross the river at Racine, and connect his lines with the Ohio roads at that point.

The Youngstown and Southern Railroad Company has been granted a franchise to build its lines through the town of East Liverpool.

The Columbus Railway Company and the Appleyard companies presented their employes each with a turkey for Christmas. Those who are not married and could not make use of a turkey were given a dollar or something of equal value.

A report is current that the Appleyard syndicate has purchased the Bellaire, Zanesville and Cincinnati steam road. It is said the road is difficult to operate because of the grades, but as an electric road it could be used without further expense. If this is true, the syndicate will not have much trouble in getting into Wheeling, W. Va., and Pittsburg.

The Yost Electric Manufacturing Company, incorporated in West Virginia, has been authorized to do business in Ohio, with headquarters at Toledo.

The Leetonia Light and Power Company of Leetonia has reduced its capital stock from $30,000 to $10,000.

The Dayton and Muncie Traction Company of Dayton has awarded contracts for the power-house machinery. Sterling boilers, Buckeye engines and Westinghouse generators and motors will be used. The contract aggregates almost $200,000.

In an interview, former Governor Asa S. Bushnell is quoted as saying that his company, now being organized, will build not less than three interurban roads leading into Springfield. It is probable that one of them will extend into Indiana, and the right-of-way is being secured for some of them. The county commissioners have granted a franchise for one extending from Springfield to Piqua.

Attorney-general Sheets has threatened to take action to oust the Miami and Erie Transportation Company unless the contention between it and the Cincinnati Electric Manufacturing Company is settled at once. The Miami and Erie company claims that its franchise gives it a right to use any lands along the canal for its own purposes, but Judge Sheets says that the Board of Public Works and the Canal Commission must concur in a contract of that kind and that such joint action was not taken in the granting of the franchise. O. M. C.

Information from Indiana.

Indianapolis, December 28.—The stockholders of the Indianapolis Street Railway Company have voted to accept the proposition of the Indianapolis Traction and Terminal Company and leased the system for a term of 30 years. The terms of lease have heretofore been made public, consisting of the guaranteeing the interest on the bonds, and the interest on the stock, assuming the obligation of the Broad Ripple Company and taking care of the fixed charges, all told amounting to over a million dollars a year. Hugh J. McGowan resigned as president of the Indianapolis Street Railway Company and was elected president of the Terminal Company. Admiral George Brown was elected president of the Indianapolis Street Railway Company. The lease becomes effective January 1st, and at midnight December 31st the property will pass into the hands of the Terminal company. The Terminal company filed notice with the secretary of state of an increase in its capital stock of $4,500,000, making a sum total of $5,000,000. Of this, $1,500,000 is to be prorated to stockholders of the street-car company as an inducement to their consent to the lease. The company will also issue $5,000,000 of bonds. The control of both companies is vested in the Widener-Elkins syndicate. Work will begin immediately on the building of the terminal station and tracks, and in order to facilitate the work a construction company, incorporated in New Jersey as the Indiana Company, with $1,000,000 capital, has been organized. This company will do the work, its directorate including many of the prominent members of the Widener-Elkins syndicate.

The rapid development of the interurban business in the state has prompted interurban men to ask for the appointment of a committee in the Legislature on interurban roads. During the previous session interurban matters were referred to the railroad committee. The interurban men say this is not fair, as the interests of the interurban and the steam roads are generally inimical; that the railroad lobby always has more or less influence with the railroad committee, and does not hesitate to fight interurban projects. It is understood that a number of important interurban bills will be introduced and that

the present statute will be amended so as to leave no doubt as to the obligation of the railroads and interurbans to put in interlocking switches at their crossings. The law is not now mandatory with either the steam or electric road. A bill will be introduced compelling interurbans to fence their tracks, the same as steam roads.

A company has been formed, and will file articles of incorporation on the first day of the new year, for the purpose of building an electric railway to connect Laporte and Logansport. The articles further contemplate the building of a branch line from Bass Lake, via Lake Maxinkuckee to Rochester. These lines are to form a connecting link between the electric systems of central and southern Indiana and the various lines in progress of construction in northern Indiana. It is said that eastern capitalists are interested in the project, and the promoters say the line will be built the coming year.

The announcement is made that the securing of rights-of-way have progressed so rapidly and that the donations of property along the line by farmers, who are very desirous for the line, have assured the speedy building of the Newcastle-Pendleton line early in the spring. This road will connect with the Union Traction Company at Pendleton, affording a large and wealthy section of country an outlet to Indianapolis by trolley-line service. Judge D. H. Bundy, Hon. D. A. Ogburn and C. S. Hernly are promoting the road.

The Wabash River Traction Company has completed its line between Wabash and Logansport, and made several successful trial trips last week.

A contract for the construction of 15 bridges along the route of the Indianapolis Northern Traction Company has been awarded to the Indiana Bridge Company at Muncie. The construction will be of stone, concrete and steel.

The Union Traction Company is contemplating the construction of a line in extension of its system to Newcastle and Richmond, paralleling the Richmond division of the Pennsylvania Railroad from Middleton east.

A Central Avenue trolley wire broke at 10 o'clock on the night of the 22d and fell on a Broad Ripple car, transmitting electricity down the stove pipe in the motorman's vestibule, shocking the motorman into unconsciousness and convulsions. The passengers escaped injury, but the car was nearly consumed by fire before the department arrived. The accident has suggested the danger of passengers sitting near the street-car stoves that have unprotected metal chimneys protruding above the roof of the car.

A head-end collision between limited car No. 225 and "Martha," the elegant private car of President McCulloch on the Union Traction Company's line on the 25th inst., damaged both to a considerable extent, killed Motorman Frazier of the limited and injured several passengers. The cause was due to the watch of Motorman Johnson of the private car being slow. F.

Northwestern Notations.

Minneapolis, December 27.—Work is to be begun at once on installing the new electric-light system at Chisholm, Minn., for John Costin.

The electric-light plant at Riceville, Iowa, has been sold for taxes.

Mr. Derby has been granted a franchise for an electric-light plant in Graettinger, Iowa.

The East Wisconsin Traction Company has been granted a franchise for an electric-railway system through the streets of Green Bay, Wis. This company proposes a line to Kaukauna, Wis., where connection will be made with a line to Oshkosh, Menasha, Appleton and other points. A connection is proposed with Beloit over the new road just being completed to Janesville.

The attorneys for the Water Board, in the suit against the Twin City Rapid Transit Company, in St. Paul, for damage to water pipes by electrolysis, have depositions from Major William M. Black, U. S. A. Corps of Engineers, commanding the post of Washington barracks; from Walter C. Allen, in charge of the electrical system of Washington, D. C., and from Adolph Knudson, an expert electrician of New York. All agree that a double-trolley system, either underground or overhead, would prevent the escape of current.

The Electric and Water Company of Little Falls, Minn., has made numerous changes and improvements to the power station recently, replacing old machinery with new. It has two new Westinghouse generators to furnish current for power, arc and Nernst-lamp service.

The Twin City Rapid Transit Company finds the use of air brakes on its cars in Minneapolis and St. Paul not entirely satisfactory. Too much pressure results in too many flat wheels, and the company contemplates changing to a magnetic track brake.

The LaCrosse and Southwestern Railroad Company has been incorporated to build a road for electric, steam or other power, from LaCrosse to adjacent points. The capital stock is $800,000.

A complete electric-light plant is to be installed for the West Side High School Building at Des Moines. R.

Detroit, Mich.

Detroit, Mich., December 27.—During the present year the Detroit United Railway has spent $680,000 for additional equipment, including $200,000 for 45 new cars, $175,000 for shortening the line to Port Huron, $175,000 for new generators, and $40,000 for 17 miles of heavy copper feed wire.

An electric line from Cincinnati to Chicago, passing through Adrian, is apparently the plan of Toledo capitalists. The road from Cincinnati to Toledo is already under the progress of construction, and the plan now is to build from Adrian to Hudson before putting in the connecting link. The promoter of the capitalists is Dr. Duket of Adrian.

Right-of-way is said to have been secured for a new electric railway from Toledo to Chicago, paralleling the Lake Shore the entire distance. The road will be completed as far west as Sturgis before December 20, 1903.

The Grand Rapids, Grand Haven and Muskegon Railway Company will build a large and magnificent hotel at Grand Haven the coming season. It is understood that the plans are out and provide for an accommodation of 1,000 people. C. G. W.

On the Pacific Slope.

San Francisco, December 24.—General Manager A. M. Hunt of the Independent Electric Light and Power Company confirms the report that his company, which now charges from four to 4½ cents per kilowatt-hour for electricity for light and power, will reduce rates on January 1st. He says the new charges will be mainly on a straight three-cent basis. President Claus Spreckels said that the company had 200 small manufacturers to which it supplies power, who could not exist except for the cheap rates. "We want," said he, "to still further encourage them and cut the rate from four and 4½ cents to three cents, even when contracts bind them to the higher rate for three years to come." He desires to increase the day load, which is at present much less than the night load at the stations. Hence the use of electric power in small units will be encouraged by a low rate. It is understood, however, that very low rates have been made to large consumers of electric power for some time past. The company has contracted with the Westinghouse company for an additional 1,500-kilowatt generator.

The United Railroads Company is preparing specifications for 50 new electric cars, which will be ordered in about one month. The different requirements of the various routes will necessitate several types of cars. A standard color is to be adopted for all cars, and standard types of construction will be followed as far as possible. Uniformed car dispatchers will be stationed on the streets, beginning January 1st. The San Mateo line will not be opened January 1st and an extension of time will be applied for, as the franchise soon expires.

C. E. Moore, city engineer for Merced, Cal., has submitted to the trustees a report on water-supply and electric-lighting systems for the town. He estimates the cost of a water-supply system at $65,000, including pumping machinery, wells and pipe system. The estimated cost of the lighting system is $30,000, the plant to consist of a generator and electrical apparatus, boiler and engine.

An electrical engineer reports that it can safely be said that a new power company, composed of H. E. Huntington and Los Angeles people, will build a power house about 30 miles from Porterville on the Tule River, to develop 8,000 to 10,000 horsepower. The company expects to get a 2,500-foot head, giving a pressure of over 1,200 pounds to the square inch. The interests in this enterprise are practically the same as the Pacific Electric Light and Power Company. Its ultimate purpose is to be an electric road between San Francisco and Los Angeles. Cars will be equipped with high-voltage polyphase motors capable of developing a high speed. Trolley poles and wheels may be superseded by slides like those used in Germany. The San Joaquin route will probably be selected, owing to the agricultural resources. He believes that the system will be in operation within from three to five years. A.

Seattle, Wash., December 24.—Another movement is under way to construct an electric railway between the cities of Seattle and Everett, a distance of 33 miles. Articles of incorporation for the new road were filed in the county auditor's office last week. The name of the corporation is the Seattle-Everett Interurban Railway Company. The capital stock is placed at $1,500,000.

Just now, owing to bad weather, telegraphic communication between Seattle and the far north—Dawson and the Yukon districts—is frequently suspended. It will be so all winter. In summer there is far less interruption, for repairs to the line are carried on with little difficulty.

The new electric-lighting plant of Vancouver, constructed and operated entirely by local capitalists, is now in running order. The total cost of the plant is more than $40,000. Fifty street lights will be used at present on an all-night basis.

The Sanders concern of Seattle, incorporated, has obtained a franchise from the King County Board of Commissioners to operate a trolley line from Seattle to the Snohomish County line. Mr. Sanders recently filed with the county auditor at Everett an instrument for the appropriation of the water right at Wallace Falls, for use in developing power for this purpose. This river flows 300,000 cubic feet per minute at the river's average stage.

The Seattle Gas and Electric Company has made application for three building permits to enlarge its plant. Besides rearranging portions of the old buildings, the plant will practically be increased by the addition of three new buildings.

Early in January a postal service will be inaugurated between Seattle and Tacoma, to be operated by the Seattle-Tacoma Interurban Railway Company. It will deliver mails to all suburban stations. L. E. C.

PERSONAL.

John Spence, one of the promoters and directors of the Rockland and Abington Street Railway Company and director of the Abington and Rockland Electric Light and Power Company, recently died at his home in Rockland, Mass.

Charles G. Armstrong, the well-known Chicago electrical and mechanical engineer, has been granted a United States patent for a "Process of Regulating Heating Systems." The patent is assigned to the Automatic Heating Company of Jersey City, N. J.

John Adams Heinson, manager of the advertising department of the H. B. Smith Machine Company of Smithville, N. J., has resigned his position to organize and conduct a promotion department for the Manhattan Electrical Supply Company of New York and Chicago, with offices at 32 Cortlandt Street, New York city.

A. Kennedy Ashworth, formerly of the firm of D. Ashworth & Son, consulting steam engineers, and later for a number of years in charge of the engineering department of the Pittsburg Gage and Supply Company, Pittsburg, has accepted service as assistant manager of the Underfeed Stoker Company, with headquarters in the Marquette Building, Chicago.

F. W. Warren, who was at one time connected with the Montreal Street Railway, has been appointed assistant to President H. S. Short of the Montreal Heat and Power Company. Mr. Warren is the nephew of James Ross, one of the largest holders of electrical stock on the continent. He has represented that gentleman in Jamaica, and Birmingham, as well as in Montreal.

President L. A. Ferguson of the National Electric Light Association has made the following appointments in the new departments which were created at the last convention: Reporter for wrinkle department, J. H. Perkins, Youngstown, Ohio; committee on lost and unaccounted-for current, L. G. Van Ness, Lincoln, Neb.; reporter department of decorative lighting, A. S. Williams, New York Edison Company, New York city; committee on theft of current, R. L. Elliot, Chicago Edison Company, Chicago; reporter department of office methods and accounting, W. M. Anthony, Chicago Edison Company, Chicago.

ELECTRIC LIGHTING.

The Navarre Light Company is erecting a new plant at Navarre, Ohio.

Chanute, Kan., has voted to erect an electric-light plant at a cost of $35,000.

Neenah and Menasha, Wis., are discussing the feasibility of erecting an electric-light plant jointly.

The City Council of Benton Harbor, Mich., is seriously considering the municipal-lighting proposition.

The Rapid City Power, Light and Woolen Manufacturing Company of Winnipeg, Man., has been incorporated with a capital of $25,000.

The Burt Smith Company has bought the Browneville Electric Light Company and plant at Browneville, Tenn. The plant will be improved.

Clarence, Mo., has voted to issue $10,000 worth of bonds, the proceeds to be used in the construction of an electric-lighting plant and system.

The Terrell (Texas) Electric Light Company has been incorporated with a capital stock of $50,000. The incorporators are M. A. Joy, S. E. Noble and others.

The Capital Power and Light Company of Las Vegas, N. M., has been granted a franchise by the Las Vegas council for a power, light and long-distance telephone system in that city.

The Central Light and Power Company of Atlanta, Ga., has been incorporated with a capital stock of $100,000. The incorporators are M. R. Wilkinson, J. R. Gordon, S. E. Smith and others.

The Citizens' Light and Water Company of Clairmont, Cal., has been incorporated with a capital stock of $75,000. The incorporators are L. T. Gillott, G. A. Gates, E. C. Johnson and others.

James N. Halstead and John G. Bryson have been awarded a 10-year contract to light Greencastle, Ind., at $65 a lamp per annum. They have incorporated with $25,000 capital stock under the name of the Putnam Electric Company. The company has the right to do business in any part of the state and has secured a 50-year franchise in Greencastle.

ELECTRIC RAILWAYS.

John T. Buckley, manager of the Frankfort and Suburban Railway Company of Frankfort, Ky., is credited with having announced the sale of the company's system to W. S. Longer of Cleveland, Ohio, and Talmege Leek of New York, who are said to represent eastern capitalists.

The report of the Lake Street Elevated Railroad Company of Chicago for the fiscal year ended July 1, 1902, shows gross earnings of $794,042, with operating expenses amounting to $388,969. The total number of passengers carried during the year was 15,481,591. The total mileage of the road is 13.27 miles. During the year the company spent in improvements and extensions $120,268.

The Omaha and Council Bluffs Street Railway Company of Omaha, Neb., has been incorporated with a capital stock of $15,000,000. The articles of incorporation provide for suburban lines to Blair, Plattsmouth, Wahoo and Lincoln, Neb., and to Griswold, Iowa. The incorporation of the company was the final step in the consolidation of the street railways of Omaha and Council Bluffs. The acquirement of the Bluffs lines is in the form of a 99-year lease, which also carries the control of the Lake Manawa line. The new company will at once spend $1,000,000 on improvements, the work on which is now under way. With the beginning of the new year the employes, numbering several hundred, will receive an increase in wages ranging from five to 10 per cent. The officials of the Omaha lines will continue in office.

POWER TRANSMISSION.

The big dam of the Kalamazoo Valley Electrical Company at Plainwell, Mich., has been opened with formal ceremonies. The dam develops 1,600 horsepower and its total cost is said to have been in excess of $100,000.

Sir Weetman Pearson & Son, the English contractors who have large investments in Mexico, have obtained a concession from the Mexican government for the establishment of an extensive power-transmission system. They announce that they have the necessary plans completed for expending $12,000,000 gold in constructing an electric generating plant in the mountains of the state of Puebla, where there is an abundance of waterpower. It is proposed to establish transmission lines from the generating plant to Mexico City and to have available 80,000 horsepower of electrical energy for electric lights and power for manufacturing concerns there.

PUBLICATIONS.

A pamphlet distributed by the American Tool Works Company of Cincinnati, Ohio, is descriptive of the American machine lathe.

The Buffalo fan system of heating, ventilating and drying, as installed by the Buffalo Forge Company of Buffalo, N. Y., in many buildings throughout this country and abroad, is treated in an illustrated folder.

The Chicago and Alton Railway Company's holiday literature is especially attractive. On its folders, posters and dining-car menus winter and Christmas scenes are used, which bring out the advantages of "The Only Way."

The Jewell Electrical Instrument Company of Chicago has issued a revised price list of Jewell standard meters for direct current. Portable switchboard and laboratory instruments are illustrated as well as shunts for the ammeters.

"Save Your Eyes" is the title of a booklet issued by McLeod, Ward & Co., 27 Thames Street, New York city, which describes their Kinsman desk lamp. Various styles of desk lamps, and also portable, orchestra, picture and pulpit lamps are illustrated.

The Bullock Electric Manufacturing Company of Cincinnati will follow its custom, established last year, of distributing to its friends and customers attractive calendar cards for each month. The series of 1903 is noteworthy for its diversity and richness of lithographic design, each month's card being of a color and design especially appropriate for the season. The cards contain portraits and, on the reverse sides, sketches of "Great Men of Science and Engineering," the series including Joule, Tyndall, Darwin, Lyell, Huxley, Lister, Hertz, Bunsen, Agassiz and others.

MISCELLANEOUS.

Signor Pansa, an engineer of Cassino, Italy, has, according to the newspapers, invented a machine which converts the sun's light and heat into an alternating electric current. He believes that everybody by the use of this machine will soon be enabled to manufacture their own electric power, light and heat.

The Minnesota State Board of Electricity held its quarterly meeting in St. Paul, Minn., recently. The board engaged in a short discussion concerning the granting of permits to prospective electricians, and on the extension of the jurisdiction of the board to include Duluth, it now being confined to St. Paul and Minneapolis.

TRADE NEWS.

The Sterling Varnish Company of Pittsburg announces that its European address has been changed to Brougham Street, Blackfriars Road, Salford-Manchester, England, where all communications relating to its foreign business should be addressed.

The annual meeting of the stockholders of the Elblight Company of America for the election of directors for the ensuing year, and for the transaction of such other business as may properly come before the meeting, will be held at the offices of the company, 114 West Thirty-second Street, New York, on January 13th, at noon.

The old firm of Merkhofer & Ratermann, electrical contractors of Cincinnati, Ohio, certifies to a change of name to the Merkhofer Electrical Works Company, with offices and warehouses at 104 East Court Street, Cincinnati. The officers of the new company are as follows: President, Charles W. Rattermann; secretary and treasurer, Harry W. Gillespie; chief electrician, J. Merkhofer.

The Goltz Engineering Company of Chicago has been appointed Chicago agent for the Duncan Electric Manufacturing Company of Lafayette, Ind., manufacturer of the Duncan integrating wattmeter for direct-current lighting and power service. The selection of the Goltz company should prove an important factor in the wide dissemination of the Duncan meters.

The name of the Standard Traction Brake Company of 26 Cortlandt Street, New York city, has been changed to the Westinghouse Traction Brake Company. This company sells all power brakes for street-railway service manufactured by the Westinghouse Air Brake Company, including straight or automatic air-operated brakes with axle-driven or motor-driven compressors, the storage system of air brakes, and the Westinghouse combined magnetic brake and electric car-heating apparatus.

BUSINESS.

The telephone department of the Electric Appliance Company, Chicago, has been improving the celebrated Noxem receiver until the company feels warranted in claiming that it is a perfect receiver. The company says that it has never put a telephone specialty upon the market which has met with the success that has been accorded to the Noxem receiver.

The Marshall-Sanders Company of Boston has just put on the market a new push-button switch, which has already met with great favor from the engineers and architects. The company claims that this is a little ahead of anything heretofore produced in push-switch construction. A good stock of these is carried in all the company's branch offices, and samples will be furnished architects and engineers upon request.

The Mechanical Boiler Cleaner Company, 413 Western Union Building, Chicago, is in receipt of a flattering letter of recommendation from the Commonwealth Hygienic Ice Company of Boston, in which it states that, after putting on cleaners in five of its boilers, it ran the boilers for 12 weeks without opening, and then found the boilers absolutely clean and free from scale. The Commonwealth company also speaks highly of the cleaner as a purifier and recommends it especially for ice companies and brewers.

The new Duncan integrating wattmeter, now being manufactured by the Duncan Electric Manufacturing Company, Lafayette, Ind., is meeting with much success. The company has only had the meter upon the market for two months, and already it is obliged to keep the factory running until 10 o'clock five nights a week. The meter is of the commutated type, and is meeting with great favor among the users of direct current for light and power. The many up-to-date features that have been incorporated into this new meter, together with its extreme accuracy, account for its success upon the market.

The C. H. Worcester Company of Marinette, Wis., reports that it has a fair stock of all sizes of poles in its yards. This company operates 11 cedar yards on the line of the Wisconsin and Michigan Railroad in Marinette County, Wisconsin, and Menominee County, Michigan; also yards at L'Anse and Ontonagon, Mich. It is putting in about the same amount of stock this winter as last, and is in position to take good care of its trade. The company has leased a handsome suite of offices in the Tribune Building, Chicago, but will not be able to occupy them until about March 1st. The company has temporary quarters at 404 Lakeside Building. George I. Gibbs will act as Chicago sales manager.

The midwinter bulletin of the Charles E. Dustin Company, 11 Broadway, New York, dealer in electrical and steam machinery, contains a large list of apparatus that is good and serviceable and of standard makes and sizes. The machinery has been purchased from stations that are changing systems or taking on larger units. Among the stock listed are direct-connected railway and lighting units of 500, 250 and 110 volts, belted railway generators, alternators, alternating-current motors and a great quantity of miscellaneous electrical apparatus, including motors, generators and arc lamps. The company also has for sale a large number of Corliss and high-speed automatic engines, water-tube and return-tubular boilers, pumps, condensers, heaters, turbines, etc.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office), December 23, 1902.

716,362. Trolley. Wallace L. Baker, Painesville, Ohio. Application filed September 29, 1902.

Flat, bowed springs which are associated with the trolley wheel are disposed and braced within the frame to exert an endwise pressure therein and yieldingly maintain the wheel in normal position in its frame.

716,365. Electrical Cooking-range and Broiler. Maurice Bayno, Cedarhurst, N. Y. Application filed December 31, 1901.

In the range are a casing, lids and covers forming a chamber and a reversible electric heating appliance in the chamber. (See cut on next page.)

716,366. Electrical Cooking Apparatus. Maurice Bayno, Cedarhurst, N. Y. Application filed February 19, 1902.

Electrical coils are supported by insulating posts in horizontal planes in a casing, and hangers supported between the sides of the casing are adapted to receive a broiling iron.

716,372. Induction Alternate-current Meter. Otto T. Bláthy, Budapest, Austria-Hungary. Application filed March 20, 1902.

In the electric meter which is of the Ferraris type are combined a U-shaped iron core having the voltage coils and an E-shaped iron core having on its middle leg the current coils with a rotating disk disposed between the cores, the outer legs of the E-shaped core being opposite to the legs of the U-shaped core.

716,376. Trolley Pole. Theodore C. Buder, St. Louis, Mo. Application filed December 18, 1901.

The pole has a forked end and a member composed of triangular plates pivoted thereto and revoluble within same with a roller pivoted at each angle of the plates.

716,398. Fuse. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1898.

A fusible cut-out comprises a fusible conductor extending through an opening in insulating walls, substantially the same size as the conductor and of sufficient length to rupture the arc before the same is stretched to the ends of the opening, and means for stretching the arc to its rupturing point within the opening and while wholly inclosed thereby when the fuse melts.

716,406. Electrical Switch. Alfred H. Gibbings, Liverpool, England. Application filed December 3, 1901.

The contact switch has a hand-actuated part adapted to actuate and store energy in a spring when moved in one direction when inoperative thereon, and on the apparatus when moved in the other, and a fluid-flow controlling device in connection with the cylinder for governing the rate of movement of moving contact part actuated by the spring.

716,411. Electric Tram and Railway. Robert Hacking, Nottingham, England, assignor to Hancock & Leighton, Nottingham, England. Application filed December 13, 1901. Renewed November 22, 1902.

Combined with a supply main and a return main are a conductor divided into sections insulated from each other, a second set of conductors each situated in advance of the junctions between the sections, and a switch for each junction supplying when in one position current to the section of the conductor next behind it and connecting the conductor of the second set next after it with the return main through means tending to reverse its position, and when in its other position connecting the section of the conductor next behind it with the return main through means tending to put it into its first position.

716,429. Compensating System. John F. Kelly, Pittsfield, Mass. Application filed August 1, 1901.

In a system of distribution by alternating currents described are a main alternating-current generator, an auxiliary alternating-current generator in series therewith, a transformer in series with the generators supplying an exciting current to the auxiliary generator, means for rectifying the exciting current and means for adjusting the relations of the field magnet and armature of one of the generators so as to vary the phase relations of the generators. (See cut on next page.)

716,445. Means for Regulating and Protecting Electric Motors. Robert Lundell, New York, N. Y. Application filed September 20, 1902.

Combined with an electric-circuit controller are one or more electric motors the speed of which is chiefly governed by coupling the armature circuits in series or in parallel, and means for preventing an undue rush of current at the time the armature circuits are changed from series to parallel, and from parallel to series with additional means for keeping the field strength practically independent of the armature current after the circuits are re-established, so that the motor or motors may be driven by the load as a generator, and the changes in the armature circuits may be effected without shock to the apparatus.

716,460. Multiple Switchboard. William E. McCormick, Chicago, Ill., assignor to the Interna-

tional Telephone Manufacturing Company, Chicago, Ill. Application filed August 26, 1901.

A range or strip of switches consists of a front rail composed of outer and inner insulating strips and intermediate fastening strip, all suitably bored, test rings in the bores having flaring mouths and rear screw threads, a channeled rear rail, terminal strips in the channels of the rail and having tapped ears to engage the threads of the test-rings, spring terminals secured to the rear rail and extending parallel with and above the strips.

716,475. Extinguishing Electric Arcs. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 3, 1901.

A high-potential switch or circuit-breaker is provided with fixed and movable tubular contacts, and means for driving the arc products into and along both tubes when the circuit opens.

716,476. Suppressing Sparking of Commutators. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 8, 1901. Renewed July 12, 1902.

Means for suppressing arcing at commutators, or circuit interrupters, comprise a tubular duct communicating with one point of contact, and means for lowering air pressure in the duct to draw the arc products into the same.

716,477. Trolley Guard. Poladore M. Reed, Paterson, N. J., assignor of one-third to John F. Kerr, Paterson, N. J. Application filed July 10, 1901. Renewed October 24, 1902.

Two spring arms are pivotally secured at their lower ends to the inside of the harp, and a conical-shaped, hard-rubber roller is mounted to rotate on them.

716,480. Regulating Apparatus for Refrigerating Compartments. Robert W. Rollins, Hartford, Conn. Application filed August 12, 1901.

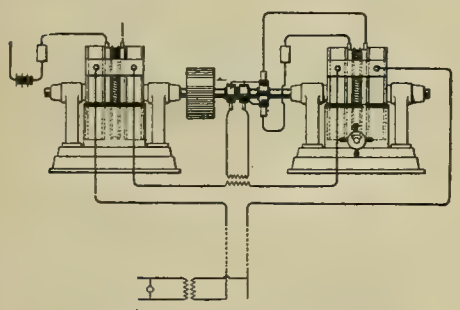
A thermostat is operable upon reduction of temperature within the compartment, to open the circuit of a magnet, which opens an admission valve.

716,487. Socket for Incandescent Lamps. Albert P. Seymour, Syracuse, N. Y. Application filed February 4, 1902.

A porcelain shell for a waterproof socket is described.

716,504. Electric Switch. George H. Whittingham, New York, N. Y. Application filed January 21, 1902.

In an electric elevator system are combined a motor-supply circuit and contact blades and terminals for closing and opening the same, and an armature circuit arranged to remain closed until after the contact blades have been brought to and past the "stop" position.



NO. 716,429.—COMPENSATING SYSTEM.

716,518. Adjustable Headlight for Street Cars, etc. George F. Chapman, Marlboro, Mass., assignor of one-half to Levi Wallace, Ayer, Mass. Application filed May 31, 1902.

Combined with a truck frame and a body are a laterally deflectable headlight, a movable member connected to turn with the headlight, an electromagnet adjacent to the path of movement of the movable member, and a switch arm operated by the truck frame to control the magnet.

716,540. Switching Apparatus for Alternating Currents. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 21, 1900.

One claim reads: The combination of an alternating-current circuit, of a high-potential circuit-breaker therefor, an electric control-circuit for the circuit-breaker, devices responsive to overload in the system governing the control-circuit, and a relay also governing the circuit, having one member responsive to line-current and the other to line potential. (See cut.)

716,562. Railway Signaling System. William Locke, Troy, N. Y., assignor to the Pneumatic Signal Company, Rochester, N. Y. Application filed February 26, 1902.

One or more sources of electric energy are connected to the track in proximity to the front end of the block or section and connected to the track in proximity to the rear end of the block. A pole changer is interposed in such front-track connection, and there are means for controlling such pole changer from a point in advance of the block or section.

716,574. Method of Treating Animals. Andrew Nimmo, Groton, Mass. Application filed May 24, 1902.

The method of freeing animals from parasites is described. It consists in completely immersing the animal in a bath, and passing an alternating current of substantially low voltage through the animal and the parasite while so immersed.

716,578. Electric-lamp Socket. Clarence D. Platt, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed August 20, 1901.

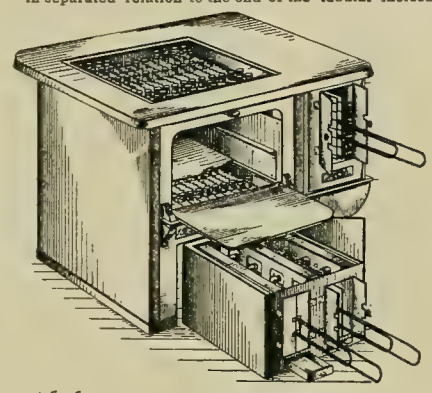
A pull socket has two insulating diaphragms, supporting brackets therefor, and lamp terminals carried by one of the diaphragms, with a rotary ratchet commutator having conducting and non-conducting teeth on its periphery.

716,583. Current-interrupter. William Scheidel, Chicago, Ill. Application filed August 29, 1902.

The device consists of a containing cell, a contained liquid electrolyte, an anode element, and an insulating casing inclosing the holder portion of the anode and formed with an enlarged chamber intermediate its vertical length, in the wall of which chamber is formed an outlet orifice.

716,584. Current-interrupter. Carl O. Schneider, Chicago, Ill., assignor to R. Friedlander & Co. Application filed June 14, 1902.

In the interrupter described are combined a cell, a contained liquid electrolyte, a cathode element, an anode element, an insulating tubular inclosure in which the anode is free to move, and an aligned abutment or rest arranged in separated relation to the end of the tubular inclosure.



NO. 716,365.—ELECTRIC COOKING RANGE AND BOILER.

716,595. Reflector for Incandescent Lamps. Joseph Taussig, Chicago, Ill. Application filed March 13, 1902.

An incandescent lamp is pivotally supported within a trough-shaped reflector and is adapted normally to lie within it in the line of its length and to be moved therefrom into an oblique position.

716,649. Circuit-breaker. Ernest A. Stevens, Chicago, Ill. Application filed July 19, 1901.

Electric conducting terminals on an insulating plate are adapted to make contact with conducting terminals of a cut-out holder.

716,653. Balanced-circuit Induction Coil. John P. Alexander, Jackson, Tenn. Application filed March 21, 1898.

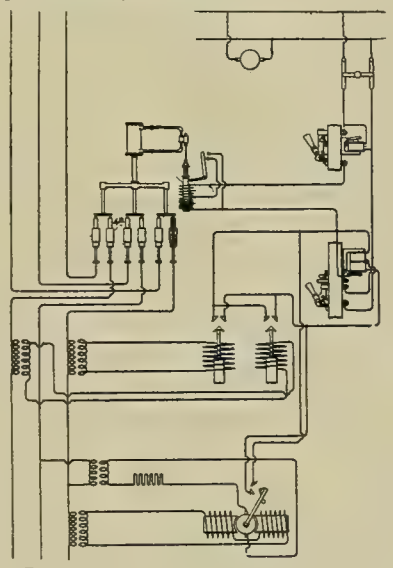
Combined with a continuous-current circuit are a branch containing a circuit-breaker and a branch containing the primary coil of an induction apparatus, the branches being of substantially balanced resistances, and means for diverting the main supply current alternately through some of the respective branch circuits without interrupting its flow.

716,654. Cable Hanger. Perrie H. Auxer, Cleveland, Ohio, assignor to Frederick P. Auxer and Carl P. Seyler, Cleveland, Ohio. Application filed May 28, 1902.

The hanger combines with the band, a link secured to the band, a clamping lever pivoted to the link and having on one side of the pivot a loop with which the other end of the band engages, and, on the opposite side of its pivot means by which it may be suspended.

716,656. Electric-battery Compound. George Bastedo, Brooklyn, N. Y. Application filed March 28, 1902.

The described composition of matter consists of dilute sulphuric acid 15 pounds, nitric acid 50 drachms and bisulphate of mercury one ounce.



NO. 716,540.—ALTERNATING-CURRENT SWITCHING APPARATUS.

716,663. Process of Preparing Storage-battery Plates. Ralph C. Browne and Frank Balch, Salem, Mass., assignors to Browne. Application filed April 21, 1902.

The process consists in heating a prescribed quantity of an acid which is a solvent of the metal of the plate to a predetermined temperature, adding thereto at such temperature a prescribed quantity of an acid which is a non-solvent of the metal, mixing in at a lowered temperature a quantity of water, and steeping the raw plates in the solution at a still lower temperature.

716,762. Electric Battery. Georges Rosset, Paris, France. Application filed February 20, 1901.

The cell contains a self-generating polarizing agent and has a porous vessel in the pores of which is formed a semipermeable membrane of ferrocyanide of copper which serves to arrest the passage of the depolarizer by a physico-chemical physical action.

716,771. Multiplex Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring and Marie V. Gehring, Philadelphia, Pa. Application filed February 25, 1901.

In the system are combined terminal and intermediate stations, each comprising a train of gears, a motor to revolve the gears, means to give a measured movement to the gears, and means adapted to convert a continuous current into an alternating current, an alternating motor operated by the current, means revolved by the motor to make successive circuits, transmitting and receiving apparatus connected in the circuit with the means and a correcting apparatus also in circuit therewith.

716,779. Telephone Transmitter Circuit. Almon B. Stetson, Malden, Mass., assignor to the American Telephone and Telegraph Company. Application filed June 6, 1902.

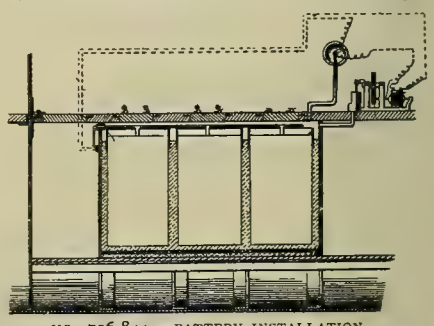
In a main telephone-circuit sub-station apparatus, combined with the transmitter, its induction coil, the receiver, a condenser, and a local circuit formed in part of the main-circuit conductors and containing in series the transmitter, receiver, condenser and the primary winding of the induction coil, is a connection conductor dividing the local circuit into two sub-circuits, one containing the transmitter and condenser, and the other the receiver and induction-coil primary.

716,801. Electric Bell. Frank W. Wood, Newport News, Va. Application filed September 2, 1902.

The bell comprises a water-tight casing inclosing the bell-hammer actuating mechanism and is provided with a removable cover-plate, the bell-ringing mechanism and the bell being carried by the cover-plate alone.

716,802. Telephone System. Wayne C. Wright, Amarillo, Texas. Application filed January 29, 1902.

In the system are a number of subscribers' stations with a line wire for each, a central operator's station, a switchboard comprising a number of contacts for each subscriber's station, and with which the subscriber's line wire is connected, a signal wire common to all of the subscribers' instruments, a number of contacts on the switchboard with which the signal wire is connected, a return, means for connecting each subscriber's line wire in multiple with the signal wire between the switchboard and the return, and an operator's wire, the switchboard including a contact arm with which the operator's wire is connected, the arm being adaptad to contact with certain of the signal-wire contacts and certain of the subscriber's wire contacts individually, and to engage a signal-wire contact and a subscriber's wire contact simultaneously.



NO. 716,844.—BATTERY INSTALLATION.

716,804. Apparatus for producing Caustic Soda by Electrolysis. Edward A. Allen, Rumford Falls, Maine, and Hugh K. Moore, Lynn, Mass., assignors to the Moore Electrolytic Company, Portland, Maine, and Boston, Mass. Application filed December 27, 1898. Renewed May 14, 1902.

The cell comprises a non-conducting substantially vertical diaphragm, sufficiently porous to permit the percolation of a considerable quantity of liquid, a suitable anode, and a cathode in contact with the outer face of the diaphragm, the cathode being formed of a porous layer of such thickness as to retain a considerable body of liquid in its pores, whereby the sodium deposited in the cathode is converted into hydrate by the water of the undecomposed solution which has passed through the diaphragm, and the electrolyzing of the undecomposed solution in the pores of the cathode is completed as it flows therethrough from edge to edge.

716,833. Method of Breaking Electric Currents. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed August 24, 1898. Divided and this application filed April 9, 1902.

The method of opening an electric circuit consists in maintaining a fusible conductor under tension, restraining the spread of arc gases developed on metallic or similar conductive rupture axially of the fuse toward the terminals, and simultaneously expelling such gases from the fuse in a direction at an angle to its axis.

716,844. Battery Installation. Simon Lake, Bridgeport, Conn. Original application filed March 4, 1902. Divided and this application filed June 23, 1902.

Combined with a hull of a submarine boat having a sealed battery compartment are a system of storage batteries contained in the compartment, and means for automatically discharging gases generated in the batteries outside of the boat and maintaining a predetermined atmospheric pressure within the compartment without the introduction therein to external air. (See cut.)

716,848. Mode of Extinguishing Electric Arcs. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed April 3, 1901. Divided and this application filed April 19, 1902.

The method consists in stretching the arc by a stream of insulating fluid and squeezing it from all sides into a contracted duct leading away from the electrodes.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, JANUARY 10, 1903. No. 2.

Latest Developments of Branly-Popp Space Telegraphy.

By Frank C. Perkins.

A system of maritime posts has been projected and is being established around the coast of France to communicate with vessels within a radius of several hundred miles of each station, by a company known as the Societe Francaise des Telegraphes et Telephones Sans Fil, having headquarters at 21 Place de la Madeleine, Paris, France. The company is headed by the celebrated engineer, Victor Popp, and the system of space telegraphy used is that of Dr. Edouard Branly, whose fame in connection with the invention of the coherer and the study of radio-conduction is world-wide.

Dr. Edouard Branly was born at Amiens, October 23, 1846, and studied at the Lycee de Saint-Quentin; also at the l'Ecole Normale and was graduated at the university. He is a doctor of physics and a doctor of medicine, and is professor of physics at the Catholic University of Paris. Victor Popp was born at Vienna, March 5, 1846, and is the son of Dr. G. Popp.

On the 25th of November, 1902, the wireless-telegraphic station (Fig. 1) at Cap de la Hague, on the coast of France, was finished and placed in operation. The apparatus employed in this post is shown in Fig. 2. Other stations are to be erected at Cape Gris Nez and other points along the coast of France and her colonies, at Tunis, Algeria, and points on the Sahara, as well as at Madagascar and elsewhere, placing all of the French possessions in communication. This will probably result in an independent and national system of space telegraphy for France, as it is proposed that the government grant a monopoly of space telegraphy in France to this company, in return for which the company maintains coast stations with government officials paid by the company, and provides schools of wireless telegraphy, maintaining them without expense to the government and allowing the latter a percentage of the receipts.

Dr. Branly is said to have received messages from ships 500 kilometers distant from the receiving station and also to have collected messages which were sent by the Marconi system between Liverpool and Crookhaven, on the coasts of England and Ireland, as well as Cape Lizard, whose distances from Cap de la Hague are from 425 to 800 kilometers. In accomplishing this, the waves must have crossed the mainland of England as well as the English Channel. The inventor claims that with his new "radio-conducteur" and the proper stations he can easily communicate with Newfoundland.

At the new wireless-telegraph station at Cap de la Hague, France, the poles are 40 meters high, and 15 wires are employed of a total length of 800 meters. A 10-horsepower dynamo and a storage-battery plant of 200 ampere-hours' capacity are used. The receiving apparatus (Fig. 3) of Branly and Popp includes a Morse receiver and one of the new tripod Branly coherers noted in Fig. 4. One pole of the battery is connected with the upper tapping screw of the receiver, and the current passes to the platinum disk which is attached to the movable arm of the instrument. A sensitive Claude relay is connected by a flexible wire to the platinum disk, which is insulated, and the relay is connected to the lower steel disk through a variable resistance, while the circuit is completed by connecting the tripod to the battery. When the waves from the transmitting station operate the coherer and relay, a secondary circuit is closed, which includes the battery cells and the receiver magnets, and the armature arm is moved. The reeciver circuit and the relay circuit are opened as the screw and platinum plate separate, while the arm continuing downward hits the lower screw, the shock acting on the coherer and opening the circuit, after which the spring returns the arm to the upper screw. The tripod coherer is enclosed in a glass case about two inches high, and when not in use the tripod is raised slightly above the polished plate.

Fig. 1. Station at Cap de la Hague, France.

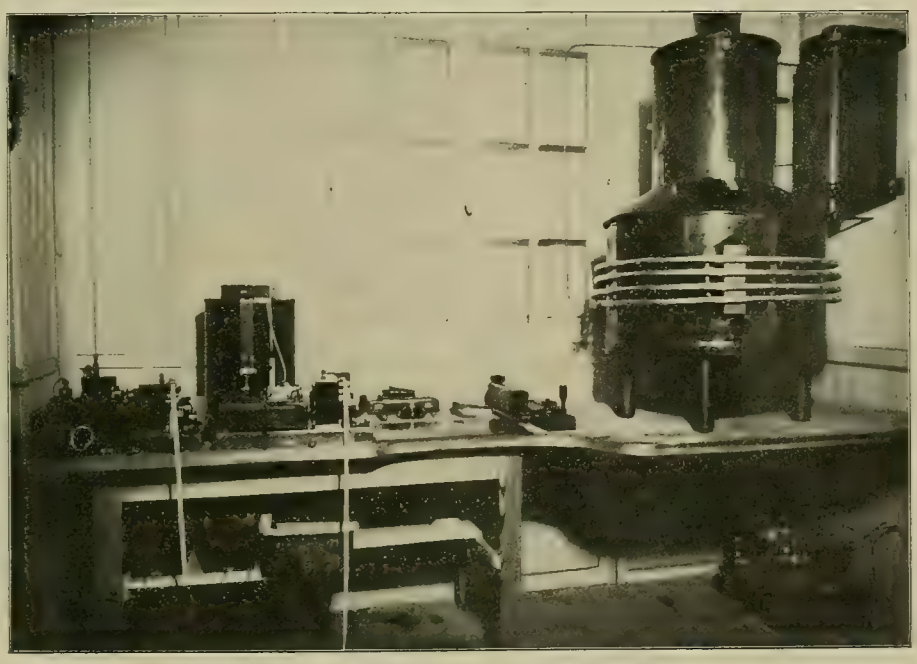


Fig. 2. Apparatus Used at Cap de la Hague Station.
LATEST DEVELOPMENTS OF THE BRANLY-POPP SPACE TELEGRAPHY.

Dr. Branly showed for the first time the effect of electric waves on powdered metal enclosed in a tube of ebonite in 1900, in connection with his celebrated paper on "Variations of Conductivity." This was the basis of the news science of wireless telegraphy. He called this tube a "radio-conducteur," and he has been experimenting largely since to produce a coherer of greater stability than those having a multiplicity of contacts. The Branly tripod coherer which he has recently invented requires but a slight tapping to decohere it, and is said to be very much more stable and sensitive. This new tripod coherer consists of a metal disk, to which is attached three metal rods, the points of which are oxidized. These three points rest upon a polished steel disk, and the care with which the oxide is produced upon the metal points, as well as the condition of the polished plate of steel, have much to do with the success of this type of coherer. It is stated that with proper care, the film of oxide may be preserved for a long time.

This form of coherer is not only more solid in construction, but is also more sensitive than the ordinary type, with a tube of metal filings. The apparatus is simplified by doing away with the tapper of the ordinary coherer tube, as a very slight shock is capable of opening the circuit of the new tripod coherer, this being accomplished by placing the Branly coherer directly on the Morse receiving instrument, the striking action of the armature being sufficient to cause the decohering action. This allows the receiver to work more rapidly, and from 18 to 20 words per minute may be received without difficulty. The steel rods forming the tripod are of one-eighth-inch diameter, the latter being about one inch high, and, owing to the extreme sensitiveness of the coherer, voltages of from one-half to one volt are employed.

The transmitting apparatus consists of a contact key and interrupter for the induction coil, motor-driven, with condenser discharger and cables leading to the masts. The necessary switchboard is provided with measuring instruments, switches, and the current is supplied at the station at Cap de la Hague by a direct-connected dynamo and storage-battery plant.

The Societe Francaise des Telegraphes et Telephones Sans Fil has organized a wireless-telegraphy

project of more than passing interest in the city of Paris. For several months past wireless-telegraphic stations have been established at the press bureau l'Agence Hava, also at the offices of the Journal and Figaro, and at the Place de la Madeleine, and it is the intention of the company to establish a subscriber system similar to the telephone system, whereby the patrons will all be supplied with the most important news. Messages have been sent regularly from these stations during the last half year,

DR. EDOUARD BRANLY. VICTOR POPP.

regardless of the weather, rain, snow or sleet, or storms of any nature proving no obstacle to the transmission by this wireless method. Winds are powerless to cripple a service of this kind, and a central transmitting station will be established soon in a central location. The coast stations can transmit messages to every incoming or outgoing ocean French mail steamer, and the weather-bureau posts can send a warning of storms. The adaptability of the system for military purposes is illustrated by the compact receiving station of the Branly system, shown in Fig. 5.

Marconi and His Work.

The citizens of Sydney, N. S., gave Marconi a dinner on December 30th, and one of the features of the decorations was the electrical display. At the opposite ends of the table were placed two miniature Marconi towers, representing the stations at Table Head and at Poldhu, Cornwall. Between these two stations an electric spark flashed at intervals, signifying the passing of wireless messages. After reviewing the early stages of wireless telegraphy, Marconi said: "The cost of establishing a trans-Atlantic wireless-telegraph service is less than $200,000, while it cost $4,000,000 to lay an Atlantic cable. We are under contract to transmit messages for 10 cents a word, but you need not be surprised if in the future wireless messages are flashed across the Atlantic at a cost of one cent a word."

In a recent interview Mr. Marconi gave it as his opinion that wireless telegraphy across the ocean

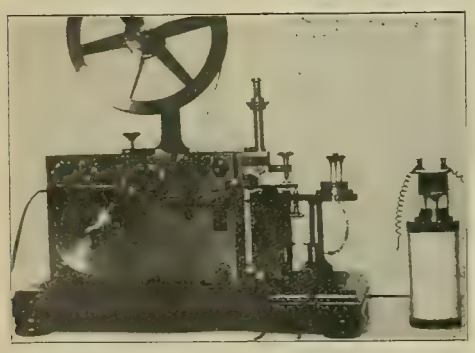


FIG. 3. BRANLY-POPP SPACE TELEGRAPHY.—MORSE RECEIVER AND BRANLY COHERER.

is now as practical as cabling. He said he had sent more than 2,000 words in all from Glace Bay to Poldhu, and had reached a speed of 15 words a minute. With a proper sending key he could easily get off 30 words a minute.

Marconi is said to be arranging for a transcontinental space-telegraph service through Canada. Experiments are now being made in the vicinity of the Rocky Mountains with that end in view. Winnipeg is to be the half-way house of the system. It is understood the station will be located at Stony Mountain, an eminence 12 miles from Winnipeg. It will receive eastern messages from Mount Royal at Montreal, and the next western station will probably be located in the Rockies.

The Marconi Wireless Telegraph Company, according to a London dispatch, has concluded contracts for a daily service of space-telegraph news messages to a British mail steamer, which sails from Liverpool for New York at the end of the month. The vessel will be equipped with a complete staff and plant, which will enable the publication of a daily newspaper on board during the voyage.

Pacific Cable Landed at Honolulu.

The American Pacific cable which, when finished, will connect the United States with the shores of Asia, has been successfully landed at Honolulu, in the Hawaiian Islands. The big cable steamer, Silvertown, reached the end of her journey on Friday, December 26th, but was unable to complete the work of making the landing until the following Thursday, January 1, 1903, owing to stormy weather. The end of the cable was buoyed and allowed to lie until the weather abated.

On the first day of the new year, at a few minutes after four o'clock in the morning, the big ship heaved anchor and started down the bay. The shore splice had already been laid to a point off Koko Head and buoyed there. At daylight the Silvertown picked up this shore end and spliced it to the connecting link of the cable. A start was again made and the connecting cable payed out at the rate of seven knots an hour. At one o'clock in the afternoon the cable steamer reached the outer buoy, which marked the position of the end of the main cable.

The sea was not rough, but the swell rolled the big ship considerably and necessitated much care in the raising of the cable. This was finally accomplished without accident at 3:44 in the afternoon. Connection was quickly made with the ship's testing-room, and San Francisco was called. A prompt reply relieved suspense at both ends of the great cable. Congratulations and compliments passed between the ship and the San Francisco office and all were once again happy. It will be remembered that no tidings had been received at San Francisco from the Silvertown between December 26th and January 1st. The final connection was made at 4:40 p. m., and there was much joy on board the Silvertown, when the extraordinary strain which had rested upon the en-

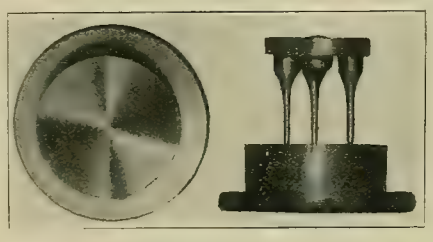


FIG. 4. BRANLY-POPP SPACE TELEGRAPHY.—BRANLY TRIPOD COHERER.

tire staff for 19 days came to an end. The proverbial luck of the Silvertown had carried her safely through 2,000 miles of as rough water as ever a cable was laid in.

Four hours were allowed to elapse in order that tests might be made and that the newly-laid cable might acquire the temperature of the ocean depths. At 8:40 p. m., Honolulu time, the first call came from San Francisco, and at 9:23 the first cablegram over the completed new cable was sent by Henry E. Cooper, secretary of Hawaii, to President Roosevelt. That message reached the White House at 2:30 a. m. on January 2d and read as follows: "The people of the territory of Hawaii send their greetings to you and express their gratification at the inauguration of telegraphic communication with the mainland. We all believe that the removal of the disadvantage of isolation will prove the strong factor in the upbuilding of a patriotic and progressive American commonwealth in these islands." The answer sent by George Cortelyou, secretary to the President, was as follows: "The President sends through you to Governor Dole and the people of Hawaii his hearty congratulations upon the opening of the cable. He believes that it will tend to knit the people of Hawaii more closely than ever to their fellow citizens of the mainland, and will be for the great advantage of all our people."

All went well with the Silvertown until she was 12 hours out from San Francisco. This was December 15th. On this day the boat ran into bad weather, which continued incessantly until she reached the end of her journey, on the morning of December 26th, and buoyed the Hawaiian end of the cable—a feat which was only accomplished after the most trying difficulties had been surmounted. The Silvertown docked at the naval wharf in the harbor of Honolulu at noon on the 26th of December and awaited favorable weather until New Year's day, at which time the cable-laying was finished. No special ceremony had been arranged, and a future day will be appointed on which to celebrate the finishing of the most difficult part of a task which, when completed, will bring San Francisco and China into direct communication over an all-American cable. As it was, the landing of the shore end in Hawaii was recognized by the laying on of a wreath of welcome and the pronunciation of the native word of greeting, "Aloha." This simple ceremony was performed by Mrs. Hawes. The shore splice was laid to a point a half mile distant from the shore station, and from there the connecting link, six miles long, was laid.

The officials of the Commercial Pacific Cable Company are greatly pleased over the successful laying of the Hawaiian cable, but do not intend to stop there, and now say that by July 4th they expect the cable will have been completed to Manila. Speaking of the project, Vice-President Ward said: "Rapid progress is being made in the manufacture of the sections to be laid between Honolulu and Manila, and over 3,500 miles of this cable has already been manufactured. I fully expect messages will be exchanged with Manila by the Fourth of July next. The laying of the remaining sections will commence from Manila the first week in May next." The cable was opened for commercial business on January 5th. Immediately after the receipt of the message to President Roosevelt a second message came to Clarence H. Mackay, president of the cable company, congratulating him upon the completion of the cable and expressing sorrow that John W. Mackay had not survived to see the "instantaneous" bond between the islands and the American continent. This message, like the first one, was signed by Henry E. Cooper, secretary of the territory of Hawaii.

Northwestern Electrical Association.

The eleventh annual convention of the Northwestern Electrical Association will be held at the Hotel Pfister, Milwaukee, Wis., commencing on Wednesday morning, January 21st and continuing through the 22d and 23d. Reports and papers on subjects of special interest to central-station men will be read and discussed. Secretary Thomas R. Mercein announces that an attractive entertainment programme is being arranged and that a pleasant and profitable time is assured to all who attend the convention. The association extends a cordial invitation to all who are interested in electrical matters.

WORLD'S FAIR NOTES.

In order to facilitate designation of exhibits in the Electricity Building at the St. Louis Exposition, the various aisles will bear the names of men of prominence in the electrical world, but at the date of writing these names have not been decided. The main aisles will be from 12 to 20 feet in width, while the large blocks will be subdivided into small sections, as the wants of the exhibitors demand. The number of minor entrances from the exterior of the building and the court are worthy of note, as the space along the walls is thus made no less valuable than that near the main entrances. A 30-ton crane will span the three large blocks extending through the middle of the western corridor, and here the heavier exhibits will be installed. The foreign exhibits will probably occupy the northeast quarter of the building, although this plan is only tentative.

The revised classification of the Exhibit Departments has just been issued, and is said to be the most complete and comprehensive ever compiled, surpassing even that of the Paris Exposition. Many changes have been made with the view of defining with greater accuracy the different elements that make up the five groups allotted to the Department of Electricity. At first thought, the classification in

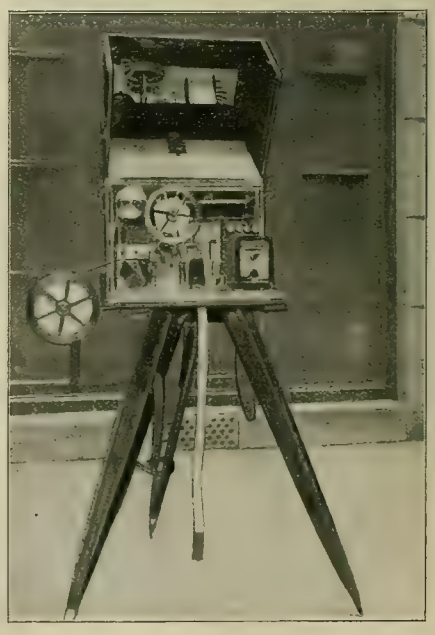


FIG. 5. BRANLY-POPP SPACE TELEGRAPHY.—MILITARY RECEIVING STATION.

some of the groups appears to conflict in two or more of the departments, as, for instance, direct-connected units, electric-railway equipments, electric automobiles, electrically driven tools, etc., but these details have all been covered and decided, with the result that any piece of machinery, or product, can be immediately and definitely located in its proper class. In the classification "Electricity—Department F" is divided into five groups and 24 classes. The groups are entitled "Machines for Generating and Using Electricity," "Electrochemistry," "Electric Lighting," "Telegraphy and Telephony" and "Various Applications of Electricity."

Arnold's Report on the Transportation Problem in Chicago.

Part I.

In last week's issue of the Western Electrician it was stated that Bion J. Arnold's report on the engineering and operating features of the Chicago transportation problem had been finished and submitted to the committee on local transportation of the Chicago City Council. Mr. Arnold's letter of transmittal and a summary of his conclusions and recommendations were given. It is now intended to present some of the more important features, particularly those of an engineering nature, of the complete report.

The text of the report is divided into six parts, each with subdivisions, and at the end are given 10 appendices. In the first part is given a general discussion of street-railway systems and conditions governing them. Nearly all of the large cities of the United States are laid out and developed on one of three distinctive plans—the peninsula, the valley and the radiating plan—and to the third plan Chicago belongs. The radiating plan is difficult of development, and an added obstacle is that the street-car companies in Chicago were named, chartered and received grants in divisions. To this mistake made in the infancy of the transportation business, can be traced the primary cause for the present demand for a change in transportation facilities. Mr. Arnold then states the problems to be solved in relation to transportation facilities for the whole of Chicago and its suburbs, as follows: First, to devise some method of operation which will relieve the congestion of the overcrowded thoroughfares in the central portion, or business district, of the city and tend to render available an increased area in that district; second, to furnish a more ready means of intercourse between the separate divisions of the city, through the business district and outside such district; third, to furnish a means of distributing passengers brought in at the several railroad stations, for transferring them from one station to another, and to facilitate intercourse between different portions of the business center.

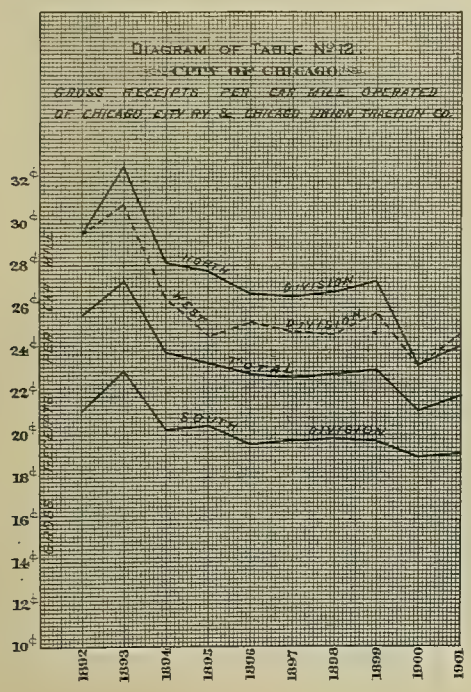


Fig. 1.

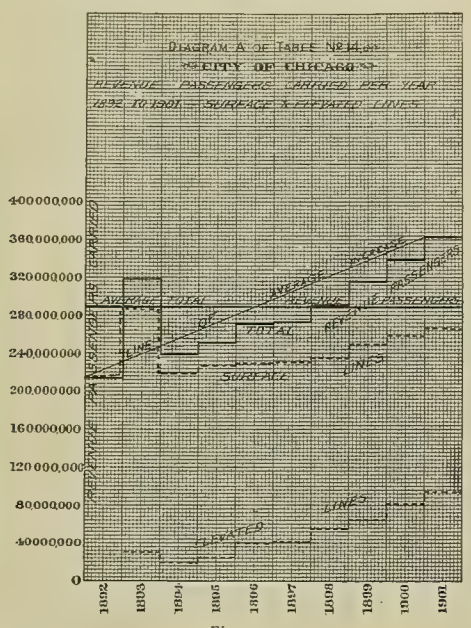


Fig. 2.

ARNOLD'S REPORT ON THE TRANSPORTATION PROBLEM IN CHICAGO.

Part II. of the report deals with the inadequacy of present terminals and service, with recommendations for improvement under divisional ownership. Three prime reasons are given for the present conditions in the business district during rush hours: First, the present terminal facilities, as arranged, are utterly inadequate; second, the operation of cars by cable power prohibits the use to their maximum capacity of the terminal facilities that are provided; third, the lack of electric power in the business district. There are now in operation, during the hours of maximum traffic on the lines that enter the business district, 1,379 cars, consisting of 772 cable cars, 97 electric motors trailed on cable trains and 510 electric cars. The 869 cable cars and electric cars trailed on cable are operated around five loops. The 510 electric cars are operated around one loop and on five street-end terminals—34 of them being hauled by horses eight blocks each, every round trip. After discussing the different terminals, the reasons for the elimination of the cable system are given.

After setting forth the conditions as they exist, and the causes which led up to these conditions, the following recommendations are submitted, with a belief that their adoption will give to the citizens of Chicago as good surface-line transportation facilities as can be given under the separate ownership and operation of territory at present existing: First, all cable operation should be abandoned, and the cable trackage converted to either overhead trolley or underground conduit for electrical propulsion of cars; second, the territory embraced by the river on the north and west, and Twelfth Street on the south should be used in common by all companies for the proper location of loop tracks for terminal facilities, all these business center tracks to be of the underground electric-conduit type; third, cars should be routed, so far as practicable, via trunk, avenue, and cross-town lines combined, in such manner as to serve the maximum amount of travel with the minimum use of transfers; fourth, sufficient cars of the double-truck pattern, equipped with brakes operated by other than hand power, adequately heated during cold weather, and operated singly, should be provided for all through lines, although lighter cars could be used on the cross-town-line service; fifth, on all well-paved streets all rails on new track built and on all tracks when renewed, should be of the grooved type, designed on such lines that the groove will be cleaned by the passage of the wheel flange and presenting the least obstruction to crossing vehicles, and extending the least invitation to tracking vehicles.

In Part III. Mr. Arnold gives a treatise on the growth of population and development of the transportation business, with a discussion of probable future increase, and an analysis of capitalization and financial results obtained in past operation. This, as other parts of the report, is very thoroughly worked out, and the text is explained largely by the aid of charts. Two typical charts are shown in Figs. 1 and 2. The first shows the gross receipts per mile operated per year from 1892 to 1901 for the south division (the Chicago City Railway Company) and the west and north divisions (the Chicago Union Traction Company). Fig. 2 shows graphically the revenue passengers carried per year from 1892 to 1901, and per cent. of increase on the surface and elevated lines.

The relative merits of operating cars over through routes as compared with downtown terminals are treated in Part IV., as well as the subject of universal transfers and the one-city-one-fare question. The concluding paragraph of this section is as follows: "It is my opinion, after a careful canvas of the matter, that a unified company could afford to furnish transportation facilities to the entire territory embraced by the lines of the Chicago City Railway Company, the Chicago Union Traction Company and the Chicago Consolidated Traction Company within the city limits for a single fare, and I am also of the opinion that companies operating under divisional ownership or management could, if properly protected against the fraudulent use of transfers, grant the same privilege, but at a slightly increased expense to themselves over what it would be to a unified company. Furthermore, I believe that no one thing that could be done for Chicago would tend more to enhance its growth and prestige than the securing of such a concession in the settlement of the transportation question."

"Discussion of a New, Reorganized and Unified System of Street Railways for Chicago" is the caption of Part V. Recommendations are given for a general plan of surface transportation under a unification of control of the Chicago City Railway Company, the Chicago Union Traction Company, the Chicago Consolidated Traction Company and the Chicago General Railway Company, utilizing subway and surface terminals in the business district and routing cars through all divisions.

The north and south tracks of the three divisions, at present built, including those west of the river, should be connected, and through north and south lines of cars be operated on each street, these lines to be designated the "Trunk System."

Upon the east and west tracks of the three divisions, at present built, through east and west lines of cars should be operated on each street, these lines to be designated the "Cross-town System."

Upon the diagonal avenues radiating from the business center and paralleling the north and south branches of the Chicago River, there should be operated lines of cars between the northeast and southwest, and between the southeast and northwest sections of the city, through the business center, designated the "Avenue System."

To serve the local travel in the business district, and distribute and transfer passengers arriving at depots, tracks in the downtown district should be so arranged as to connect all the depots, and lines of cars be routed and operated continuously in that district, independent of any of the foregoing systems. This local system should issue and receive transfers to and from any and all lines entering the business district.

A sufficient number of cars of proper design, properly routed, and operated judiciously, under adequate headway, on this general plan, would give to the citizens of Chicago a system of transportation that would only be excelled in cities where elevated, underground and surface systems exist under one control, and are all used to equalize time and distance within the city limits.

By using this "Business-center System," as a distributing and collecting agency, the necessity of large loops is eliminated, and the limited area suitable for terminal facilities can be utilized to its fullest capacity. By the operation of such a distributing system the through service on the north and south trunk tracks can be taken through the business center in subways under streets most suitable, without reference to any local points, and the terminal loops of the east and west cross-town system and of the avenue system can be located with reference only to the highways over which they enter the business district.

One of the fundamental principles in conducting transportation is to give through traffic the right-of-way, or to route it in the channel of least resistance, over the shortest distance. The through service on the plan outlined will be on the north and south tracks and on the avenue tracks. Over the easterly north and south tracks which traverse the business center, will be routed the avenue traffic.

Conforming to the fundamental principle above laid down, and recognizing that a large proportion of the through traffic will be conducted between the North and South Divisions contiguous to the lake shore, and over the avenue lines, through the business center, the subway system of Chicago should consist of subways between Fourteenth Street and Indiana Street, under the north and south streets best adapted to serve the north and south through traffic, with east and west connections from the most westerly subway, to the two tunnels leading to the West Division, for the accommodation of the avenue through traffic. The avenue through traffic from the North and South Divisions should be routed—outside of the subway district—to the tracks leading into the most westerly subway. As quite a proportion of the traffic from the westerly portion of the South Division and from the West Division designed to terminate in the business center will naturally be brought in over the avenue lines, and from lines leading into the avenues, two subway loops for the joint use of this traffic terminating in the business center should be constructed, using the most westerly north and south subway for the east side of each loop. All other cars from the West Division and from the westerly portion of the South Division, should be brought into the business district over the bridges, and returned via surface loops. To provide terminal facilities for the divisional traffic of the North Division and that portion of the South Division lying east of Halsted Street, terminating in the business center, a cross subway should be constructed in the center of the business district—with reference to the north and south—connecting all the north and south subways. This lateral subway, in connection with the north and south subways, would provide six loops, three for the North Division and three for the South Division traffic. To carry out this general plan it will be necessary to construct two more tunnels to the North Division, to supply an outlet to the north for each transportation highway entering from the south. By this plan the following results would be obtained:

First, the greatest possible capacity of the limited area in the business district would be utilized for terminal facilities; second, all through traffic via the business center would be taken through the congested district, underground, saving time to the passenger, and relieving the congestion in this district; third, all subways would be on the high level without grade crossings, thus cheapening the construction and not interfering with existing low-level improvements; fourth, all river-tunnel approaches within the business center would be closed; fifth, as all traffic from the North and South Divisions would be underground, if Surface Plan No. 1 were used, grade crossings of surface loops would be eliminated, except those incident to the operation of the local distributing system.

With an operation of cars under a 30-second head-

way on the 15 loops provided, the present traffic from each division could be taken care of, and each division have an ultimate capacity of about three times as much business as is being done at the present time, or the terminal facilities which would be provided under this plan would take care of a population of over 5,000,000 people.

The plant for power production would be of the high-tension type, of 100,000-kilowatt capacity, with 15 sub-stations, of 200,000-kilowatt total capacity, for transformation of the current to a suitable voltage for the working conductors, the latest and best practice in vogue for such a system. The cars [2,000] would be of the closed, double-truck type, with reversible-back cross seats, seating 52 passengers, equipped with power brakes and adequate motor capacity, and as this type is eminently suitable for summer operation, only one equipment would be necessary.

The estimate of total cost to produce an ideal system of street railways, as described, exclusive of the subway proper, ready for operation, is given as $69,800,000. The track mileage embraced in this estimate is 220 miles in excess of the present mileage of the Chicago City Railway Company and the Chicago Union Traction Company combined, which is sufficient to include the present mileage in the city limits of the Chicago Consolidated Traction Company and the Chicago General Railway Company. The gross earnings of the present companies should be materially increased in the operation of this completed system. Such a system, built in the best manner known to the art, and on lines calculated for the most economical results, in operation, should show marked decrease in operating expenses from the expenses of the present companies. An estimate of operation, for one year, of this system, based on the past performances for one year of the railway companies, shows gross receipts from all sources of $14,763,138.98. With operating expenses 60 per cent. of passenger receipts, or $8,695,599.72, there would be net earnings from operation of $6,067,539.26. Estimating taxes as paid in the past at $943,283.28, would leave net earnings per annum to be applied to interest on bonds and stock, maintenance of property, and to be set aside for sinking fund to renew the property, and for all other purposes incumbent upon the property, $5,124,255.98.

Part VI. of the report is divided into nine chapters and treats of technical problems, valuations and estimates. The first chapter definitely discusses the subways proposed. In the development of the subway plans submitted there have been kept in mind the following principal objects:

First—The ultimate unification of all street-railway facilities within the city limits under a single operating management.

Second—The proper location of the subway lines and the construction of a track system which will provide for the operation of cars under any of the following plans:

(a) Between the various divisions of the city through the business district.

(b) Divisional operation of the cars only, using the subway system as a loop terminal.

(c) Plans (a) and (b) in combination.

Third—To build the subway as close to the surface of the street as possible, reducing the distance from station platforms to the level of the street to a minimum.

Fourth—The arrangement of a subway system to provide for the maximum efficiency with a minimum length of underground tracks.

Fifth—The disposition of all underground utilities in such a manner that they will be easily accessible without disturbing the surface of the street, and without any direct connection with the transportation subway.

The location of subways referred to as Subway Plans No. 1 and No. 2 is shown on maps accompanying the report. Plan No. 1 is suggested as the most feasible plan without disturbing the existing low-level improvements. Under this plan the north and south subway would be located in Wabash Avenue, State Street, Dearborn Street, Clark Street, and partially in LaSalle Street, and would extend from Fourteenth Street on the south to Indiana Street on the north, there being three loops for each the North and South Divisions. Two West Division loops are provided, passing under Jackson, Adams, Monroe and Washington Streets.

The length of subways to be constructed along the routes described, exclusive of the tunnels under the river, would be 20,825 lineal feet of double-track structure and 20,000 lineal feet of single-track structure.

The proposed subway construction is shown in drawings accompanying the report. One of these, Fig. 3, shows a typical cross-section of a double-track subway in an 80-foot street. The cross-section represents the subway located above the large tunnel of the Illinois Telephone and Telegraph Company. The normal section of the subway proper would be rectangular, with the tracks side by side, and consists of transverse bents of steel columns and roof beams, which would carry side walls and a roof of concrete arches and rest on a concrete floor. The side columns and the roof beams would be rolled I-beam sections, and the central columns would be built up of angles and plates riveted together. The entire four sides of the section would be protected from seepage by a layer of waterproofing, embedded in the floor, walls and roof. Fig. 4 shows a typical cross-section of single-track subway on Wabash Avenue, in conjunction with the elevated structure.

It is proposed to place the station entrance and exit stairways at the outer edge of the sidewalk space, the stairways leading down to a corridor located just inside the curb-wall line, and opening onto the station platform, which would be 13 feet in width and about 150 feet in length. Wherever possible the station should be located at street intersections, with the platforms extending an equal distance each way from the center of the street crossing the line of the subway, and with a stairway leading down to the station from the subway street on each side of the intersecting street.

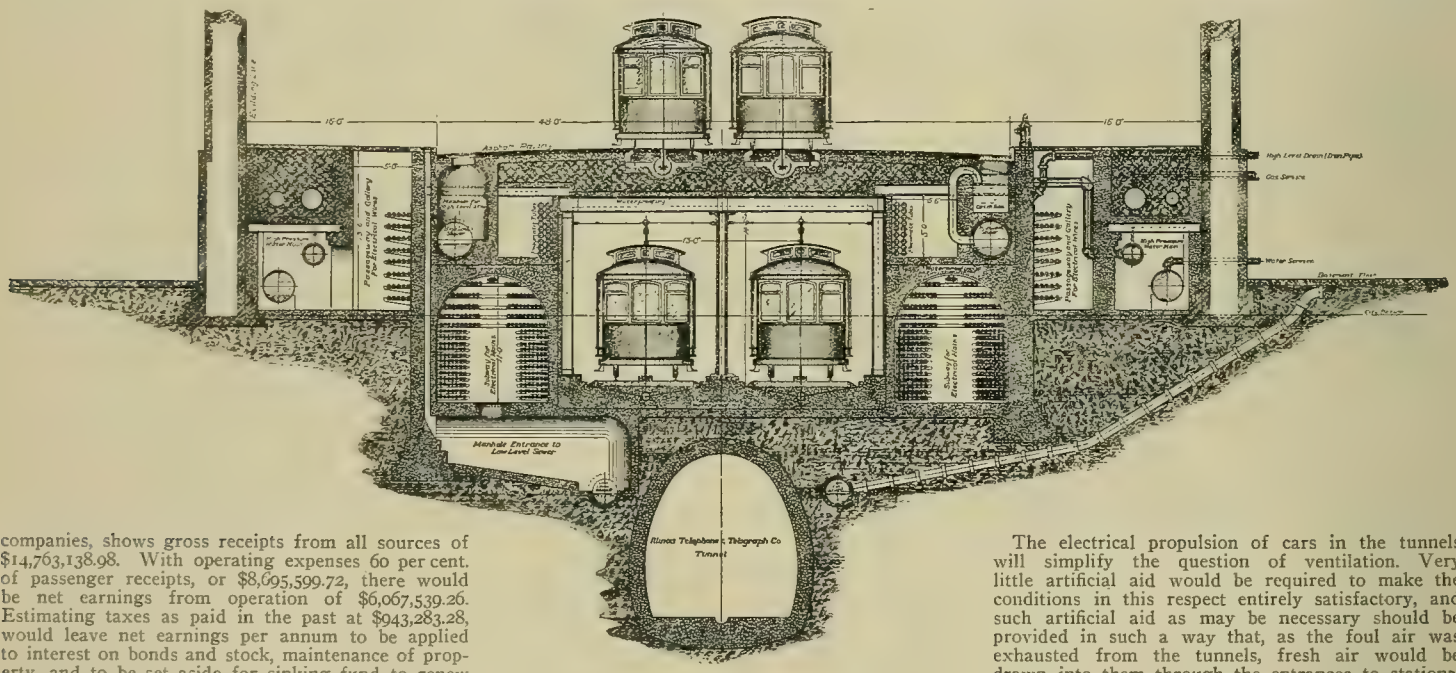


FIG. 3. ARNOLD'S REPORT ON THE TRANSPORTATION PROBLEM IN CHICAGO.—TYPICAL CROSS-SECTION OF DOUBLE-TRACK SUBWAY IN 80-FOOT STREET.

The walls and ceilings of all passageways leading to the station platforms and the walls and ceilings of the station should be finished in white glazed terra cotta, or other equally attractive material.

The cross-section of the subways has been fixed to provide for the operation of the large cars now in use, and the necessary clearances to insure safety to passengers and also to the force of employes which would be stationed in the subways for the purpose of inspection and repairs to the tracks.

The resulting interior dimensions of the subway would be as follows: Clear height above track rail, 14 feet six inches; clear width between side walls, 25 feet; clearance between the wall and the car, one foot 8½ inches; clearance between the central columns and the car, one foot 8½ inches; total distance between passing cars, four feet three inches.

Should the final plans for subways in the business district be developed in accordance with the suggestions contained in the preliminary plans, especially in respect to the proximity of the subways to the surface of the streets, it is evident that a large part of the work must be done by attacking the street from the top, the excavations and trenches being thoroughly sheathed and braced or strutted across to prevent any movement of the foundations of buildings abutting the street. The subways leading to the North and West Sides of the city must pass under the Chicago River, with the tracks at the center of the stream approximately 43 feet below city datum. Assuming that the channel would be 24 feet deep, the inclination of the subways toward the river would be quite abrupt, and the structure for a short distance before reaching the stream would be at a depth below the surface, where it may prove to be more economical and less dangerous to resort to tunneling, without disturbing the surface of the street, than to prosecute the entire work by the open-cut method. This would also be true for the entire low-level system of subways of Plan No. 2. By the use of a proper system of timbering for the surface excavation, the surface of the street may be planked over, and, to a considerable extent, be kept open to traffic during the construction period, but a certain amount of interference with the street traffic would be a part of the sacrifice to be made by the public to secure adequate transportation facilities within the business district and the permanent disposition of other underground public utilities in a manner to provide for their future maintenance or extension without disturbing the surface of the streets occupied by the subways.

The structural details of the sections of the subways as given by the drawings have been worked out sufficiently to demonstrate the entire practicability of constructing the tunnels in accordance with the general plans, the ability of the structure successfully to resist the stresses which would be produced by the loads to which it would be subjected, and to furnish sufficient information from which reasonably correct estimates of the cost of construction may be made.

The depth of the platform floors below the street grade will vary with the variation in the gradients of the subways, the minimum depth being 18 feet six inches below the established grade of the street.

The electrical propulsion of cars in the tunnels will simplify the question of ventilation. Very little artificial aid would be required to make the conditions in this respect entirely satisfactory, and such artificial aid as may be necessary should be provided in such a way that, as the foul air was exhausted from the tunnels, fresh air would be drawn into them through the entrances to stations.

Within the subway district it is proposed to provide a high-level gravity system of sewers to take care of all house drainage at and above the first-floor level. This gravity system would be proportioned to take care of storm water, in addition to the house drainage. A low-level sewer would be provided to take the drainage from the basement level of buildings and such drainage as may be required for the subway, pipe and electrical conduits, etc. The low-level drains would discharge into sumps or receiving wells, advantageously placed to permit the low-level sewage to be pumped up and discharged into the river (see Fig 3).

As a general arrangement of the water-supply system within the subway district, it is proposed to install a belt of main feeder pipes, to be connected with the various pumping stations which at present supply the district under consideration. From the belt of feeder pipes lateral supply mains would be projected, and wherever in the construction of the subway the present system of pipes would not be interfered with these pipes would be connected with the new feeder system in such manner as to provide for complete circulation of the water.

The general arrangement of the gas-circulating system within the subway district would be similar to that described for the water-circulating system, i. e., it is proposed to install a belt line of main-supply pipes, feeding into the circulating system and connected with it in such manner as to provide complete circulation and equalization of pressure. Separate systems of equal capacity to present systems would be provided for illuminating and fuel gas.

For the disposition of the electric wires and cables for electric lighting, power, telegraph, telephone, and other public utilities of like character occupying conduits beneath the surface of the streets, it is proposed to supply roomy, dry and well-ven-

tilated galleries running parallel with and adjacent to the transportation subways, as shown in Fig. 3.

The galleries designed to carry the feeder mains would have their floors located at practically the same level as the railway tracks within the subway. These galleries would be approximately 9½ feet wide and 11 feet high in the clear, with an arched roof, which would also form the floor of a gallery immediately beneath the surface of the street, and designed to contain the high-level sewer and pneumatic tubes. The galleries for the electrical-feeder mains would be continuous betwen the subway stations, and would occupy the space between the wall of the subway and the curb wall, situated at the outer edge of the sidewalk space. The electrical wires and cables would pass by the station point in tile conduits, situated beneath the station platforms. These tiled conduits would terminate in large manholes located outside the subway walls, at each end of a station platform. Out of the manholes the feeder mains would be carried to the racks provided for them in the galleries above mentioned. The manholes would be of sufficient size to permit of making all necessary transposition of the wires and cables of the various circuits, and to make necessary connections with the service mains which it is proposed to locate within a separate gallery at a higher level, and convenient for the distribution system.

On account of the precautions which would be taken to exclude moisture, it is not expected that these wire galleries would ever contain much water; however, it is proposed to incline the floors of the galleries toward the manholes into which the tile conduits would terminate, and to connect these manholes with the low-level sewers with outlets of sufficient capacity to meet any emergency, including possible leakage from water pipes located in the water-pipe gallery, at a higher level than the level of the wire and cable gallery. Adequate ventilation of the wire and cable gallery would be provided by the introduction of ventilating flues into the curb walls. These ventilating flues would terminate at the sidewalk level, and would be covered with iron-bar grates.

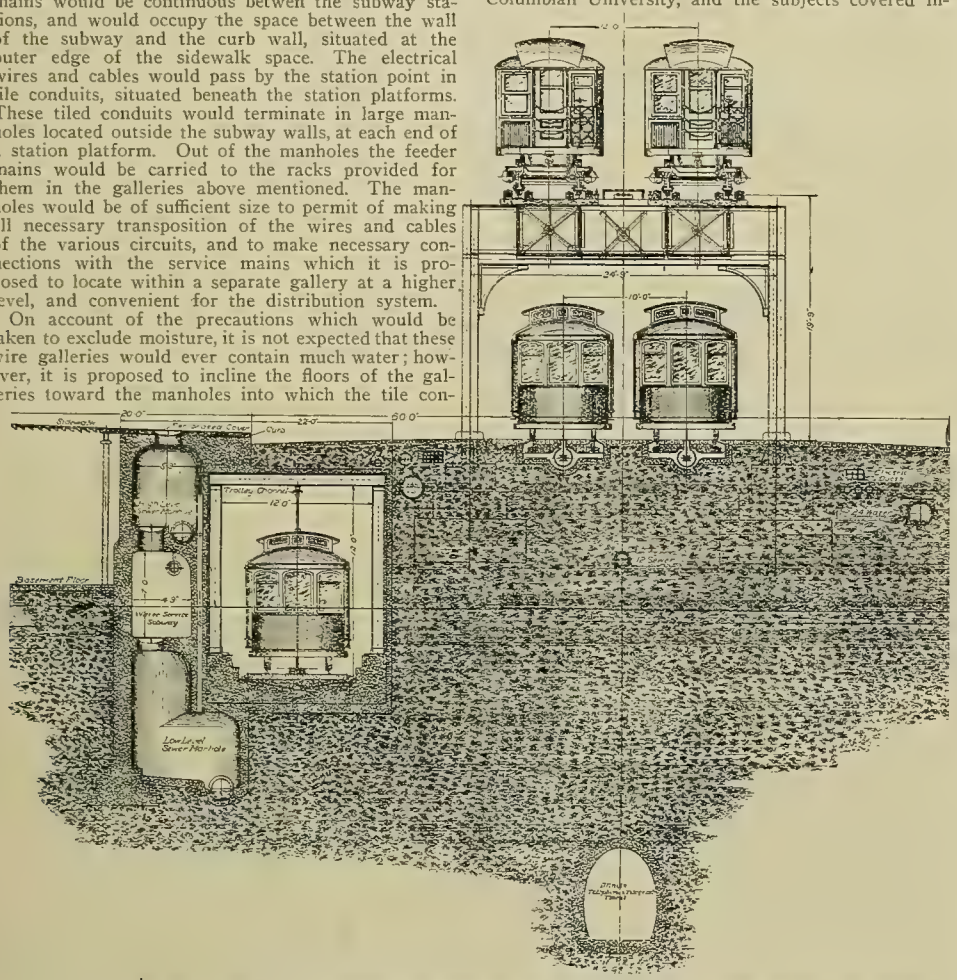


FIG. 4. ARNOLD'S REPORT ON THE TRANSPORTATION PROBLEM IN CHICAGO.—TYPICAL CROSS SECTION OF SINGLE-TRACK SUBWAY IN WABASH AVENUE.

It is proposed to carry the service mains in each block in a gallery, which would occupy the first five feet of the space inside of the curb wall; the floor of this gallery would be at or near the level of the basement floor of the buildings, and its roof would be formed by the concrete sidewalk.

In the space between the service-main gallery and the building line of the street would be located the gallery for water pipes, and the space filled with sand, which would be devoted to gas mains. A concrete wall would separate these latter utilities from the upper wire gallery. Through the walls of the electrical-service-main gallery at intervals of about 20 feet would be provided service ducts, through which service wires could be drawn into the buildings on either side of the street, as the ducts through the curb walls would extend entirely across the street above the subway roof.

[To be concluded.]

Institute Chapter at St. Louis.

The St. Louis members of the American Institute of Electrical Engineers have been for some time talking of a local chapter, and steps will be taken within the next few days toward the organization of such a body in the World's Fair city. In addition to several members in business in St. Louis, the exposition numbers among its officials and employes nearly a score, among whom may be mentioned Professor Goldsborough, who is a member of the Institute committee on local organizations, and Henry Rustin, chief electrical and mechanical engineer of the exposition. With such men as these at the head, a bright future is promised the chapter that may act as host on many notable occasions.

American Association for the Advancement of Science.

Washington, D. C., January 3.—The sessions of the American Association for the Advancement of Science, which began on December 29th, have each one been so crowded with work that but little time has been given to amusement of any description; indeed, it almost seemed as though, at this session, almost too much work was undertaken for the time allotted. The various sections met in different parts of the Columbian University, and the subjects covered included almost all the known branches of science.

Monday, at 4 p. m., Professor J. J. Flather of Minneapolis, Minn., delivered one of the most interesting lectures of the session, the subject being "Modern Tendencies in the Utilization of Power," before the section of mechanical science and engineering, of which he was vice-president. This address was printed in full in the Western Electrician of last week.

At the same time on Monday afternoon Eugene C. Foster of the Columbia Liquid Air Company gave a demonstration of the manufacture of liquid air at a plant which had been erected for the purpose at the power house of the Capital Traction Company and gave a short talk on the special features of the plant to the visiting chemists and physicists. Demonstrations were given of its low temperature and its expansive force. To show that liquid air is rich in oxygen, and that the latter may be easily recovered, a detonating bomb was made out of cotton waste, wrapped in newspaper, the waste having first been moistened with the oxygen residue from liquid air. When the flame was applied an explosion was the result, so forceful in its nature that it shook the entire building, a very extensive brick and stone structure.

On Tuesday morning a short general session was held, followed by the meeting of the various sections, that of physics containing more items of interest to electricians than any other. The programme, as laid down by this section, contained a total number of 25 papers to be read, and, in addition to this 23 papers of the American Physical Society, the sessions being held jointly. The second paper on the programme was one covering the "Construction of a Sensitive Galvanometer," by C. G. Abbott of the Smithsonian Institution of this city, who was introduced by Professor S. P. Langley, who was given a most cordial welcome by all present. In the course of his introductory remarks he stated that they must of necessity be brief, as he had a paper to read before the Astrophysical Society at the Cosmos Club, and consequently could not have the pleasure of staying to listen to what Mr. Abbott would have to say. He stated that in earlier days he had had considerable struggle with the difficulty of having a galvanometer at once sensitive and precise. The one he used in early days was what would be considered now as almost ludicrous, and was incorrect, yet Lord Kelvin, 16 years ago thought its possibilities, even in that crude state, were wonderful. The galvanometer which Mr. Abbott was to present was 100 times more sensitive than the one which Lord Kelvin thought incredible, and this has only been brought about by years of work and experiment.

In the course of Mr. Abbott's paper he called attention to the fact that the progress in the application of a galvanometer to bolometric work was in part historical, and in part on account of experiment. The galvanometers in use at the Smithsonian Astrophysical Observatory at the present time and for bolographic purposes are of 1.6 ohms resistance, and are customarily used at 1.5 seconds time of single swing, but may be employed with an exhaustion of the case at such a degree of sensitiveness and steadiness that 1×10^{12} amperes can be detected with certainty.

Both coil and needle construction has been extensively studied at the Smithsonian Observatory, and at the present time 16-coil instruments with needle systems of eight groups containing 48 magnets in all, are employed. These systems weigh 10 milligrams, or thereabouts, and while it must be admitted that the use of 16-coil instruments involves a distinct loss of computed sensibility, yet the greater weight and better astaticism obtained more than counterbalances all this. Freedom from drift and tremor is so remarkable, so much so indeed in the whole bolometer and galvanometer circuit, that this circuit often remains in constant connection with the galvanometer for weeks at a time without drifts of more than 10 centimeters, or tremors above 0.5 millimeters. This, when one millimeter upon the scale means a current of 2×10^{-9} amperes, the smallest constant yet reached for a galvanometer of 1.6 ohms resistance, with a computed time of single swing of 10 seconds. By means of air exhaustion to 0.2 millimeter Hg. strict proportionality between deflection and the square of the time of swing has been carried for the 16-coil galvanometer up to six seconds single swing, while with atmospheric pressure the proportionality fails at 1½ seconds.

This was followed by a five-minute paper, by Professor Carl Kinsley of the University of Chicago on the "Conditions Governing the Coherence of Metals When There Is an Electrical Discharge Between Them," and a 10-minute talk on the "Possibility of a Determination of the Frequency of Alternating Currents by the Automatic Adjustment of the Circuit to Resonance." During the course of the latter paper he stated that the distance between which coherence would occur had been reduced to one-tenth of a wave-length.

A paper was presented on "Methods of Measuring Radiant Efficiency," by E. L. Nichols and W. W. Coblentz of Cornell University, and another on "The Infra-red Spectrum of the Mercury Arc," by W. W. Coblentz and W. C. Geer. Professor Herschel C. Parker then read a very brief but comprehensive statement on "Experiments Concerning Very Brief Electrical Contacts." The programme also contained papers as follows: "A Portable Apparatus for the Measurement of Sound," by Professor A. G. Webster of Clark University; "The Damped Ballistic Galvanometer," by Professor O. M. Stewart, University of Missouri; "The Electrical Conductivity of Solutions in Amyl-amine," by Professor L. Kahlenberg, University of Wisconsin; "Why the Electromotive Force of the Daniell Cell Changes When the Density of the Solutions Change," by Professor H. S. Carhart, University of Michigan; "The Change in Volume in Clark and Cadmium Cells Due to Pressure, and Its Relation to Electromotive Force," by Professor R. R. Ramsay, University of Missouri.

On Wednesday Professor L. A. Bauer of the United States Coast and Geodetic Survey, gave a 20-minute paper on the results of the comparisons of magnetic instruments, in the course of which he called attention to the fact that the Coast and Geodetic Survey has the best and most thorough equipment of magnetic instruments to be found anywhere in the country, some of the instruments having been manufactured in France, Germany, England, and the United States, and all of these being of the very best workmanship. They have been able to correlate six of these instruments, and it is expected that they will be soon able to tell the exact volume of the wind. The paper gave a full and detailed account of some special observances that were made during the eclipses of May 25, 1900, and May 17, 1901, which tended to show that within certain radii of the total-eclipse belt very marked magnetic changes had taken place.

Professor J. R. Benton of Washington, D. C., read a paper on the elasticity of copper and steel at 186° C., tending to show that it was much greater at the temperature of liquid air than at any other point.

At the Wednesday session of the association Dr. Daniel C. Gilman, president of the Carnegie Institution, announced the fact that the institution had made an appropriation of $8,000 for the establishment of a desert laboratory, the request having been made some time ago by the Botanical Section of the association. While the laboratory is to be established for the purpose of a thorough study of the physiological features of plants under the unusual conditions to be found in desert regions, it is also expected that much attention will be paid to the

relation of water to desert vegetation, light and temperature, and provision will be made whereby scientists from any part of the world may carry on experiments on any problem affecting desert vegetation.

Hon. Carroll D. Wright has been elected the president of the association for the ensuing year, and it has been decided that the next meeting will be held in St. Louis, from December 28, 1903, to January 2, 1904, and it is urgently insisted upon by the association that all members shall be present at that time.

The total registration of members for the meeting just ended was 975, and the meeting is thus second on the list in point of attendance, the meeting in Boston, 1880, having 980 members. This, of course, does not include the meeting in Philadelphia, when 1,261 members were present in 1864, but that number included 300 members of the British Association, who were present at that meeting. The geographical distribution of the members is always a matter of more or less interest, and along this line it is noteworthy that Washington leads the list with 354 members; New York, 135; Massachusetts, 82; Pennsylvania, 70; Ohio, 39; Maryland, 38; Illinois, 27; Connecticut, 23; Michigan, 22; New Jersey and Wisconsin, 19 each; Indiana, 16; Virginia, 14; North Carolina, 13; California, 12; New Hampshire, eight; Nebraska, seven; Vermont, six, and the remainder in scattering numbers, including eight members from Canada and one from England, Ceylon and Nicaragua, respectively.

In his closing address to the association Dr. Minot stated that the convention had been one of the most noted gatherings of scientists ever held on the American Continent.

Some very fine instruments were placed at the disposal of the association during its work in Washington, among which may be mentioned the triple projecting outfit, combining an electric lantern, projecting microscope and mediascope, mounted on a common baseboard, and using the same electric lamp in succession, supplied by Williams, Brown & Earle of Philadelphia, also a new projecting apparatus, especially designed for scientific projection work, and made by the Bausch & Lomb Optical Company of Rochester, N. Y. An Ideal electric arc lantern was supplied by A. T. Thompson & Co., Boston, Mass., and a 16-plate static X-ray outfit by the C. W. & R. M. Bowen Company of Providence, R. I.

T.

New Swiss Hydro-electric Plant.

One of the new Swiss hydraulic plants is that which has been installed at Vouvray, near Lake Leman. It uses the water of Lake Tanay, a small basin at a considerable altitude, and affording a good fall. The hydraulic station is located at Vouvray, on the left bank of the Rhone, not far from where it enters Lake Leman. The same company had already erected a plant at Varguay, on the other side of the Rhone, using the water of a small stream which gives a 600-foot fall and affords 2,500 horsepower. The power is distributed to a number of villages in the Rhone Valley, and at present about 80 miles of line have been installed, which feeds 63 sub-stations, containing 97 transformers. The station supplies 20,000 lamps of 10 candlepower (or equivalent), besides 450 horsepower to motors.

In the new plant the Lake Tanay acts as a permanent reservoir. The voltage and frequency is the same in both plants, and they can be worked in parallel on the line when desired. The new plant at Vouvray is laid out for 10,000 horsepower; at present there has been installed 4 generating units of 500 horsepower each, but it is intended to increase this number to 20.

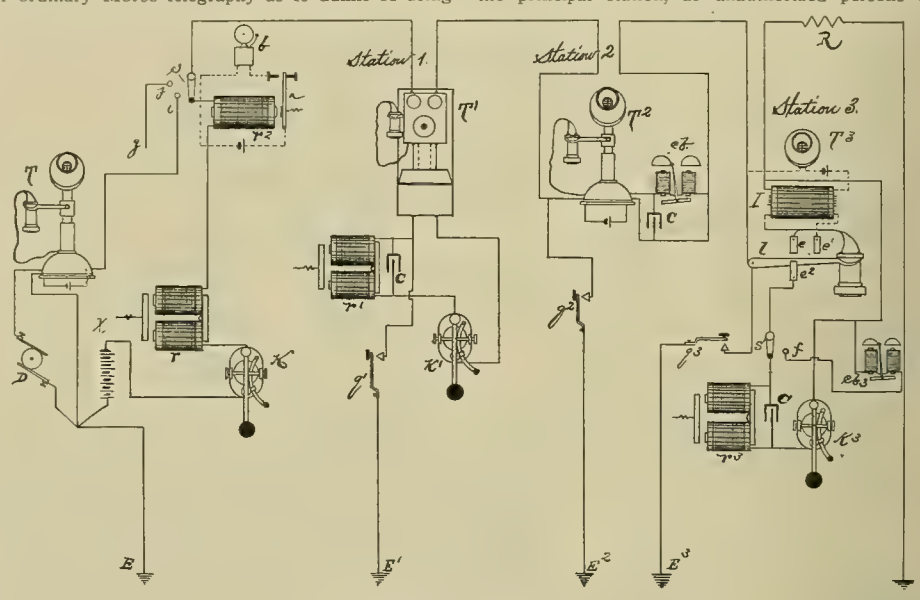
The water is taken from the lake at a point 60 feet below the normal level; the water enters a shaft 30 feet deep, which connects below to a tunnel. The latter is 950 feet long and has four square yards' section, being laid in an easy grade. To the end of the tunnel connects a high-pressure conduit of sheet iron three feet in diameter and 320 feet long; then comes a high-pressure tunnel 900 feet long, and then a high-pressure conduit like the former, which has a five per cent. grade and runs for 3,900 feet. The end next the station is provided with three tubulures of 18 inches diameter, which receive the penstocks for the turbines. At present there is but one in use. The penstock is 6,000 feet long, with a difference of level of 2,800 feet. Its lower end connects to a 14-inch pipe, which runs 3,900 feet to the station, and is laid underground.

The station will have 20 direct-coupled groups, using Pelton wheels of different makes, giving 1,000 revolutions per minute. Two of the alternators furnished by Brown, Boveri & Co., are coupled to turbines of the Vevey Company, while two Devillard turbines are used with alternators built by the Geneva Company. All the machines are single-phase and give 60 amperes and 5,500 to 6,000 volts with 50 cycles. The Brown-Boveri machines have the exciters mounted on the end of the shaft, while the others are excited from a small turbine set of 25 horsepower.

The present plant cost $160,000, including the water rights, which, for 2,000 horsepower, makes $80 per horsepower. The next addition of 2,000 horsepower will require a new conduit and four generating sets, or $60,000, and thus for the first 4,000 horsepower the figure will be lower, or $55, and this will decrease with each addition.

Combined Telephone and Telegraph System.

The necessity, especially on railroads, of making use of both telephone and telegraph lines is frequently made apparent, and a patented invention of Charles E. Buell of Camden, N. J., is designed to meet this want successfully. In the words of the inventor, the object of his system is so to combine apparatus for oral communication and apparatus for telephone-call signals with a main line which is used for ordinary Morse telegraphy as to admit of using the two systems successively upon the same line, with the result that small stations that are not equipped with telegraph apparatus can be equipped with the necessary apparatus for transmitting and receiving telephone-call signals and with apparatus for oral communication, and railway conductors and others who may be authorized to use the line can without special apprenticeship put themselves in communication by telephone with the principal station on the telegraph line which is thus provided to report a wreck or other information, and through the manipulation of the combined systems by the attendant at the principal station the person calling up from the small outlying station can be put in telephone communication with any desired station on the line, or by switch connections being provided for interconnecting the line with other lines communication can be held with any desired station.



COMBINED TELEPHONE AND TELEGRAPH SYSTEM.

A further object of the invention is to combine a telephone apparatus with a telegraph apparatus at outlying stations where an office is provided to admit of the successive use of the telephone and the telegraph systems over the same main line, so that during the absence of the skilled telegraph operator communications can be sent to the principal station on the line by an unskilled person by means of the telephone.

The invention consists, primarily, in the combination, with a normally charged main line, of a series of stations, each of which is provided with a telephone set adapted to be used for oral communications when interconnected with the line, and devices at each station for sending and receiving calls from a principal station and apparatus included in the main line for receiving and transmitting messages by the so-called "Morse" system of telegraphing. In the accompanying drawing the figure shows the apparatus of a combined system of telephone and telegraph for carrying out Mr. Buell's invention. The parts shown are self-explanatory.

The operation of the combined system is as follows: The telephone sets along the line are normally excluded from the charged line while the battery (X) is charging the main line for telegraphic transmission. When it is desired to employ the main line for oral communication, the key (q^2), for instance, is pressed, grounding the charged line at (E^2), and the relay (r^2) at the principal station attracts its armature ringing bell (b). The operator at the principal station hearing the call on bell (b) turns the switch (s), disconnecting the battery (X) from the main line and making contact at (i) to include the telephone set (T) in the main line, and taking the receiving telephone from its support asks the wishes of the person thus calling. The person calling having taken the receiver from its support at the outlying station where the call originated, oral communication is established between the outlying station and the principal station in the ordinary manner for oral communicating.

If the outlying station desires to speak with another outlying station, the fact is communicated to the operator at the principal station, who replaces his receiver on the support and by turning maneto (D) calls up the desired outlying station, if the station is without a Morse relay, by producing a definite signal, which will be denoted by the bell (c) (b), for instance, and responded to by the attendant at station 2. At the stations where Morse instruments are provided, and the operator is present, the calls can be sent telegraphically. Oral communication is then established between station 3 and station 2. The conversation is listened to by the operator at the principal station, and when the conversation is concluded the operator at the principal station restores the line to normal for telegraphic transmission.

The inventor says that it is of advantage to have the call signals to outlying stations sent out from the principal station, as unauthorized persons are not liable to interrupt and use the line, and the persons requiring to use the line for telephoning are afforded the direction of a skilled person, with results that might fail of accomplishment if the attempt was made by persons who were not as familiar with the system. Moreover, lines can be interconnected at the principal station, and by the sending of such calls from the principal station the system is without complications present when calls are sent from several stations.

Space Telegraphy Over Land.

The official report of Lieutenant Luigi Solari regarding the recent cruises of the Italian warship Carlo Alberto contains some interesting information relative to the trials of wireless telegraphy made on board that vessel. The cruises were made during the months of July, August and September, 1902, starting from the Lizard, Cornwall. In the harbor of Cronstadt Marconi, in the presence of the emperor of Russia and the king of Italy, exhibited the apparatus and received messages from the station at Poldhu, a distance of 1,700 kilometers.

The return voyages through the Mediterranean, says the Engineering Magazine, in its summary of Lieutenant Luigi's report, repeated the success of the cruise in the Baltic, and satisfactory communications were had from Gibraltar and from Spezzia, this latter communication being necessarily almost entirely over land, a distance of 1,200 kilometers from Poldhu, with the mass of the Alps between.

The wiring on the Carlo Alberto consisted of a horizontal cable stretched between the tops of the masts, from which 70 parallel wires descended to the instrument room, in which were placed two receivers equipped with coherers and three magnetic detectors.

Concerning the most important features of the trials, the best information can be obtained from the summing up of Lieutenant Luigi's report, as follows: (1) No limit has been observed as to the transmission of electric waves over the surface of the globe, provided the energy expended in the transmission is proportional to the distance to be covered; (2) communication between transmitting and receiving radio-telegraphic stations is not prevented by the interposition of land; (3) the influence of the light of the sun is to diminish the range of radiation of electric waves, rendering it necessary to use a greater amount of energy in transmitting messages by day than by night; (4) the superior efficiency of the magnetic detector over the coherer as a receiving instrument is fully demonstrated, not only with respect to the freedom from tapping, but also because of its greater sensitiveness and convenience; (5) the experiments have demonstrated the entire practicability of the Marconi system, both for commerce and for warfare, without regard to distance.

The Stark Electric Railway Company has been incorporated at Columbus, Ohio, with a capital of $1,000,000. The president, C. R. Morely, and the board of directors, reside in Cleveland. By this incorporation the Alliance and Stark electric lines are merged into one under the above title.

New Nernst Lamp Patents.

Alexander J. Wurts of Pittsburg, Pa., has recently been granted a patent entitled "Electric Lamp," which refers specially to the type of lamp known as the Nernst lamp. The object of the invention is so to simplify the several parts of the lamp structure and the means for holding them in co-operative relations that they may be readily assembled and as readily separated from each other and so to construct and combine certain of the parts that such of the devices as it may be necessary to renew from time to time may be readily detached and as readily placed in operative position.

Fig. 1 is a view, partially in side elevation and partially in section, of a lamp constructed in accordance with the invention. Fig. 2 is a diagram of the operating parts of the lamp and the connecting circuits. The essential operating parts of the lamp comprise the glowers (1), shown as six in number; the heaters (2), of which four are shown; the ballast resistances (3), six of which are shown as respectively connected in series with the six glowers, and a heater cut-out (4), operating to open the heater circuit when the glowers become conductive. These essential parts of the lamp do not, either independently or collectively, of themselves constitute parts of the invention; but the means whereby they are assembled, properly supported in the lamp and connected in circuit with each other, are comprised within the invention.

The glowers (1) and heater tube (2) are removably supported by a holder (5), of porcelain or other suitable refractory non-conducting material, and this holder is detachably supported from and below a disk (6) of porcelain or other suitable non-conducting material, by means of metal hangers (7), to which lugs (8) on the holder (5) are fastened by cotter-pins (9). These hangers (7) are fastened to the disk (6) by pins (10), the lower ends of which are screwed into the hangers and are also provided with nuts (10^a) above the disk. The hang-

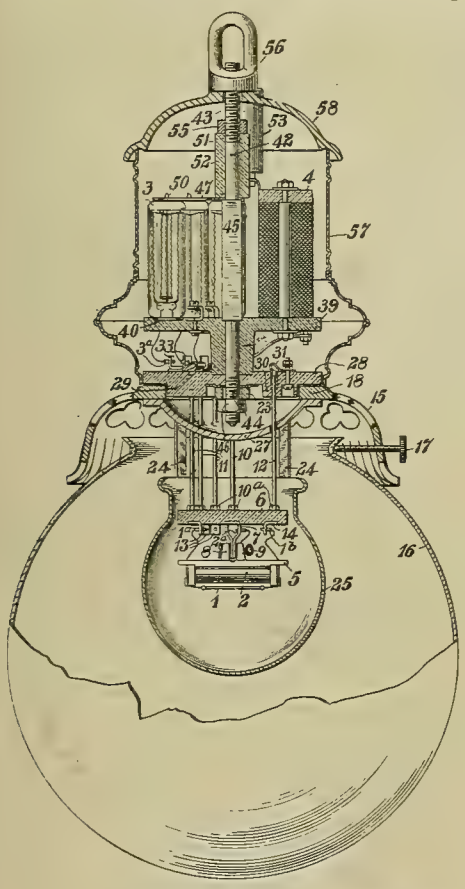


FIG. 1. NEW NERNST LAMP PATENTS.—ASSEMBLED LAMP.

ers (7) and pins (10) are located at diametrically opposite points of the disk, and constitute heater terminals. The disk (6) is also provided at one side of the diameter in which the pins are located with a series of six similar pins (11), and at the opposite side of the diameter with one similar pin (12). The lower ends of the pins (11) project through the disk (6) and are screwed into angular metal pieces (13), and the lower end of the pin (12) projects through the disk in a similar manner and is screwed into a longer angular piece (14). Each of the pins (11) and (12) is also provided with a nut (10^a) for clamping it and the corresponding angular piece to the disk. Each of the pieces (13) is perforated and receives the terminal plug (1^a) of a corresponding glower. The piece (14) has six perforations and receives the terminal plugs (1^b) of all the glowers of the set. The hangers (7) are also perforated at one side to receive the terminal plugs (2^a) of the heaters.

As shown in Fig. 2, the tubular heaters are so connected in multiple series that those of each series-connected pair are alternately disposed with reference to those of the other pair. With this arrangement should either pair be disabled the other pair would serve to heat the glowers to conducting temperature.

Located above the heaters and glowers and their supporting frame is a metal hood (15), which is shown as of fanciful open-work construction, in

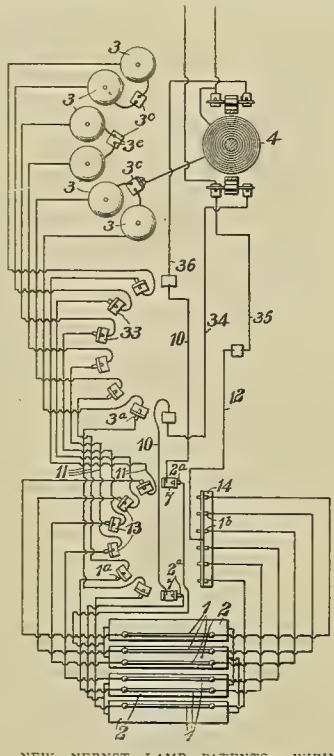


FIG. 2. NEW NERNST LAMP PATENTS.—WIRING CONNECTIONS OF LAMP.

order that it may have a pleasing appearance and also in order to promote ventilation. To this hood is attached a large outer globe (16), by means of suitable screws (17) or otherwise. The hood (15) has a central flat plate (18), provided with two openings (19) and (20), separated by arms or spokes (21) and (22), and a central hub (23). A number of spring-arms (24) are fastened at the upper ends to the plate (18) and serve as supports for an inner globe (25), this globe being readily sprung into position and as readily detached when desired. The annular portion of the plate (18) is clamped between a porcelain reflector (27), which is of spherical contour and is provided with perforations, through which the pins (10), (11) and (12) project, and a disk (28) of porcelain or other suitable non-conducting material. This disk (28) has comparatively thick portions (29) and (30), which, respectively, project through the openings (19) and (20) in the plate (18), and the portion (29) is provided with cylindrical openings, in which are located split-metal tubes (31) to receive the pins (10) and (11), and the part (30) is provided with a like opening to receive a similar split tube (31) for the pin (12). Each of these tubes (31) is formed of a strip of malleable metal—such, for example, as aluminum—which, for approximately one-half of its length, is bent into tubular form and inserted into one of the openings in the disk (28). The remaining portion is left flat and is bent over against the upper surface of the disk, and is fastened thereto by a screw and a nut. The pieces (31), with which the glower terminal pins (11) engage, are fastened to the disk by means of screws and nuts in the form of angle-pieces (33), which are perforated to receive the terminal plugs (3^a) of the ballast devices (3) and the pieces (31), corresponding to the heater terminal pins (10) are connected to the proper cut-out terminals by means of strips and suitable clamping screws and nuts. The split tubular portions of the pieces (31) receive the pins (10), (11) and (12) and are sufficiently yielding to permit of the ready insertion and removal of the pins. By reason of the location of the tubes in cylindrical holes of proper diameter only such expansion is possible as will permit insertion of the pins and at the same time insure a firm gripping action.

The upper face of the disk (28) is provided with a rectangular recess, in which rests the lower rectangular end of a boss, which projects from and constitutes an integral part of the disk (39), of porcelain or other suitable insulating material. This disk (39) supports the heater cut-out (4) and the ballast devices (3), its upper surface being provided with recesses (40) to receive the lower ends of the ballast tubes. The disk is also provided with perforations (41), corresponding in number and position to the ballast devices for the passage of the ballast terminal wires, and also with a metal strip on its bottom face and pieces (3^c) on its top face, which are mechanically and electrically fastened together by screws. The several ballast wires are detachably connected to the pieces (3^c) by means of terminal plugs (3^e), each piece (3^c) being provided with two holes to receive the corresponding plugs.

A bolt (42), which has cylindrical screw-threaded ends (43) and (44) and an intermediate squared or rectangular portion (45), extends through the boss (38), the disk (28), and the central portion (23) of the plate (18), and is provided below the part (23) with a clamping nut (46). Mounted upon this bolt above the squared portion (45) and so as to rest thereon is a plate (47), having six spring-arms, corresponding in number and position to the ballast tubes (3), and having at their outer ends openings to receive the projections (50) on the upper ends of the ballast tubes. Mounted upon the portion (42) of the bolt and resting upon the plate (47) is a porcelain piece (51), comprising a middle cylinder (52), through which the bolt projects, and two side cylinders (53), in which are located terminal rods (54), to the upper ends of which are connected the outside circuit wires and to the inner ends of which are fastened the conductors (54^a), which lead to the cut-out terminals. Above the piece (51) is located a nut (55) which, together with the nut (46) and the bolt upon which they are mounted, serves to clamp the intermediate parts together, and thus form a compact rigid structure, the members of which may be readily separated by removing the nuts. The screw-threaded portion (43) projects some distance above the normal position of the nut (55) and receives a nut (56), the upper portion of which is in the form of a loop, to serve as a means for suspending the lamp. This nut also serves to fasten the housing of the lamp in position, this housing comprising a main body portion (57) and a dome-shaped cap (58), the cap resting upon the body portion (57) and the latter resting upon the top of the hood (15).

To Henry Noel Potter of Berlin and Walther Nernst of Göttingen, Germany, are granted a patent for a glower for Nernst lamps, shown in longitudinal

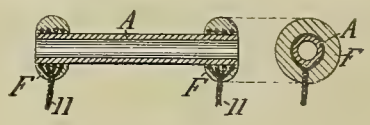


FIG. 3. NEW NERNST LAMP PATENTS.—IMPROVED GLOWER.

section in Fig. 3. The glower is hollow or tubular, with very thin walls. With such glowers it is possible to employ much heavier currents without danger of breaking down the glowers, and as a consequence it is possible to obtain from a single glower a far greater candlepower than could be obtained from a solid glower.

The glower (A) is shown to be hollow and of a tubular cross-section. To the ends of the tubes terminal connections are secured, which, in the present instance, consist of loops (11) (11), of fine wires, having their ends made long enough to twist into good connecting devices for the circuit in which the glower is to be included. Outside the loops, on the ends of the glower, are secured bodies (FF), formed by applying pasty material similar to that which enters into the composition of the glower, to the outside of the glowers, molding or pressing them thereupon and afterward hardening them by heat.

Marshall W. Hanks of Pittsburg has produced an improvement in the use of Nernst lamps by which lamps can be operated in series and in which the heaters shall cease to take any substantial quantity of current when the glowers become conductive, but which shall automatically operate to take current if the corresponding glowers become broken or for any other reason fail to permit the passage of current therethrough, all without the employment of moving parts. All these patents are assigned to George Westinghouse.

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DATES AHEAD.

Master mechanics of street-railway companies (meeting for organization), Cleveland, O., January 12, 1903.

Northwestern Electrical Association, Pfister House, Milwaukee, Wis., January 21, 22 and 23, 1903.

FRANCE has not been unmindful of the great possibilities of space telegraphy, as is shown by Mr. Perkins' article on the Branly-Popp system in this issue. Dr. Branly has evolved an interesting modification, which seems to show excellent results in practice, but we do not observe what plan is adopted to secure non-interference. This problem is indeed the greatest that confronts students in space-telegraphy. In a private letter an esteemed correspondent makes these observations: "Just as soon as such powerful transmissions as Marconi uses become common, the range of actual messages will be restricted again. It is like the fact that one megaphone on a football field is a success, while twenty are practically useless. Of course, syntony, if attained, will improve matters; but no more than seven or eight different rates of vibration are sufficiently inharmonious to be used successfully, as has been found by telegraphic harmonic experimenters." Herein lies a huge stumbling-block in the way of a great development in the wireless method comparable to the growth of the telegraph and the telephone. How shall this momentous problem be solved?

SELDOM beautiful, but very useful, the wooden pole supporting the wires of electric-railway, telephone, telegraph, electric-light and power-transmission companies has come to occupy an important place as a sort of side-issue of electrical development. In the present issue of the Western Electrician, on the eve of the convention of the Northwestern Cedarmen's Association, some attention is paid to the pole industry, which has assumed large dimensions. We are sure that our readers will be interested in Mr. Worcester's article and in the data relating to representative pole men. In large cities overhead wires are gradually disappearing, but in smaller towns and across country it will be a long time before the humble pole, upholding the electrical nerves of commerce, will be effaced from the earth.

SOME instructive figures are contained in the annual report of the secretary of state for Ohio. In all there were 48 street and electric-railway companies incorporated, with a capitalization of $9,929,000, whereas in 1901 the total capitalization of the new companies was $24,361,000. The capital of new electric-light and power companies in 1902 was $2,418,000, and the year before it was $3,265,000. The 54 telegraph and telephone companies incorporated last year have a capital stock less in amount than the year before. There are reasons for this, however. The business in all its branches received a serious setback in Ohio at the first of the year, owing to the Everett-Moore entanglements, and it has never entirely recovered from it. More than that there has been much money invested that is not covered by the figures in the secretary of state's office. Within the last two months both the electric railway and telephone business has shown a wonderful revival, and it would not be strange if the next 12 months witnesses a greater investment in this line than in any year since the industries were opened up. Moreover, the retardation of development in Ohio was not serious enough to affect the advance in the country at large, as was shown by the encouraging reports in the New Years number of the Western Electrician.

IT would be rather curious, in view of the marvelous multiplication of electric street and interurban railways in this country, if the movement to apply electric power on a large scale to existing steam trunk-line railroads should receive its first great impetus in Great Britain. Such may be the case, however, and the possibility is partially accounted for by the differing conditions applying to railroad operation in the two countries. The great railroad systems of the United States have thousands of miles of track mileage, much of it single-track, with fluctuating traffic conditions, and, taken as a whole, perhaps greater difficulties would be encountered in applying electric power economically than in a smaller, more compact and more thickly settled country like Great Britain. Then, again, electric railroading, with the exception of a few isolated examples, is much newer in England and Scotland than with us, and thus steam-railroad managers, in studying the problem, may be more impressed with the later development of the art than American managers, who may retain unfavorable impressions acquired 10 or 12 years ago. Still, these hypotheses can account for the situation only partially, after all, if the foreign correspondents are not unduly optimistic over the electric-traction prospects in England. One of these newsgatherers, writing from London, says: "George Westinghouse, the famous inventor and electrician, will entertain a company of British railroad presidents and general managers in this city on Friday [January 9th]. The object of the gathering is nominally to witness an exhibition of the Cooper-Hewitt mercury-vapor lamp, but the real intention is to inaugurate the British Westinghouse Company's campaign for the capture of the contracts to introduce electricity on the principal steam-railway lines in Great Britain. Already the Great Northern is experimenting with electrical traction in the works of the Westinghouse company at Manchester, while that company itself is engaged in substituting electricity for steam on the Mersey railway. Aside from the roads mentioned, the Great Eastern, the Northeastern, the Southeastern, the London, Chatham and Dover, the London, Brighton and South Coast and the Great Western have applied for parliamentary powers to use electricity on their properties. The contract for the Mersey line is a bagatelle compared with some others in prospect, yet it amounts to three-quarters of a million sterling ($3,649,820)."

American steam-railroad managers, as a class, have been ultra-conservative in dealing with electric traction. Is it not time for them to wake up?

ANOTHER interesting decision has been added to the string of precedents in telephone-pole litigation. This time the operating company seems to have had the best of the argument. In New York state the Fourth Appellate Division of the Supreme Court has decided that a telephone company has the right, with the permission and under the control of the authorities, to erect poles and string wires through the main street of a village of several thousand inhabitants, notwithstanding that the abutting property owners refuse to give their consent. The village in question is Salamanca, N. Y. The property owners there own to the center of the street. The defendant had no right to erect the poles unless their erection was within the limits of the public easement in the street, and it is settled that the ownership by a property owner of the fee to the center of a street does not give him the right to prevent any additional use of the street, provided such use is within the limits of the public easement. Justice Hiscock said: "Passing upon the right of a telephone company like defendant to place its wires in a public street in a city, this court has fully held and decided that such right was within the limits of the public easement in a city street. In the classification of, and distinction to be drawn between, city streets and rural highways, the courts have treated village streets as more analogous and akin to the former than to the latter. Such conclusion is a natural one. No fixed and arbitrary line upon the subject of public uses and necessities can be drawn between the streets of a city and a village. The more populous the latter becomes, the more extensive will be its public needs and the demand for public conveniences." Evidently, then, it is for the courts to say, in New York state, in each particular case, whether the streets of a village are to be classed with city streets or rural highways.

THIS coming spring an enterprise is to be entered upon in a quiet and unostentatious manner by a sturdy Norwegian which may result in investigations and conclusions that will be of great importance to the scientific world. Reference is made to an expedition to discover the magnetic north pole and there to carry out observations during a series of years. Captain Roald Amundsen will make the attempt in a small craft called the Gjöa, with a crew of but seven men. The magnetic north pole differs from the earth's mathematical north pole in two essential respects—(1) the magnetic north pole is comparatively easy to reach, while the mathematical pole has proved sufficiently difficult to approach; (2) investigation of the magnetic pole is of much scientific interest, whereas the mathematical one is of little real importance for purposes of study, the gain in reaching it being of the kind experienced in attaining to the summit of some difficult mountain peak. One person, James Ross, succeeded in reaching the magnetic pole in 1831, but his researches were made with the imperfect instruments of his time and are doubtless inaccurate in many respects. Captain Amundsen will practically begin where Ross left off. He will make a magnetic survey of the whole ground and thus establish whether the pole is a mere point, a more widely spread area, or even several points. His equipment is very complete and entirely modern; he has had much experience in voyaging through the polar regions, and he is said to have every qualification necessary to carry to a successful end an expedition of this nature. He starts on a task that may take him years to complete, but his undertaking is probably the most important that is embraced in the field of magnetic research at the present time, and the entire scientific world will wish him every success and await his return with expectation and interest.

Pole Supply for 1903.

By C. H. Worcester,
President Northwestern Cedarmen's Association.

In common with almost every other business in this country during the past six years the white-cedar pole business has experienced a surprising increase in volume. During the four years ended December 31, 1901, the production failed to keep pace with the rapidly increasing demand, and almost without exception the dealers found themselves in the fall of the year practically sold out and unable to supply the demands of their trade. This condition stimulated production to the highest point last winter, with the result that December of last year found the dealers with a fair assortment of all sizes of poles on hand, which are dry and ready for shipment to supply the spring demands for early construction. Heretofore it has been necessary to ship green poles to supply this demand, resulting in greatly increased freight charges and creating very high cost to the consumer. From the viewpoint of both seller and buyer the market is now in a very healthy condition. Stock is in fair supply, prices with few exceptions steady at about the same values as have ruled during the past 12 months, with every prospect of remaining at the present level for another year. The production this winter will be fully one-third less than that of last winter, but in connection with stocks now on hand, the production will probably be sufficient to supply comfortably the requisitions of the trade without any surplus.

It is safe to assume that the scramble for stock, which has ruled during the last four years, is over and that from now on production will be better regulated and result in more satisfactory trade conditions. This is now possible, because of the change in the methods of production, which has been going on during the last six years.

For an understanding of this some further explanation of this change is necessary. The timber lands of Michigan and Wisconsin were first bought and lumbered by lumbermen operating saw mills, cutting only the white pine and Norway. These woods were in plentiful supply and only these woods were considered of any value. In the earlier days it was a common practice, after the pine had been cut on lands, to default on the payment of taxes and allow the lands to revert to the state. At this time the demand for poles was confined almost entirely to the telegraph companies, and as the lines in the West were comparatively few, the demand was easily supplied, from timber which cost next to nothing, by small jobbers, who usually worked in connection with the country store dealers. Up to the year 1895 the purchase of cedar poles was carried on very largely through the country store merchants, who made a practice of giving credit for supplies to the small farmer jobbers, taking their poles, posts and ties in exchange and then selling these products to the pole dealers, who in turn supplied the telegraph and telephone companies.

About this time the demand for cedar telegraph poles, fence posts, railroad ties and shingles began to increase very fast. Dealers found it necessary to stimulate production by entering the field with their own camps. Lumbermen whose stock of pine was exhausted, began to turn their attention to the hemlock, hardwoods and cedar remaining upon their lands, and these woods, heretofore considered of little value, began to be looked upon as good property. The tremendous increase in construction of telephone, telegraph, electric-trolley and electric-lighting plants created a very large demand for poles. The railroads commenced construction of new lines and the rebuilding of old ones, creating a large demand for cedar ties. With the disappearance of the white pine, cedar shingles came into use, and to-day 95 per cent. of the shingles used in this section are made from white cedar.

This demand created a new field for lumber operations and the business of cutting cedar was taken up by the more independent operators owning lands and possessing capital to carry their operations on a larger scale than had heretofore been practiced. These operations proving profitable, cedar lands throughout the northern country became more valuable and were eagerly bought up by the larger operators, so that to-day these lands have increased tenfold in value and are largely held by lumber firms as reserves for prolonging the life of their business. The result of this is that the small country-store operators are disappearing; the lumbermen, managing their own camps, are replacing the country storekeeper; stumpage is scarce, very high in price, and held by owners who consider it a good investment and who will cut it only when the market conditions demand the stock and prices are adequate.

The day of cheap cedar has passed away forever. While there will be fluctuations of price, due to light demand or temporary overstock, the general tendency of prices will be higher, in accord with the increase in the value of the timber, wages and supplies.

The personnel of the firms engaged in the handling of cedar products has changed greatly for the better. The business is now systematically handled by responsible firms, many of which own lands and cut with their own camps a large part of the poles they handle, in addition to handling as jobbers the stocks of other producers. The production last winter, the largest in the history of the business, exceeded 2,500,000 poles of all lengths, 18 feet and upwards, of which not more than 400,000 are now in the hands of dealers at this date.

The production this winter will probably be between 1,750,000 and 2,000,000 white-cedar poles. Construction will probably not be so large during 1903 as during previous years. It is, therefore, to be expected that supply will be equal to demand, without any overstock. Should there be any accumulation of poles in the hands of dealers above the ordinary stock, which every dealer must carry at all times, from which to supply his trade, the production will decrease sufficiently to balance this surplus. Owners of cedar timber appreciate its value so keenly that they will not cut it unless market conditions warrant. Each year diminishes the amount of such timber and there never will be any more than is now existing, as it would require 100 years of careful forestry methods to reproduce the average run of timber now being cut.

Electric Braking.

At the meeting of the western members of the American Institute of Electrical Engineers, held in Chicago, on December 30th, in discussing the general subject of the evening, "Braking and Traction Brakes," the following points were brought out in the discussion:

Eugene B. Clark, electrical engineer of Illinois Steel Company, Chicago: The point of interest that has occurred to me in connection with the magnetic track-braking device, mentioned in the latter part of Mr. Parke's paper, was the question of how much power is supplied by the motors when they are acting as generators in doing that braking. In this connection I might mention a little instance that came to my attention recently. We had a question come up to brake the trolley of an ore-handling machine. The trolley weighed about 140,000 pounds and traveled about 1,000 feet a minute across the bridge of a crane about 100 feet in the air, and the bridge was about 500 feet long. We took every possible precaution to produce the most effective braking we could devise. We used air brakes, we provided the motor brake, the brake controller where they convert the motors into generators, also a hand brake, and besides that, at the ends there is a special device of a friction brake on a car running up on to a shoe. That was afterward given up. We considered that the most effective part of the braking was that done by the motors and that part which was due to the effect of the disk, or whatever part might be supplied in place of the disk, and, acting upon that supposition, we did not provide anything except straight resistance in the motors; therefore we simply converted the generators into motors by using the load on them to stop the motion of the car. That was very effective —in fact, too effective. It would not take hold until a certain point, and when it did take hold it did so very strongly. One disastrous result which we thought was due to this cause, was the breaking of the axles. We designed an axle that appeared to be strong enough, and we had to increase it, and then increase it again, and even then the axles would break. Now, I wonder if it is not a fact that the same experience has been met with before in braking street cars; do the axles break? This is quite commonly used in Pittsburg and other places where it is hilly, but that is certainly a feature which, if it is present in all of those systems using the motors as generators, is a very bad point against it.

B. J. Arnold: I think the chief objection that has been brought against electric brakes that act upon the clutch principle is the increased size that the motors must have, in order to stand up under the work, since they are working all the time, as Mr. Pierce has pointed out, and as others here have mentioned. I have never heard of the axles breaking from that cause, although they might have done so, but, of course, axles break for other reasons. In hilly countries you are liable to break more axles than in flat countries. It might be that the axles break more on that account than from the magnetic brake.

T. P. Gaylord: I am somewhat familiar with the situation in Pittsburg, and have never heard of any number of axles breaking. As Mr. Arnold has said, I think the breaking is largely due to mechanical conditions rather than conditions of the load on the motor. As to the amount of energy developed in the motor, I understood that that energy was only about sufficient to compensate for the energy stored in the revolving elements of the motors and the truck wheels.

Mr. Clark: It is to be noted in the case I mention that we worked on the assumption that the principal part of the breaking of the axles was evidently due to the load on the motors. It is not at all unlikely that we were wrong in that assumption. Of course, under such conditions as we were operating, all of the work was done in the motors, and therefore the load on the motors was considerable, and there was no breaking anywhere else. We found no difference, as far as we could determine, in the temperature of the motor, whether we were using the motor brakes or not. The motor was acting at a lower voltage during the time it was working on the brakes. There was probably considerable current, but only for short periods of time. We had an air brake which could be used.

Electrolysis Ordinance of Atlantic City, N. J.

Atlantic City, N. J., has adopted an interesting ordinance to prevent damage to buried pipes by escaping street-railway current. Street-railway companies are not allowed to bond to water mains, but must furnish and insulate a complete metallic circuit. For this circuit three conditions are prescribed: "The maximum difference in potential between any part of the metallic return circuit and any water or service pipe or other metal conductor not intended as a part of such return circuit shall not at any time exceed one-fourth volt. The difference in potential between any two points upon said metallic return circuit within a distance of 200 feet from each other shall not at any time exceed one-fourth volt. The current passing along any water or service pipes or other metallic conductor not intended as a part of said return circuit shall not, at any given time and point, exceed one ampere." Semi-annual tests to determine whether these conditions are complied with must be made. Suitable penalties are provided for the enforcement of the law.

This ordinance is especially significant as being the first, outside of Chicago, to adopt the principle laid down by City Electrician Ellicott of this city that the variations in voltage on the return circuit should not exceed a small maximum fluctuation between certain predetermined limits.

Northwestern Cedarmen's Association.

Pole men are taking much interest in the seventh annual meeting of the Northwestern Cedarmen's Association, which will be held in the West Hotel, Minneapolis, on Monday, January 12th, beginning at 2 p. m. The Northwestern Lumbermen's Association will be in session on the 13th, 14th and 15th in Minneapolis, and thus, in a sense, the convention will be a joint one. Reduced railroad fares have been secured, and a large attendance is anticipated, as matters of importance, including the reports of standing committees and the annual election of officers, are to be considered.

Present officers of the association are the following-named: President, C. H. Worcester, Marinette, Wis.; vice-president, R. H. Downing, Minneapolis; secretary, Fred H. Gilman, Minneapolis; treasurer, H. W. Reade, Escanaba, Mich.; directors, H. S. Gilkey of Janesville, Wis., A. D. Watson of Chicago, J. K. Wright of Marinette, Wis., and J. C. Kirkpatrick of Escanaba, Mich. The standing committee on poles consists of G. L. Lindsley of Menominee, Mich., William Mueller, Jr., of Chicago, H. W. Reade of Escanaba, D. M. Fulmer of Florence, Wis., and E. L. Clarke of Chicago.

Large Electric-railway Consolidation in Pennsylvania.

Announcement has been made in Philadelphia that control of the United Power and Transportation Company has been sold to the Interstate Railways Company at $75 a share. The Interstate Railways Company was incorporated recently in New Jersey with a capital of $10,000,000 for the purpose of operating electric companies and street railways in Pennsylvania, New Jersey and Delaware. The United Power and Transportation Company is also a New Jersey corporation, chartered in 1899. Its authorized capital was $12,500,000. Among the operations controlled by the company are the following-named: Edison Illuminating Company, Lebanon; Schuylkill Valley Traction Company; Trenton (N. J.) street railway; United Traction Company, Reading; Wilkesbarre and Wyoming Valley Traction Company, Wilkesbarre; Dallas and Harvey's Lake Railway; Wilmington and Chester Traction Company; Wilmington City Electric Company; Citizens' Electric Light and Power Company of Delaware County; Delaware County and Philadelphia Electric Railway, and several lines in the suburbs of Philadelphia.

The South Side Elevated Railroad Company of Chicago gave conductors, ticket sellers and guards in its employment a raise in wages amounting to 10 per cent. on January 1st. Other employes had already received an increase.

REPRESENTATIVE MEN IN THE POLE INDUSTRY.

Unless his attention is especially directed toward it, the electrical man is unapt to realize the magnitude assumed by the pole industry within the last few years. When one stops to think of it, however, the consumption of poles, cross-arms, etc., to say nothing of ties for electric railways, forms a large and important item in nearly every kind of electrical-construction work. In his article on "Pole Supply for 1903," on the preceding page, Mr. Worcester gives a clear idea of the development and present state of the white-cedar-pole industry and shows that the ubiquitous wire-supporting pole is a part of the equipment that demands a due share of attention. The subject is particularly apropos at this time, as the convention of the Northwestern Cedarmen's Association will be held in Minneapolis on Monday next. With the idea that the readers of the Western Electrician will be interested in portraits and brief biographical data of some of the leading men in this important industry, the present article has been prepared.

A. Bushnell, Kansas City.

Ira Carley, Ingalls, Mich.

W. J. Carney, Chicago.

M. H. Coolidge, Minneapolis.

M. B. Cross, Chicago.

A. E. Darling, Minneapolis.

G. W. Earle, Hermansville, Mich.

J. H. Fowler, Chicago.

REPRESENTATIVE MEN IN THE POLE INDUSTRY.

A. Bushnell of Kansas City, Mo., is one of the pioneers in the cypress-pole business. He was born in Western New York, and after graduating from college went West and engaged in the lumber trade. In the early '90's he became interested in cypress for poles, and although at first he encountered much opposition, he says that where one car of cypress poles was shipped seven years ago, 10 cars are now shipped.

Ira Carley of Ingalls, Mich., can point to an experience of 20 years with poles. He says that there is a large quantity of dry poles now ready for shipment, and thinks that producers may overdo the market if they are not careful. Nevertheless great inroads are being made into the visible supply of cedar.

W. J. Carney is president of the Carney Brothers Company of Chicago. This concern is one of the leading cedar-pole producers in the Northwest, having several thousands of acres of timberland from which to supply yards in Minnesota, Wisconsin and Michigan. W. J. Carney has been in the business for the last 21 years, but it was not until five years ago that he embarked extensively in the cedar-pole end of it.

Marshall H. Coolidge of Minneapolis has recently purchased the Coolidge Fuel and Supply Company and is now conducting the business under the name of Marshall H. Coolidge. He secures most of his poles in the northern part of Minnesota, both on the north and south shore of Lake Superior, barging them to New Duluth, where he has a dock of 1,800 feet water frontage and 27 acres in area. Mr. Coolidge is also president of the Coolidge-Schussler Company, which is quite a large producer of poles and posts, with headquarters at Floodwood, Minn.

M. B. Cross was, until three years ago, connected with the Jackson Bros. Company of Baltimore. He went from there to Chicago, where he organized the cedar department of Francis Beidler & Co., of which he has been a most efficient manager, having established pole yards in various parts of the United States.

A. E. Darling is manager of the cedar business of the Chicago Lumber and Coal Company of Minneapolis, with yards at St. Paul and Blackduck, Minn., and Sand Point, Idaho. This company has made a specialty of handling short poles, catering to the country telephone trade, but during the next year it expects to be able to furnish poles in any lengths desired, either in Idaho or white cedar.

G. W. Earle hails from Hermansville, Mich., where he is president and manager of the Wisconsin Land and Lumber Company, which is a considerable producer of poles and still has a large acreage of uncut timber. Mr. Earle was one of the prime movers in the formation of the Northwestern Cedarmen's Association and is a firm believer in the value of uniform pole standards.

D. M. Fulmer, Florence, Wis.

W. H. Holcomb, Chicago.

C. J. Huebel, Menominee, Mich.

J. C. Kirkpatrick, Escanaba, Mich.

Geo. L. Lindsley, Chicago.

Fred L. Merritt, New York.

Wm. Mueller, Jr. Chicago.

A. T. Naugle, Chicago.

REPRESENTATIVE MEN IN THE POLE INDUSTRY.

John H. Fowler is president and treasurer of the Fowler-Jacobs Company of Chicago, J. A. Jacobs of Washburne, Wis., being vice-president. He is also president of the Elmore-Fowler-Jacobs Company, of which Eltinge Elmore is secretary and treasurer. Though only 31 years old, Mr. Fowler is one of the largest producers and dealers of cedar poles. In 1902 Mr. Fowler produced from his own lands nearly 200,000 poles, besides large quantities of posts, ties, etc. Mr. Fowler operates five concentrating yards in Northern Wisconsin, also yards in Idaho. He is one of the most successful pole men in the business, and his indefatigable spirit will undoubtedly win him greater honors.

D. M. Fulmer, president of the D. M. Fulmer Lumber Company of Florence, Wis., has been engaged in the lumber business for 20 years. Eight years ago he went to Florence and built mills and engaged in the wholesale-lumber business, as well as manufacturing. Four years ago he commenced to handle white-cedar poles and posts, and he has been successful. This company has cedar camps in Northern Wisconsin and Michigan, and produces large quantities of poles yearly. On November 17th Mr. Fulmer opened an office in Chicago.

W. H. Holcomb, president of the Holcomb-Lobb Company of Chicago, has been engaged in handling cedar products, oak ties, etc., for the last 10 years. He supplied the material of this character used in building the Aurora, Elgin and Chicago electric railway; also the material for constructing the Mason City and Fort Dodge Railroad (Fort Dodge to Council Bluffs, Iowa), requiring about 1,000,000 ties. He is now filling large contracts for poles and other material for the Indianapolis Northern Traction Company and the Union Pacific Railway Company.

C. J. Huebel of Menominee, Mich., has been in the business since 1887. He is secretary and treasurer of the C. J. Huebel Company and is familiar with the kinds of poles required by the telephone and telegraph companies. In its main yard at Menominee the company carries from 20,000 to 30,000 poles for urgent shipments, and it also has five branch yards.

J. C. Kirkpatrick is president and general manager of the Pittsburg and Lake Superior Iron Company, Escanaba, Mich. The success of this company is in a large measure due to the efforts of Mr. Kirkpatrick. The company is one of the largest producers of cedar poles, ties, etc., and holds an enviable position in the pole business. It controls some of the finest cedar stumpage in the Northwest and has excellent facilities for handling its pole business.

George L. Lindsley, president of Lindsley Brothers Company of Chicago and Menominee, Mich., is a prominent figure in the cedar-pole industry. He was one of the founders of the Northwestern Cedarmen's Association and was chairman of the committee that formulated the standard rules of inspection. Mr. Lindsley started with a small yard and supply store at Goll, Wis., and has gradually extended the business, until now his company has yards all over the cedar-producing districts of Michigan and Northern Wisconsin and general offices in Chicago; also an office at Menominee, Mich., where it maintains a large distributing yard and operates a shingle mill and post yard in connection with its pole yards. In 1899 the company attracted attention by filling an order for 12,000 telephone poles, each 50 feet or more in length. To do this it established yards in Idaho. In 1900 offices were opened in Portland, Ore., and Spokane, Wash., and the company has since built up an extensive trade on the Pacific Coast. It makes a specialty of long poles in large lots.

Fred L. Merritt of New York is secretary of the Standard Pole and Tie Company, which produces octagonal long-leaf yellow pine and round juniper poles, with branch offices in Wilmington, N. C., and Brooksville, Fla. This company introduced the juniper pole in the North and West. The juniper pole is more technically known as southern white cedar and is a swamp growth. It is asserted to be straighter and of closer grain than

the northern cedar. The company owns 7,000 acres of heart-pine timberland in Florida and has a cross-arm mill in that state.

William Mueller, Jr., is secretary and treasurer of the William Mueller Company, Chicago. Perhaps no more popular pole man exists than Mr. Mueller, and the high esteem in which his competitors hold him is deserved. Mr. Mueller has been in the pole business for many years, and began at the bottom. The Mueller company has been in the cedar business since 1862, and is one of the largest in existence. Its specialty is white-cedar poles. The company operates seven concentrating yards and handles about 125,000 poles a year. It has among its customers some of the largest consumers of poles in the country.

A. T. Naugle is with the E. E. Naugle Tie Company, Chicago. Mr. Naugle is one of the youngest men in the business, being only 28 years of age. He has been in the cedar pole business six or seven years and is in charge of this branch of the Naugle company's large business. The Naugle company has been in the pole and tie business for the past 19 years, operating previously as E. E. Naugle & Co. It owns five concentrating yards and produces and handles about 175,000 poles per annum. Mr. A. T. Naugle handles the interests of his firm with the skill of a veteran and is popular with his associates.

E. C. Norton of Escanaba, Mich., has charge of the pole department of the Kellogg Switchboard and Supply Company of Chicago. Mr. Norton was born and brought up in Burlington, Wis. In the early days of the Independent telephone movement he went to live in Escanaba, Mich. Becoming familiar with and seeing the possibilities of the cedar-pole business, he determined to cast his lot with it, and opened an inspection bureau, advertising that he was prepared to act as inspection agent for purchasers of poles. This was a new idea, but the immediate response which it received, from both East and West, showed that the situation demanded such an institution. In 1900 Mr. Norton became associated with the Kellogg company. The large and profitable pole business transacted by the company from the start is an evidence of Mr. Norton's energy and ability in his chosen calling.

Paul Perrizo, Jr., is a member and manager of the firm of Perrizo & Sons of Daggett, Mich. He has had 15 years' experience in the business. The firm has branch yards at Marinette, Wis., and at Gardner, Ames, Nathan and Faithorn Junction, Mich. It has in stock 25,000 poles and does a general wholesale business, producing the most of its output.

D. W. Phelan of New York has been in the pole business since 1894. He has a large trade in octagonal long-leaf yellow-pine poles, which he ships from his own mill in North Carolina. He also reports a great demand for southern cedar and is preparing for a run on poles of this kind in 1903.

John Stilman Porter is president of the Porter Cedar Company of Saginaw, Mich. He was born in Massachusetts, about 45 years ago, and came to Michigan in 1875. He has been in the cedar business ever since 1889. Mr. Porter has the appointment of state salt inspector for Michigan in his inside pocket, as he has done good work for Gov. A. T. Bliss, who has just entered on his second term and is a fellow-townsman of Mr. Porter.

Philip W. Raber, president of Raber & Watson, Chicago, has been in the pole business since 1881, and consequently is one of the most experienced of cedar-pole men. Raber & Watson make a specialty of white-cedar poles and are among the largest producers. The company owns four large concentrating yards and supplies many large consumers. Mr. Raber is well and favorably known in the cedar-pole industry, and ir A. D. Watson, his associate, has a partner who is ir every way calculated to further the interests of a progressive concern.

W. T. Reynolds of Minneapolis has been connected with the lumber business since 1876. In 1897 he went to Minneapolis and engaged in the white-cedar industry, handling also Idaho red cedar. His business has increased yearly, until in 1902 his sales were approximately 100,000 poles.

W. C. Sterling is the senior member of the old-established firm of W. C. Sterling & Son of Monroe, Mich. This large concern was started 20 years ago and now handles over 125,000 poles a year, besides ties and fence posts. It enjoys a large export trade, as well as shipping its products all over the United States. The firm has 11 large sorting and storing yards and has done an especially large business with telephone companies. It looks for a large business in 1903.

E. H. Valentine is president of the Valentine-Clark Company of Chicago. His business career may be summed up in a few words indicative of the solidity of character of the man. For an uninterrupted term of 20 years Mr. Valentine was western manager for the Walter A. Wood Mowing and Reaping Machine Company of Hoosick Falls, N. Y. His connection with the pole business dates back to 1892, when he purchased a large interest in Ernest L. Clark's pole business, that had been in successful operation since 1888, and became president of the newly organized company. This company's business has been exclusively that of handling poles. It owns four large yards and a considerable number of smaller subsidiary yards.

B. F. Vreeland is of Denver, Colo. Mr. Vreeland is one of the comparatively few pole men in the Far West. He makes a specialty of long Idaho red-cedar poles and has yards in Idaho and Montana. His principal business is in the Pacific Coast states. Mr. Vreeland has a reputation of being a wide-awake and progressive business man and has met with success.

C. H. Worcester, president of the C. H. Worcester Company, Marinette, Wis., entered the pole business in 1896, and was previously engaged in handling southern and northern lumber. In 1898 he purchased the plant of the Northern Supply Company, on the Wisconsin and Michigan Railroad; then actively entered the pole business. Mr. Worcester studied the situation carefully and made up his mind that the pole business had a very bright future, and bought up all the cedar stumpage in that district. In 1900 Mr. Worcester bought a tract of 44,000 acres near Munising, Mich., said to be the best and largest group of cedar standing to-day. In 1902 the Worcester company bought the Sturgeon River Lumber Company at Chassell, Mich., the Sturgeon River Boom Company, controlling the Sturgeon River, and over 35,000 acres of land in the same territory. The Worcester company now controls over 100,000 acres of land, in which cedar predominates. The company produced in 1902 from its own timber about 100,000 poles and handles about 75,000 additional poles secured from smaller producers. Mr. Worcester is about 40 years old and is highly esteemed by not only his customers, but by his competitors as well. He is president of the Northwestern Cedarmen's Association and is among the leaders in the pole business.

E. C. Norton, Escanaba, Mich.

Paul Perrizo, Jr., Daggett, Mich.

D. W. Phelan, New York.

J. S. Porter, Saginaw, Mich.

P. W. Raber, Chicago.

W. T. Reynolds, Minneapolis.

W. C. Sterling, Monroe, Mich.

E. H. Valentine, Chicago.

B. F. Vreeland, Denver, Colo.

C. H. Worcester, Marinette, Wis.

REPRESENTATIVE MEN IN THE POLE INDUSTRY.

Tubal-cain Precedent Rejected

Those who have had to do with many papers on engineering subjects will be rather amused by the following, which is the introductory paragraph in a paper on "Modern Handling of Iron Ore on the Great Lakes," presented by James N. Hatch at a recent meeting of the Western Society of Engineers in Chicago: "In what shall be said regarding the great iron industry, I have decided to depart from that time-honored and almost universal custom of beginning by quoting from the fifth chapter of Genesis, in which Tubal-cain is introduced as the first known worker of iron. I know this is a radical departure from a well-established custom, but when I state my reasons for this innovation, I trust I may be pardoned for this apparent sacrilege. The first reason is the fact that this talk is not intended as an historical account of the iron and steel industry, but rather a glimpse of some of the modern methods of mining and transporting the constituents of iron and steel, and need not, therefore, begin with the antediluvian times. The second reason is the fact that, after long and careful research, I was unable to find anything that would indicate that Tubal-cain belonged to the Amalgamated Association of Ironworkers, and I did not think it prudent at this time to give public commendation to the actions of a scab."

High-frequency and High-voltage Currents as a Cure for Consumption.

Dr. G. P. Girdwood of Montreal, Que., as the result of a series of experiments, is of the belief that high-frequency and high-voltage electrical currents as used for therapeutic purposes, may cure consumption and prolong human life. In the experiments eight guinea pigs, inoculated with tuberculosis bacilli, were separated into two groups of four pigs each. Those of one group were treated to applications of high-frequency currents from an Oudin resonator. A pole was fastened to an iron plate, covered with a thick pad, and, standing on this pad, the pigs received a part of the current by induction. The other four animals were permitted to live or die without any attempt being made to cure them. Of the pigs not treated, the first died in 16 days, the second in 17 days, the third and fourth in 36 and 48 days, respectively. Those receiving the current for two-minute periods lived almost twice as long. Dr. Girdwood is of the opinion that similar results could be obtained by treating human beings to such currents. He is at present treating a large number of patients for consumption, cancer, rheumatism and many other diseases, but does not feel at liberty to give the results obtained until he lays the matter before his confreres.

Chicago Elevated Railway Traffic in 1902.

Traffic on the elevated railways in Chicago during 1902 was good and showed an increase over the preceding year. The Metropolitan made the greatest gain, its increase of business being 15.1 per cent. The Northwestern elevated was next, with a gain of 14.8, and the South Side elevated followed with a gain of 8.9 per cent. The Lake Street does not issue monthly statements of traffic, so that its business for the year could only be approximated. The three roads mentioned, however, carried the total of about 90,685,345 passengers, divided as follows: Metropolitan, 38,653,865; South Side, 28,676,590, and Northwestern, 23,354,890. The Metropolitan carried a daily average of 105,901 passengers, the South Side 78,566, and the Northwestern 63,986. The record by months shows that the greatest travel on the Metropolitan was during October, probably due to the opening of the Aurora railway, when 115,980 passengers were carried, an increase of 20.7 per cent. over the corresponding month of 1901. The Northwestern and South Side companies' heaviest month was December, when they carried 71,607 and 88,513 passengers, respectively.

The Manufacturers' Record of Baltimore says that Charles F. Howe, 1855 West Ninety-fifth Street, Chicago, contemplates the improvement of the Ocmulgee River, near Gainesville, Ga., with a view to long-distance transmission of power for industrial purposes.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Talked-of Telephone Combination.

The report that there will be a combination of the Independent interests in the South in order to secure long-distance connections is interesting to Ohio people, says the Ohio correspondent of the Western Electrician, on account of the connection many of them have with the companies which have been doing the construction work in that territory. The North American Telephone and Telegraph Company of Chicago was planned by J. S. Brailey of Wauseon, Ohio, and from it sprang the Southwestern Contracting and Trading Company and the National Contracting Company. W. B. Ritchie is the president of the three companies. These two gentlemen are said to be the leaders in planning the merger which will make possible the long-distance line. Others interested are C. D. Crites, Lima; Oliver Jay, St. Marys; G. W. Barnes, Toledo; J. W. Van Dyke, Lima; H. M. Daugherty, Columbus; M. Donnelly, Napoleon; Mel. D. Shaw, Wapakoneta; Judge J. H. Day, Celina; A. Howells, Massillon; Prof. B. S. Young, Ada, and many others in Ohio. The plants interested are those in San Antonio, Beaumont, Orange, Austin, Waco, Houston, Tyler, Williamson County, Grayson County, Ellis County, Paris, Texarkana, Indianola, Lone Star, Commercial and Shreveport. The long-distance line is to extend from Memphis, Tenn., to St. Louis, and on south to connect with the towns named, as well as many others. Several towns in Tennessee and other states will also be connected up with it. J. S. Warren of Memphis is the one who has charge of the southern end of the proposed deal.

Federal Telephone Company's Finances.

The directors of the Federal Telephone Company met at the offices of the company in Cleveland last week and heard the reports of President Dickson and Chief Engineer Maxine Reber. The Federal company has a debt of $3,800,000, and the president said that, by handling all matters with care, the assets of the company would equal this amount. The Everett-Moore syndicate has $1,500,000 in the company. All but three of the subsidiary companies show a profit equal to the bonded interest and expenses, with a surplus ranging from two to six per cent., and one company has a surplus of 35 per cent. The net balance for November is $11,016.55, which in the course of one year would amount to $134,198.60. The companies owe the Federal about $800,000. The amount of bonds in these companies owned by the Federal is $1,800,000, and of the stock it has about $6,000,000. Over $550,000 will be needed to put the subsidiary companies in good shape, according to the calculations of Mr. Reber. The percentage of telephones to the population shows in the city of Cleveland 2.3; in the suburbs about six, and in the smaller towns it is as high as 11. There are in use in the territory covered by the Federal 25,085 telephones.

NEW COMPANIES.

The Holloway Telephone Company of Holloway, Mich., has been incorporated with a capital stock of $1,000.

The Milligan Rural Telephone Company of Milligan, Mich., has been incorporated with a capital of $5,000.

The Cheboygan Telephone Company of Cheboygan, Mich., has been incorporated with a capital stock of $30,000.

The Eldridge Mutual Telephone Company of Eldridge, Iowa, has been incorporated with a capital stock of $10,000. A local system is to be constructed at once.

The Oconee Telephone Company has been granted a charter at Walhalla, S. C., with a capital of $10,000. The officers are: President and treasurer, W. J. Stribling, and secretary, W. R. Dongle.

The Crawford County Mutual Telephone Company of Robinson, Ill., has been incorporated with a capital of $25,000 to operate a telephone system. The incorporators are D. J. Chamblin, C. W. Chamblin and L. B. Chamblin.

The Bitter Root Telephone Company has been incorporated by Matt Blindauer, H. L. Myers and F. T. Lillick at Hamilton, Mont. The company will construct a telephone line from Hamilton up Bitter Root Valley to Hughes Creek and into Idaho.

The following-named telephone companies have been recently incorporated in Michigan: Holloway Telephone Company, Holloway, capital $1,000; Cheboygan Telephone Company, Cheboygan, capital $30,000; Millington Rural Telephone Company, Millington.

Indiana Telephone Items.

Only one telephone company organization is reported for last week—that of the Farmers' Rural Telephone Company of Sweetsers, with 100 stockholders. Work of constructing the lines and establishing the exchange will begin January 20th, and it is the purpose to complete the work by March 15th. The following-named directors have been elected: James Dooley, J. E. Carey, Thomas Johnson, Alfred Burge and F. H. Stevens.

The Eureka Telephone Company, a farmers' company of Boon, Heth and Washington townships in Harrison County, is extending its lines into a number of neighboring townships and will soon connect with the system of Corydon, and thence with Louisville, Ky. In a short time nearly every farmer of the territory will have this modern convenience. The boxes are purchased by the subscribers who, under that plan, have the free service of the lines.

The Home Telephone Company of Gas City and Jonesboro was put in operation on the 1st inst. at Gas City, with 125 telephones in service. With the Jonesboro exchange in operation, in a few days 350 subscribers will be using the new service. It is expected that long-distance communication will be established soon between Gas City and a number of other towns and cities of the state, including Indianapolis. R. D. Haymaker is manager of the new company. Free service will be established between Gas City, Jonesboro, Marion and Upland.

Unusual tactics are being employed at Goshen to secure a telephone franchise for a farmers' company. Goshen has two well-equipped exchanges—the Central Union and the Home Telephone Company of Elkhart County. Both give free telephone service between Goshen and Elkhart, and the Home company gives free service to Middlebury and with two farmers' mutual companies at smaller towns. The Mutual of Clinton Township violated the terms of its contract and it was revoked. The company refused to pay the rate asked in a new contract, and adroitly got the privilege of running a toll line into a restaurant in Goshen, but did not construct the line. Later it applied for a franchise to operate a telephone exchange in Goshen. A councilman interviewed the business men, and five to one were against granting a third exchange franchise. Thereupon, the farmers began a new plan. They are circulating a petition among business men, asking the council to grant the request of the company for a franchise. When the merchant refuses to sign he is threatened with a boycott by the farmers and their friends, and by this plan 40 signatures have been secured to the petition.

L. A. Frazee of Noblesville, president of the Indiana Mutual Telephone Association, has appointed a legislative committee for the association, with the Hon. Hugh Dougherty of Bluffton as chairman. F.

Ohio Telephone Notes.

The mutual telephone company formed at Bowling Green is said to be making good progress. Forty farmers have subscribed $100 each to push the matter along.

The heads of the departments of the Bell office at Columbus were entertained at dinner at the Chittenden Hotel Friday evening by Manager H. P. Miller.

It is said that Henry A. Everett has under consideration the purchase of the Stark County Telephone Company of Canton. The company has exchanges at Canton and Alliance, and others are now being built. The stock issued amounts to $500,000, and there is also a bond issued of $350,000. Mr. Everett feels that the investment would be a good one and the purchase would also relieve the Federal Telephone Company of a heavy load, which it has with its present debts. The Stark County company is making money, however, and the Federal may hesitate to sell it.

The Cuyahoga Telephone Company is still working to secure an increase of rates, but it is hard to tell when the matter will be settled, unless the City Council grants the request without a fight.

The Bell Telephone Company is planning to build a line from Pomeroy to Athens, most of the right-of-way having been secured already.

Claude Wyant and others of Toledo have purchased the plant of the National Telephone Company at North Baltimore.

J. O. Angell of Belle Center has been awarded the red ribbon for having made the largest gain of any of the exchanges of the United Telephone Company of Bellefontaine.

The Toledo Construction Company failed to secure a franchise to operate a plant at Miamisburg.

The Rock Creek Telephone Company of Rock Creek has purchased a portion of the outfit of the old Ashtabula plant, and, after going over it thoroughly, it will be installed in the smaller station.

The Beaver Dam Telephone Company of Beaver Dam has been incorporated, with a capital stock of $15,000. C. C. Miller, Allen Phillips and others are interested.

The switchboard of the Oberlin Telephone Company, Oberlin, was burned out a few days ago by some of the wires dropping across the feed wires of the street-railway company. It is stated the actual damage to the plant will amount to $1,000.

O. M. C.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has withdrawn from Lyle, Minn., because of inability to make terms with the local company for connections.

George Stitch, a former manager of the Wisconsin Telephone Company at LaCrosse, Wis., died recently in Chicago, of apoplexy.

The Northwestern Telephone Exchange Company has secured new quarters for its exchange office in Stillwater, Minn. Its system there will be entirely rebuilt on modern lines.

The Citizens' Telephone Company of Mankato, Minn., has introduced on its rural line in Nicollet County a cut-off, whereby the operator can control every instrument on the line, cutting out all but the one talking.

The Farmers' Mutual Telephone Company of Yarmouth, Iowa, has been incorporated with $7,000 capital stock to build and operate lines through the county.

Six Independent telephone companies of Northwestern Iowa have combined to secure an entrance to Sioux City, where the Bell forces hold full sway at present. They ask a franchise for a local exchange, and offer connections by toll lines with 7,000 instruments whose holders now have no connection with Sioux City. They offer to build a modern system in the city, with wires underground, and will probably erect a building of their own.

The Dubuque (Iowa) Telephone Company has bonded its system for $25,000 to make improvements, including new switchboards and increased equipment. R.

Southern Telephone Developments.

The exchange of the Interstate Telephone Company of Durham, N. C., was burned on January 1st. The company's loss is placed at $8,000, with $5,000 insurance. The fire was caused by the explosion of a kerosene lamp.

The Waynesboro-Strowger Telephone Company has been chartered in Georgia with Colonel W. E. Jones as president. The capital stock is $5,000.

The electrical workers of Asheville, N. C., have gone out on a strike because the Asheville Telephone Company did not comply with the union wage scale. Only linemen are involved. L.

Pupin Load Coils in Europe.

In one of the German journals F. Dolezalek and A. Ebeling describe experiments on the application of Pupin's system to telephone circuits. These experiments were carried out by Siemens & Halske, with the co-operation of the German postoffice telegraph administration, and the results were so favorable that the German firm named has undertaken the development of Dr. Pupin's European patents. In concluding their paper, the authors assert that the experiments prove that by the insertion of inductance coils in telephone circuits in the manner described by Pupin the great advantages theoretically claimed are obtained in actual practice, and that a new field is now opened for a wider extension of telephonic intercommunication, for even the problem of transatlantic telephony might be considered as within the bounds of possibility; but, unfortunately, the cost would be excessive, and the technical difficulty of the construction and submersion of a cable with added inductance coils in such great depths must be considered as lying outside the realms of practicability, though for shallower waters, as the North Sea and Baltic, the laying of such a cable may be deemed to be not utterly impossible, thus securing direct communication between London and Berlin and between Berlin and Copenhagen.

TELEPHONE MEN.

J. W. Laird has been appointed manager of the Bell telephone exchange at Huntington, W. Va., vice W. R. Winn, who has gone to Atlanta, Ga.

J. F. Laning has resigned as president of the local Independent company at Norwalk, Ohio, and C. R. Callaghan has been chosen to fill the vacancy. Both are closely connected in the business of the company and the change is said to be one for convenience only.

Frank Lukenbell, manager of the Central Union Telephone Company's office at Delaware, Ohio, has been promoted to the position of traveling auditor, with Ohio as his territory. A gentleman by the name of Putnam, with the Columbus office, has been appointed to the position at Delaware.

County Attorney Killpack of Council Bluffs, Iowa, has served notice on the Nebraska Telephone Company that he will ask the District Court for a writ of ouster to force the company to remove its wires and poles from the streets, alleys and public places of the city. His grounds, as shown in the petition, are that the ordinance by which the company secured franchise was illegally passed.

The Telephone Transmitter.[1]

By J. J. Nate.

The names of those identified with the microphone, or transmitter, are Boursel, Reiss, Hughes, Hunning, Cushman, Edison, Drawbaugh, Bell, Blake, Gray, Berliner, Harrison and others, whose names I do not now recall.

[An interesting account is then given by the author of the early work of these telephone pioneers, but limitation of space prevents its reproduction. Coming down to the issues of more vital interest at the present time, Mr. Nate presents the following description pertaining to Berliner's invention, application for patents, and consequent litigation.]

Berliner's application, and the original drawings shown in his application of November 2, 1880, are the same as those shown and described in his patent of November 17, 1891. In fact, this is practically true of his British patent, No. 91, granted in 1880. Other patents were also granted to Berliner in France, in 1880, 1883, 1884 and 1886, all of which have expired, and which cover every essential point under his American patent; and in view of the decision of the Supreme Court in the Bate refrigerator case, March 4, 1895, his American patents can hardly be considered other than null and void.

Similarity of Claims.

Coming now to the similarity of the claims covering his applications, it will only be necessary to cite one or two, for the purpose of illustration. It will be noted that, aside from the phraseology employed, his claims are practically the same. Take, for instance, Claim 1 of the United States patent of 1880. He herein described a "method of producing sound variations in a plate, by causing a varying electric current to pass to the plate, or to the electrodes connected therewith, and from a second electrode in contact therewith, substantially as described."

In his patent of 1891, or the patent under appeal, Claim 1 reads: "Method of producing in a circuit electric undulations similar in form to sound waves, by causing the sound waves to vary the pressure between the electrodes in constant contact, so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit."

In his first patent it will be noted that the word "constant" does not occur in referring to the electrodes in contact.

In his British patent of 1880, expired, we have the complete description of a transmitter, as in Claim 5: "A microphone or contact telephone, having only one contact affected by sound waves, and consisting of two electrodes in contact with one another, which contact is varied during the transmission of sounds by the variation in pressure upon such contact, of a pendulous weight, which is kept out of its point of rest by the interposition of the set of electrodes, and is supported in such a manner that there is no lateral movement or pressure between the electrodes."

Claim 2 of his United States patent of 1880 reads: "An apparatus for producing sound by means of a varying electric current, which consists of a plate forming or carrying an electrode, placed in contact with another electrode, from one to another of which the electric current is caused to pass."

In his United States patent of 1891 Claim 2 reads: "An electric speaking telephone transmitter operated by sound waves and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other, forming a part of the circuit, which includes a battery or other source of electric energy, and adapted to increase and decrease the resistance of an electric circuit by the variations in pressure between them, caused by the vibrational movement of said sensitive plate."

It will be noted, in comparing these two claims, that in the 1880 patent the instrument is referred to as an apparatus for producing sound by means of a varying electric current which consists of a plate forming or carrying an electrode; said electrode in contact with another electrode, from one to the other of which the electric current is caused to pass. This claim is similar to Claim 2 of the 1891 patent, in that the instrument is operated from the same cause—sound waves—and is constructed in a precisely similar manner, having both electrodes in contact; such electrodes forming part of the circuit. In this claim also is noted the means for varying the resistance, namely, battery or other source of electric energy, which must, of course, be accepted as the mode of producing similar results in the patent of 1880, taken together with the Edison patents, expired, describing and claiming in part a battery, induction coil and carbon in the primary circuit as a means of varying the resistance of electrodes in constant contact and actuated by sound waves.

The British patent of 1880 covers also a part of the conditions embraced in the American patent of 1891, as also does Claim 6, as follows: "In a microphone or contact telephone, the combination of a vibrating surface forming one electrode and a pendulous weight forming the opposite electrode, with or without a device for changing the inclination of said weight."

So on, in claim after claim, taken in parallel. It is needless to take up your time along these lines. Something like 87,000 pages of record is now under consideration by the Circuit Court of Appeals; and some day, if we have the time to spare, "He who runs may read."

Bell Scheme to Patent Method.

The scheme on the part of the Bell company seems to have been a disposition to patent a method, principle or function; and in order to bring about this result the first application was withdrawn, and only a part of the same returned to the Patent Office promptly. I have heard it stated that the original specifications were so poorly drawn as to be hardly explanatory, conveying much less than the amended claims of his second application. The claims of the second application and the subject-matter covered therein are handled in a masterly manner, demonstrating in the broadness of their intent the work of someone thoroughly conversant with the Bell company's methods at that time. I can hardly believe that Berliner, whom it is currently reported was a dry-goods clerk at the time of his application, was sufficiently well enough acquainted with the subject to do it justice. The phraseology employed in the second application, while not materially differing from the claims of the first patent, was very subtle in its intent; and it would seem as if the claims of the second application were based on Edison's inventions, and which, owing to his connection with the Western Union at that time, and the existing contracts, were probably passed to the Bell company for consideration. In any event, the Edison patents were early patented abroad, a description of which is reported to have appeared in eastern papers at that time.

It is pretty well understood just what a patent may be granted for, and stress is laid upon the fact that a patent cannot be granted for a principle, function or abstract effect of a machine, but only for the machine itself. Further, if a foreign patent has been previously granted for an invention, the United States patent is limited to expire with the foreign patent, provided the termination of the latter does not exceed 17 years.

The delay in the Patent Office, pending the issue of the Berliner patent, no doubt held up all other applications—Drawbaugh, Hughes, Edison and many others. These were all contingent on the final result.

Government Investigation.

It was during President Harrison's administration that his attention was called to the number of years that the patent had been held back from issue, and he instructed that an investigation be made. The result of this was that a suit was instituted by the government, for the purpose of annulling the patent in question. Judge Carpenter, in his decision rendered in 1895, in one of the most scorching opinions ever delivered, stated that fraud had been clearly proven, and ordered the Bell company to surrender the patent for cancellation, because of the fraud. The Bell company appealed from the decision of Judge Carpenter on technical grounds. The Circuit Court of Appeals and the Supreme Court reversed Judge Carpenter's decision, leaving the patent in exactly the same position as before. The decision of the court of last resort was rendered by Justice Brewer. Justice Gray and Justice Brown did not hear the argument, and took no part in the discussion of the case. Justice Harlan dissented.

Bell Delay.

The methods supposed to have been followed out by the Bell company, for the purpose of delaying the issue of this patent, have been quite thoroughly discussed at different times; and while there probably is no written proof to show collusion between the representatives of the Bell company and the Patent Office officials, the evidence in the case, from letters written by the Bell company, urging an issue of the patent, and further evidence tending to show that these matters were taken up in person by the company's counsel, who found apparently good and sufficient reasons why the delay should continue, justified Judge Carpenter in his opinion. It would not be surprising, if the truth were known, that this correspondence was all reviewed before going to Washington, and that the scheme was one in which the records, at least, would show good faith on the part of the applicant.

Suit Against National Company.

I think I am correct in stating that it was some time during the early litigation that the National Telephone Company and the Century Telephone Company were sued for infringement by the American Bell Telephone Company under the Berliner patent. As the pressure of this litigation grew stronger, Mr. Leatherbee of the National Telephone Company sent out letters to various telephone manufacturers and others, soliciting financial aid; and I remember that in the letter, which I read, he stated that their company had already expended something like $4,000, and had practically reached the end of their rope. Some controversy occurred at that time relative to Mr. Leatherbee's good faith. It was claimed that, in the matter of the Century company, no effort whatever had been made to secure valuable evidence, and that in the matter of the National company's suit, the evidence was of an insincere character; all of which I believe was made known to Mr. Leatherbee, who strenuously denied all statements and accusations of a character which would tend to show his want of honesty and sincerity of purpose in defense of the suit brought against his company.

Shortly following, the National Telephone Association was organized, and at its second meeting in Detroit, when officers were elected for the following year, it was determined that by some means money should be forthcoming for the purpose of assisting the National company through this litigation. The money required, to a very large extent, was forthcoming. It was deemed advisable, however, at that time, not to implicate the National association in any way, and I presume the contributions made toward this fund were of a private character. In view of the amount of money subscribed, and the wide financial interest which the Independent people held, Mr. Leatherbee was asked to allow counsel to be selected by the contributors to direct the case. This, I have been told, he refused to do, claiming that Judge Payson had worked long and earnestly in their interest, and it would be an injustice to him to allow other counsel to predominate throughout the litigation then pending. Still, he appreciated the assistance which had come to him at this time, and advocated a co-operation, stating that counsel under these conditions would be gladly accepted. The result of all this was that Judge Taylor assisted Judge Payson for the defense, in the suit of the Bell versus the National Telephone Company.

The result of the hard-fought battle in Judge Brown's court is of such recent date that it need not be discussed at any length. Suffice it to say that after the argument in the case, in which, from an observer's standpoint, the arguments of the counsel for the complainant—Mr. Fish, Richardson & Starrow, G. L. Roberts and W. W. Swan, and for the defense—J. E. Maynadier, E. P. Payson and R. S. Taylor, would, in a possible 10-point estimate, show five points to the credit of the counsel for the complainant, and four points for Judge Taylor as one of the counsel for the defense, and not in any way strengthened by the arguments of his assistants.

The court says: "I find the Berliner patent invalid, because at the date of the application—June 4, 1877, Berliner had not made the invention covered by the patent issued to the American Bell Telephone Company, November 17, 1891."

It is not necessary to call extended attention to Judge Brown's decision, a reprint of which can be found in its entirety in the electrical papers of March, 1901. The conclusion of the court's opinion takes us back, however, to the work of others who were even prior to Berliner in developing an instrument for the transmission of speech, which would be louder and broader in its effect than the telephone.

The court says: "The patent does not disclose or suggest any material other than metal or metallic electrodes, and it is not proven that the metallic electrodes are generally suitable for practical use in a speech transmitter. The court holds that the conception of Edison, of the use of carbon for speech transmission, preceded Berliner's conception of the use of solid metal electrodes, and that from his first conception Edison diligently proceeded upon a line of experiments that led to an invention of remarkable character, which borrows nothing from Berliner and has no substantial resemblance to what is shown in the Berliner patent, and cannot be identified with it by any ingenious use of language."

Still, in the face of this strong, reasonable and wise judgment, the American Bell Telephone Company, on application, was granted an appeal to the Circuit Court of Appeals, where the case is now pending, and from which court I understand we can look for a decision in the very near future.

Is it possible, in the face of the evidence presented, and the absolute proof of what had preceded Berliner, that any court can or will, in its wise judgment, reverse the opinion of Judge Brown? We must, of course, appreciate that the influence of the Bell company, no matter of what character, has ever been so great that until the advent of the Independent telephone movement, with the expiration of the Bell patent, it overcame every obstacle in its path. Not only was it strong in its own home, but also at Washington, in the Patent Office and the Supreme Court, where—it will be remembered—in the government suit for annulment of the patent, two of the Supreme Court judges, for personal reasons, thought that it would be unwise for them to sit in judgment—thus losing to the rights of the common people, in a case of such vital importance, their judgment of questions involved, and which judgment might have sustained Judge Carpenter in his decision.

Should the Circuit Court of Appeals reverse Judge Brown's decision, the patent is then in full force, and only the Supreme Court of the United States can determine the rights of either party. Will they elect to do this on technical grounds, or, in the common interests of the people, is a matter to be determined. My understanding is that the Circuit Court of Appeals is the final court in patent litigation, other than on those points mentioned. Technical differences will unquestionably occur should the Circuit Court of Appeals differ from Judge Brown in his judgment of the rights of the defense. And should the Supreme Court of the United States sustain the Circuit Court of Appeals in their reversal of Judge Brown's opinion, then the Independent Telephone companies can shut

1. Abstract of paper read before the Interstate Independent Telephone Association at Chicago on December 11, 1902.

up shop for the period of time between the rendering of that decision and the expiration of the Berliner patent, unless the verdict of the court be so modified that this unfortunate condition can be obviated. If the decision rendered is without let or hindrance, the Independent telephone people may be possibly allowed to continue in business by the Bell company on some equitable arrangement as to rentals, royalties, and matters of like character. If this condition were possible, I doubt if the Independent properties would realize enough financially to make the fight worth while; and we can safely assume, from the experiences which we have had with this gigantic competitor in the past, that there will be no mercy shown in the future.

Bell Telephone Output.

The American Telephone and Telegraph Company reports its output of instruments for the month and year ended December 20th as follows:

December.	1902.	1901.	1900.
Gross	84,095	92,732	63,196
Returned	33,121	34,688	23,593
Net.	50,974	58,044	39,603
Year ended December 20th			
Gross.	1,078,517	960,055	683 956
Returned	453,803	386,861	311,645
Net	624,714	573,194	372,311
Total outstanding, December 21st	3,150,320	2,525 010	1,839,568

Power Development on the Genesee River.

A power project of no little extent is being carried out at the Lower Falls of the Genesee River, in Rochester, N. Y. This work is being done by the Rochester Gas and Electric Company, which purposes to develop 12,000 horsepower eventually. At the present time the Lower Falls of the Genesee are made to drive some 35 arc-lighting machines, but the present development throws all previous attempts into the background.

The available head at the Lower Falls during all seasons of the year is never less than 96 feet, and the volume of water is always more than sufficient. The forebay is 14 feet deep and extends a considerable distance above the falls on the east side. The bulkheads are massive and calculated to resist the greatest flood pressure that may be brought to bear upon them. At the upper end of the forebay are the regulating gates, also of very heavy construction. From the forebay two large steel penstocks convey the water to six undershot turbines installed in the power house below. These penstocks, which are 11 feet in diameter (one now nearly finished) will extend down underneath the floor of the power house, each one dividing so as to supply three twin turbines. These turbines are rated at 2,100 horsepower each, hence the total rating of the six to be installed is seen to be 12,600 horsepower. A two-phase alternating-current generator will be direct-connected to each one of the turbines.

The power station, housing the installation of turbines and generators, is well designed and was constructed under the personal direction of George A. Redman, superintendent of the company. The new building is upward of 100 feet long, and takes in the building there at present, which contains the existing arc machines. The new part will be 47 feet wide. The foundations are sunk into the solid rock in the bed of the lower river, and are placed in solid concrete. The west wall is eight feet thick for a considerable distance above the foundation. Then it tapers, by steps, until it is three feet at the top, which is over 100 feet from the level of the river. The south wall of the station is formed by the solid rock of the precipice, which has been concreted to prevent shelving.

The tailrace which will carry away the waste water after it leaves the turbines is in itself a considerable work. It is floored with concrete and for a portion of its length has been excavated from the solid rock.

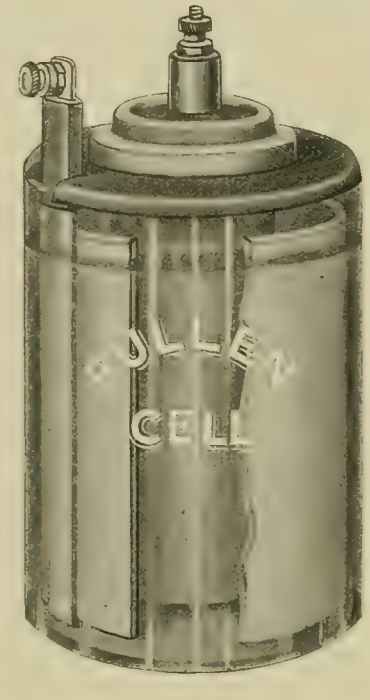
Pennsylvania Electric Railways.

The annual report on railways in Pennsylvania prepared by the State Bureau of Railways contains some interesting statistics of the capital stock, funded indebtedness, liabilities, assets, cost of construction and operation of the 97 electric-railway corporations in the state. The total capitalization, as indicated in the report for the year ended June 30, 1902, aggregated $60,698,238; the funded indebtedness, $36,773,200; the gross income, $29,001,741; the mileage, 2,175. Operating companies with large amounts of outstanding stock included the Conestoga Traction Company, $4,000,000; the Harrisburg Traction Company, $2,000,000; the Lehigh Valley, $2,654,000; the Pittsburg Railways Company, $5,000,000; the Scranton Railway Company, $3,000,000; the Wilkesbarre and Wyoming Valley Traction Company, $5,000,000, and the Union Traction Company of Philadelphia, $10,500,000. Of the total funded debt of $36,773,200, the Lehigh Valley Traction Company had $3,000,000, the Pittsburg Railways Company $4,579,000, and the Scranton Railway Company, $3,000,000. The total liabilities aggregate $15,698,575, making a total of capital and liability of $112,770,013.

The Chicago Record-Herald estimates the value of electrical apparatus and supplies manufactured in Chicago during the year 1902 at $16,500,000.

Pullen Primary Cell.

The Pullen primary battery, illustrated herewith, has a low internal resistance and can be used to operate everything electrical that requires a battery either in closed or open circuit. Where a light, powerful and efficient battery is wanted, this cell, it is claimed, will be found unequaled. The cells are made in three sizes, giving on normal discharge rate, three-fourths, one and 1¼ amperes, respectively, at two volts, the capacities in watt-hours being 40, 80 and 160. The cells can be used in either closed or open circuit, such as for bells, burglar alarms, telephones, electric clocks, carriage lamps, phonographs, fan motors, dental engines, gas-engine ig-



PULLEN PRIMARY CELL.

nition in automobiles or launches, fire and police signals, railway signals, miniature lamps for Christmas trees and candelabra, X-ray outfits, electrotherapeutic work, etc. These cells can be recharged the same as a storage battery a number of times, the porous cup being positive. The solution of the Pullen cells can be congealed by the addition of a chemical compound Solidium, which makes them better for portable work, without materially changing the efficiency of the cell. The cell is manufactured by the Leon W. Pullen Electric Company of 613 Chestnut Street, Philadelphia. The company also puts out battery fan outfits which run from 40 to 160 hours at 1,200 revolutions a minute on two cells.

New French Accumulator.

Paul Schmitt, a young French engineer, has invented a new accumulator, which, according to an account in La Revue, Paris, promises to be eminently successful. Unlike all of the accumulators manufactured up to the present, in which the plate forms only a single compact and rigid mass, the plates of the Schmitt apparatus, made of a multitude of grains of an active matter which repose on each other without tie or welding, are kept between two rigid walls which are perforated over their entire surface by holes arranged in such a way that the electrolyte can circulate freely between them. The conducting core of the electrode is composed of horizontal bands or plates of antimonial lead of variable width and length, according to the importance of the accumulator and the use to which it is to be put. These plates, about one centimeter's distance from each other, are united at their extremities by a vertical band of the same width, constituting a side of the frame of the electrode, of which the upper plate supports the connection. In order to prevent rupture of the horizontal plates at the junction with the vertical band, there is placed on the casting, under the connection, a partition on the surface of the plate and in the middle of its thickness, which gives to this plate great solidity and great conductibility.

The rigid, perforated walls are doubled and joined in such a manner that the holes of one are opposite the solid part of the other, which, while allowing the liquid to flow freely, absolutely prevents the passage of the active matter. The separation of the two systems of double walls or cheeks of the electrode is kept constant by means of horizontal plates, which prevents all settling of the grains constituting the active matter. This arrangement constantly assures a perfect distribution of the electrolytical action.

An accumulator of the above type which will give a current strength of 32 amperes for a period of three hours, weighs 1,800 grams, of which weight 1,260 grams is active material. This apparatus has but two plates, a positive and a negative, each of a thickness of 15 millimeters, separated by a space of two millimeters. The total thickness of the apparatus, wall of tank included, is 35 millimeters, its width, 10 centimeters, and its height 16 centimeters. An accumulator of the same capacity manufactured with compact active matter, weighs twice as much as the above.

Waterpower Project Near Vancouver.

An important waterpower plant, by which electricity will be furnished to Vancouver, B. C., and New Westminster, 12 miles distant from Vancouver, is under construction. The waterpower for generating the current is to be furnished from an artificial lake to be formed by the waters of Lakes Coquitlam and Beautiful, situated 2½ miles apart, the former being 35 feet above the other, and the two to be connected by a tunnel. The dam which will form the lake will be located upon a bed-rock foundation across an available stream, whose bed will form part of the lake. In seeking for a location where the dam could be set on solid rock, several preliminary shafts were sunk. When the proper locality was found tunnels were run under the stream and the site thoroughly prospected over the bedrock. In doing this alone, 500 feet of tunnel were run. At present a temporary dam is being put in, so as to enable the company to carry off the water by flume while the permanent dam is in course of construction. This permanent dam at the chosen locality will be 405 feet above sea level. It will be 300 feet long, 50 feet high, 35 feet wide at the base and taper to eight feet wide on the top. Besides this work, a gang of men is employed cutting a terrace out of the face of the rock to form a site for the power house, which will be so situated that even if the big dam did give way, the rush of water would not affect it. The lake surface will be about 500 acres. The intention is to keep the water always 20 feet above the outlet pipe at the big dam. From the dam down to the power house is a drop of 400 feet in 1,600. Other men are working on the tunnel which will bring the waters of Coquitlam Lake down to Lake Beautiful. The tunnel, when completed, will be 2.5 miles long, and will have, in that distance, a drop of 32 feet.

At present all the hauling is done on a tramway by a cable line, but an electric locomotive has been ordered. This will not be used on the first section of the road from the inlet up, which is a 58 per cent. grade, but will be employed above, to haul the rock from out the tunnel. The transmission line, for which two big gangs of men are now cutting a road through the forest, will cross the inlet at Barnet. A steel cable will cross the inlet, copper being too ductile. On one side there will be a steel tower to receive the cable. The distance across is nearly half a mile.

Western Society of Engineers.

The thirty-third annual meeting and banquet of the Western Society of Engineers took place on the evening of January 6th, at the Victoria Hotel, Chicago. Nearly 100 members and guests were present. The retiring president, W. H. Finley, gave his farewell address and then introduced the president-elect, Ralph Modjeski, who formally accepted the office and turned the meeting over to J. F. Wallace, general manager of the Illinois Central Railroad, who carried out the duties of toastmaster in a very happy manner. Toasts were responded to by Judge C. C. Kohlsaat, Professor S. P. Howland of the University of Chicago, Professor Ira O. Baker of the University of Illinois, General William Sooy Smith and Captain R. W. Hunt. The following-named new officers were elected for the ensuing year: President, Ralph Modjeski; first vice-president, H. W Parkhurst; second vice-president, F. E. Turneure; treasurer, Andrew S. Allen; secretary, J. H. Warder; trustees, C. W. Hotchkiss, J. W. Alvord and B. E. Grant.

Railways in New South Wales.

O. W. Bain, electrical engineer to the Board of Railway Commissioners for New South Wales, has been on a tour of inspection of the chief railway centers of Canada. For some time past he has been visiting the railway centers of England and the Continent, with a view of gathering the latest information in the way of new electrical appliances. In discussing the railway situation in New South Wales, Mr. Bain pointed out that, at the present time, there are 4,000 miles of railway, 120 miles of electrical tramway, and about 30 miles of steam street railway in the country, all of which is controlled by a railway commission. Mr. Bain has announced that he will place an order with the Westinghouse Electric and Manufacturing Company for electrical equipment which will aggregate over $2,000,000. The equipment will consist of several 9,000-horsepower engines, signaling devices, and air brakes, with which the electric lines will be equipped.

An electrical washing machine has, according to the Budapest papers, been invented by Josef Nagy of Szegedin. With this remarkable machine the use of soap is dispensed with, the electric current being intended to take away any stain or grease. This machine is said to be capable of washing as many as 200 or 300 pieces without the assistance of an attendant being required.

CORRESPONDENCE

London Letter.

London, December 24, 1902.—The Tunbridge Wells telephone transfer to the National Telephone Company has received the official sanction of the postmaster-general. As in the agreement with the Tunbridge Wells municipality, the rates are to be kept at the minimum now charged.

In Great Britain, as elsewhere, gas and electric companies come into conflict, chiefly during the ordinary process of repairs to mains. An interesting and important case of this description has been decided between the Sandower Gas Company (Isle of Wight) and the Isle of Wight Electric Light and Power Company. The gas company claimed compensation for 110,000 cubic feet of gas, which it estimated had escaped from a damage to its mains by a workman in the employment of the electric-light company. The decision of the court against the electric-light company will no doubt instil a greater respect for gas mains in future with workmen employed by the electric-light companies, although a "short" on an electric-light main caused by a gas company workman could not be so easily rounded off in pounds, shillings and pence. The result of the action is considered to be of some importance on this side, as it is the first of its kind.

The growth of municipal generating plants in Great Britain is well testified to by the numerous additional sets which are being installed. At Bolton a new 1,500-kilowatt set has ben put into service, and at Tunbridge Wells a new 800-horsepower set was started up a day or two ago. At Bolton the engine is of the vertical cross-compound condensing type, running at 100 revolutions per minute, being coupled up to a dynamo manufactured by the English Electric Manufacturing Company. The Tunbridge Wells engine is a Willans compound, three-cylinder, direct-coupled to a Ferranti single-phase alternator, generating at 2,100 volts. Two additional boilers have also been put in at Tunbridge Wells, where the electric-lighting and power department is much more capably managed than its telephone business has been. An additional dynamo and engine have also just been installed at Bradford, and at Hastings an inspection is to be made of a similar extension.

For the past one or two seasons the quality of the papers read at the British Institution of Electrical Engineers has been complained of for their mediocrity, an admittedly quite fair imputation. This session, however, under the presidency of Mr. James Swinburne, the Institution appears to have taken a fresh lease of life, and the first two papers have been by two such eminent authorities as Professor Sir Oliver Lodge, F. R. S., on "Electrons," and Dr. J. A. Fleming, F. R. S., on "The Photometry of Electric Lamps." The nature of Dr. Lodge's contribution may be gathered from its title, as well as the fact that he gave one lecture and wrote another for the official report. At the same time he kept himself down to the level of his hearers throughout. Dr. Fleming's paper was of a more practical nature, in the truer sense of the word. In it he gave a description of an attempt to invent an incandescent standard, by means of burning the filaments a certain number of hours on an ordinary-size globe and then transferring them to a globe about four or six times as large, the use of the larger bulb, after the filament has previously solidified, allowing the candlepower to remain constant for a much longer time than had hitherto been the case. He also wished for the abolition of the term "candlepower" in place of "lamp," suggesting the eight-candlepower lamp being called one "lamp," the 16-candlepower, two "lamps," and so on. W.

New York Notes.

New York, January 5.—The State Railroad Commission held many sessions and consultations with various traction officials and citizens during last week, for the purpose of devising plans for relief from the present inadequate and inefficient service on the city's transportation lines. The first result of these conferences was announced Friday in an order effecting the Manhattan (elevated) Railroad Company. The company is ordered to put on 100 more cars in each of the months of January, February and March; to lay third tracks for express service in Third Avenue, between Ninth and Fifty-ninth Streets, in Second Avenue, between Canal and One hundred and Twenty-ninth streets, and in Ninth Avenue, between Fourteenth and Cortlandt Streets; and to run as many cars from early morning till midnight as are now run during the so-called "rush" hours. Reforms in the surface roads will next be taken up by the commission.

On Wednesday the Kings County grand jury made a presentment on traction facilities in Brooklyn, recommending that steps be taken to annul the charters of the constituent companies of the Brooklyn Rapid Transit Company, and that the city acquire and operate the surface and elevated lines. The presentment declares that present conditions are intolerable, and that the officials of the Brooklyn Rapid Transit Company had admitted they could cure the evils, but were unwilling to do so. The jury expresses the opinion that the roads could be operated at a profit on a three-cent fare basis. The presentment says that the only solution of this vexed problem of metropolitan transportation is municipal ownership and operation of the means of public travel.

The contracts for the mechanical and electrical equipment of the power houses, passenger stations and the complete underground system of the Pennsylvania tunnel have been awarded by the Pennsylvania Railroad Company to Westinghouse, Church, Kerr & Co. of this city. As the same firm is acting for the architects of the big hotel to be built at Seventh and Eighth Avenues and Thirty-second and Thirty-third Streets, it will have charge of all structural and electrical work in the hotel above ground, as well as designing and constructing the substructure which is to be the New York terminal of the tunnel. All the problems of providing access and egress for the passengers at the New York terminal, all the planning and installation of the equipment of power houses, all the details of the underground work are to be given into the hands of Westinghouse, Church, Kerr & Co., to be administered under the supervision of the engineer of the Pennsylvania railroad.

The Manhattan Transit Company is said to have purchased the entire block at Fulton and Furman Streets, Brooklyn, to be used as a terminal station of the tunnel the company proposes to construct under the East River. Charles St. Clair Drummond, the president of the company, said that the consideration was $700,000. The Manhattan Transit Company, which is said to be controlled by English financiers interested in tunnel construction, recently bought property at Park Row and Ann Street for the Manhattan terminal of the tunnel. It was said that the tunnel would cost about $6,000,000.

The conductors and motormen of the Metropolitan Street Railway Company were given an increase in wages at the beginning of the new year. The pay of the men will be regulated by their terms of service. The management of the road claims the new scale will be higher than that of any similar corporation in the country.

Topsy, the original "baby elephant," with a record of three men slain, was executed at Coney Island on Sunday, with the aid of an electric current of 6,600 volts. The elephant was chained to four posts and electrodes were carefully fastened to her right fore and left hind feet. When all was in readiness two carrots filled with 460 grains of cyanide of potassium were given her, which she promptly swallowed. Then the current was turned on and the beast died almost instantly. The current was kept on for 10 seconds to make sure that the work was finished. It is believed that the elephant's death was caused by the electric shock.

As the result of the burning out of two fuses on the main generator in the plant of the United Electric Light and Power Company, the section of the city east of Third Avenue from Fourteenth to Forty-second Streets was in darkness for 15 minutes to-night. Lights were out in eight theaters, several large hotels and clubs and in private houses, stores and advertising signs.

Among the companies of an electrical or allied nature incorporated at Albany during the week are the following of this city:

Charles L. Eidlitz Company, to install electric light, heat, and power plants; capital, $50,000; directors, C. L. Eidlitz, F. M. Dyer and Roger Lewis, New York.

New York Consolidated Die Company, to act as mechanical and electrical engineers; capital, $100,000; directors, Abednego Dewes and John Dewes, New York; R. W. Long, Brooklyn.

The New York and Long Island Traction Company (formerly Mineola, Hempstead and Freeport Traction Company) has filed a certificate with the secretary of state increasing its capital stock from $125,000 to $1,000,000. O.

Canadian Intelligence.

Ottawa, Ont., January 3.—It is said that the Canada Cycle and Motor Company is about to absorb the Canadian Motors, Limited, of Toronto, Ont. The stock of the latter concern is held mostly in Great Britain. It is a large manufacturer of electric vehicles and electric-lighting and storage batteries, and does considerable of an export trade to England.

The Cataract Auxilary Company has been granted incorporation by the Ontario government. Attorney-general Gibson of Ontario is one of the company's directors. The new company, whose head office is in Hamilton, Ont., is empowered "to manufacture, sell or purchase electric power, whether generated by waterpower, steam or other force, and to apply the same in any of the arts or sciences, or in the manufacture of any article." The capital of the company is placed at $1,000,000.

Banker R. Paine, manager of the Ontario Power Company, promises delivery of electrical energy from Niagara Falls in Toronto. Ont., by the end of 1903. The company by that time, he says, will be in a position to furnish Toronto with about 15,000 horsepower, and if more is needed, it can be had. A double pole line will be built from Niagara to Toronto, so that, in the event of one line being disabled from any cause, a second line will be available. Mr. Paine was recently in Ottawa, submitting to Hon. Mr. Blair, Canadian minister of railways, the plans of the proposed electric route. Mr. Paine said that the company's aim was to develop some 150,000 electrical horsepower.

A new copper-producing plant is projected for Shawinigan Falls, Que. This is the determination of C. K. Milburne, who is backed in the project by English and American capitalists, who are prepared to invest heavily in the production of manufactured copper in Canada. There are no copper works in the Dominion, and it is claimed that by the new electrolytic process of which Mr. Milburne holds the patents the manufactured copper can be produced at a fraction of the cost at which it is manufactured in the United States, and it can consequently be sold at a profit at half the price that is now paid for it. W.

New England News.

Boston, January 3.—At the annual banquet of the Alumni Association of the Massachusetts Institute of Technology, President Pritchett of the Institute spoke of the proposed graduate school of engineering which is to be inaugurated next year. He explained that its purpose was to bring together a small body of men capable of undertaking investigation, the work to lead to the degree of doctor of engineering. He said that in three years the Institute's registration had grown from 1,187 to 1,606, and that the time had come to decide whether the Institute's growth is to be fitted to its present limited quarters or whether it should be removed to some site still in close touch with the industrial life of the city, where it would have room for a natural growth under favorable conditions. President Pritchett announced that he believed that the time for such removal had come.

The Connecticut Railroad Commissioners' annual report shows that the electric railway mileage in that state is 517, against 317 in 1895, when the companies made their first annual reports to the commission. The companies' capital stock amounts to $23,571,248, against $8,604,240 in 1895; the earnings were $3,937,771 in 1902, against $2,232,051 in 1895; passengers carried, 91,554,028 in 1902, against 38,037,474 in 1895; taxes paid, $244,768 in 1902, against $76,522 in 1895.

The time ball on the Ames Building in Boston was officially dropped for the first time last Monday noon. Lieutenant Richardson of the United States Hydrographic Office has charge of the service. The ball is released upon a signal from Washington, D. C. When it is at the top of the staff it is 228 feet above the street and 263 feet above mean low water. It can be seen for many miles at sea and will prove of great service to mariners.

The Worcester and Southbridge Street Railway Company is planning to extend its electric railway from Fiskdale to Brookfield, Mass., a distance of about seven miles.

After 12 to 15 months' experience, the Armstrong Transfer Company of Boston has decided not to increase its equipment of electric automobiles. It will continue to use its two automobiles, but they are not wholly satisfactory owing to the difficulties in charging the batteries and in "braking" the vehicles. Superintendent Wheeler believes that electricity is preferable to gasoline or steam as a motive power, but that some improvements in the application of electricity are necessary before the company will consider it advisable to buy any more electric automobiles.

The Hartford (Conn.) Electric Light Company is to erect a building five stories high and measuring 48 by 32 feet, adjacent to its plant in that city.

One of the largest waterpowers in Connecticut is to be developed at Bulls Fall, on the Housatonic River, by the New Milford Power Company, which is building a dam 200 feet long and 20 feet deep. The water will be carried two miles through a canal 30 feet wide and 10 feet deep to a power house, where it will have a fall of 116 feet. The company expects to obtain 7,000 horsepower and will generate electricity for manufacturing, heating, lighting, and motive purposes. It is understood that the work will cost $2,000,000.

A dispatch from Northboro, Mass., states an electric-railway company has been using peat as fuel in its power house in that place. The trial demonstrated that peat would not produce as much steam as the same amount of coal in a given time, but the peat cost only $2 to $3 a ton, against about three times that price for coal. B.

Southern Developments.

Charlotte, N. C., January 3.—Definite announcement has been made that Frank Gould of New York has secured control of the Virginia Passenger and Power Company of Richmond, Va., which owns 122 miles of electric railways. The deal was concluded through the Merchants' Trust Company of New York, which will be the fiscal agent and depositary of the company's funds.

A deal has been on for the sale of the Memphis street-railway property by F. G. Jones and C. K. G. Billings. Hart Newman of Newman Brothers, New Orleans, is the prospective buyer. The amount involved is about $7,000,000. Newman Brothers already own a number of street-railway properties in the South. They regard the Memphis plant as an excellent investment.

The plant of the Brunswick (Ga.) Light and Water Company has passed into the hands of the Mutual Light and Water Company. The former concern has been in the hands of a receiver, Major W. S. Greene. Albert Fendig will be manager of the Mutual company. He has been elected president of the concern.

Major Greene has also been named as receiver for the Columbus Light and Water Company of Columbus, Ga.

The John P. Martin Company of Tampa, Fla., has secured the contract to supply electric lights to the city, and has begun operations.

The Railway and Light Company of America, of which R. L. Williams of Richmond is first vice-president, is enabled this year to pay dividends on several acquisitions where no dividends were previously paid. The Knoxville Traction Company will pay a semi-annual dividend of one per cent.; the Lexington railway will increase its semi-annual dividend from one to 1½ per cent.; the Macon (Ga.) property bought by Mr. Williams and others, will pay its first dividend of six per cent. semi-annual on preferred stock. The net earnings on the Macon property are given out at $47,378.44, with a surplus of over $15,000.

Judge W. F. Cox of Anderson, S. C., and associates are planning to develop a fine waterpower two miles from Calhoun Falls, S. C.

The government is making ready to erect a wireless-telegraph station at Key West, Fla. It is said that Havana is the objective point. L.

Texas and Mexico.

Austin, Texas, January 2.—The prospects are favorable for the consummation of a number of the electric interurban-railway projects, now on foot, during the coming year. In addition to those already mentioned in this correspondence, the authoritative announcement is made that the company which owns and operates the electric street-railway system in the city of Houston proposes to build an interurban line between that city and the town of Harrisburg, situated six miles south of there.

A syndicate of St. Louis (Mo.) capitalists has obtained a franchise from the City Council of Palestine, Texas, for building and operating an electric-railway system over certain streets of that city. The same people have obtained an option on the electric-lighting plant of Palestine.

Major C. C. Waller of Houston, Texas, who was associated with a number of Chicago capitalists in a project to build an electric interurban railway between Houston and Galveston, a distance of about 50 miles, recently applied to the City Council of the former city for a franchise, covering certain streets for the proposed road. The council granted the application, but surrounded it with so many stipulations that it has been refused.

It is announced by the owners of the street-railway lines in the city of Aguascalientes, Mexico, that the entire system is to be immediately reconstructed and electricity adopted for motive power in place of the mule. Aguascalientes is becoming an important manufacturing center, and a number of important American investments have been made there recently.

A company of local capitalists has been organized for the purpose of building and operating a street-railway system at Viesca, state of Coahuila, Mexico. Material for the proposed system has been ordered from the United States.

The Legislature of the state of Durango, Mexico, has extended the concession exempting from taxation the property of the street-railway company in the city of Durango for another period of 20 years. This company contemplates converting its system into electric lines and the making of other important improvements. H.

From the Buckeye State.

Cleveland, Ohio, January 3.—The formal reorganization of the Northern Ohio Traction Company took place on Monday of last week at a meeting of the directors at Akron. The new company is known as the Northern Ohio Traction and Light Company, and more than 95 per cent. of the stockholders voted for the change, both in name and capitalization. The company now has a capitalization of $7,500,000, whereas the old one had $3,500,000, and there will be $6,000,000 of the new stock issued. The officers of the new company are as follows: President, Henry A. Everett; first vice-president, Will Christy; second vice-president and general manager, Charles Currie; treasurer, J. R. Nutt. It is said that there is some possibility that the Northern Ohio Traction and Light Company may purchase the Akron-Canton line, which was formerly owned by the Northern Ohio.

V. A. Watkins of Aurora, Ill., R. S. Vivian, A. B. Cotton and S. J. Vinnedge, all of Chicago, are interested in a proposed electric line between Bryan, Ohio, and Fort Wayne, Ind., a distance of about forty-four miles. It is intended that the new line shall connect with the Toledo and Indiana at Bryan. These gentlemen are said to have filed a petition with the commissioners at Fort Wayne, asking for a franchise along the Maysville road for their line, and they are working on the right-of-way along other portions of the route.

J. N. Bick of Toledo has secured the contract to build the electric line from Peru to Kokomo, Ind.

The Youngstown-Sharon Street Railway Company has increased its capital stock from $600,000 to $750,000.

The Union Traction Company and the Western Ohio Railroad Company are planning to build a line from Portland, Ind., to Celina, Ohio, where it will connect with the Western Ohio.

The Appleyard syndicate has closed a deal for the lines of the Bellaire, Zanesville and Cincinnati Railway Company, which will be changed to an electric line. The deal includes immense coal interests in Belmont County.

The commissioners of Clermont County have extended the time of the Cincinnati, Milford and Goshen and the Cincinnati and Columbus Traction Company for one year from the present time.

The Cincinnati Car Company, with a capital stock of $100,000, has been incorporated by George H. Warring and others. The interests in this company are identical with those of the Cincinnati Traction Company.

The courts at Dayton have decided that the law preventing the delivery of freight in cities by traction companies is invalid. O. M. C.

Detroit, Mich.

Detroit, Mich., January 3.—Henry R. Newcomb of the Detroit Everett-Moore electric-railway and telephone syndicate is in New York getting estimates and making contracts for electric-railway supplies for the Everett-Moore people. He says that the recent sale for $1,500,000 of the Toledo and Detroit Shore Line by the Everett-Moore syndicate to the Grand Trunk and Clover Leaf Railway will cancel all obligations owing by the syndicate.

The car sheds and repair shops of the Detroit United Railway, located on Jefferson Street, were almost entirely destroyed by fire this week. President Hutchins has sent a check of $100 to the Firemen's Fund Association, in recognition of the excellent work done by the firemen.

An electric-lighting plant, to be owned by the village, will soon be erected at Laingsburg, Mich. It has been proven that the primitive kerosene-oil street lamps cost nearly as much as electricity, and the business men are using their influence to have a plant built.

The Great Lakes Engineering Company has been reorganized with capital stock of $1,500,000, with a bond issue of $500,000, and will commence at once the erection of a large shipbuilding plant in Detroit. So far as possible, electrical machinery will be used in the operation of the plant. Plate rolls, shears and punches will be operated by electricity, and electric overhead cranes will serve each shop, of which there will be 14. An 100-ton pair of shears will handle boilers and engines to and from the ships. Electric power will be furnished by three generators of 150 kilowatts each, and 30 motors will be distributed throughout the works. Electric traveling cranes of the gantry type will be used between the berths, and will be furnished by the Seaver-Morgan Company of Cleveland. The overhead cranes for shop service will be furnished by the Northern Engineering Works of Detroit. The small electric machinery has not been contracted for as yet.

The mayor of Saginaw has called to the attention of the council the fact that his city has more overhead wires than any other city of its size in the country. He considers them not only unsightly, but dangerous to life and property. The mayor is convinced that all wires within the city limits should go underground, and that the city should own its own conduits, charging a small fee for the use of them.

The business men of South Haven have subscribed $75,000 toward the construction of the proposed electric road between that point and Kalamazoo. There will be a branch to Paw Paw Lake and also an extension on the north to connect with the electric line now running to Holland. This line will be of great advantage to fruit growers, as it will traverse one of the greatest peach-growing districts of Michigan.

Former Attorney-general Fred. H. Maynard is in Washington for the purpose of arguing the case of the Detroit United Railway against the state of Michigan in the United States Supreme Court. This case involves the right of the state to compel street railroads and suburban roads when built on public highways to help maintain safety gates, and other kinds of guards at the crossings of electric and steam railways. C. G. W.

Information from Indiana.

Indianapolis, January 5.—The total capitalization of the street-railway interests in this city, under the readjustment scheme, by which the Indianapolis Terminal Traction Company leases and operates the city lines is about $25,000,000. President McGowan has called architects into consultation, and the work on the interurban passenger station and the nine-story office building will be begun at once. The work of constructing a freight station and a loop will be pursued at the same time. The buildings on a portion of the site will be razed during January. Only 14 months remain in which to complete the work, and President McGowan says cars will be entering the loop and station at the end of that time. The control of the Indianapolis street-car system is vested in the bondholders of the Indianapolis Street Railway Company and the stockholders of the Indianapolis Traction and Terminal Company. These interests are the Widener-Elkins interests. The manipulation and consummation of the lease and readjustment of the debts secured by bonds and securities is regarded as a master stroke of clear-sighted business sagacity, in which President McGowan has played the prominent part.

The Indiana and Illinois Traction Company, with headquarters in Muncie, was incorporated during the week. The initial capital is placed at $10,500. The purpose set out in the articles is to buy, construct, rent or otherwise acquire lines and systems of interurban railroads in Indiana and Illinois. The directors are L. G. Holmes, J. G. Leffler, A. E. Needham, L. A. Gutherie and others. Some of these men are connected with the Portland and Muncie interurban scheme, and this gave rise to the rumor which is denied, that the Union Traction Company was behind the enterprise. The counties through which the proposed lines of this new company are to run are Marion, Montgomery and Fountain in Indiana, Vermillion, Champaign, Pratt, Macon, Sangamon, Morgan, Dewitt, McLean, Logan, Livingston, Grundy and Will, in Illinois. The principal towns and cities in these counties will be connected.

The commissioners of Huntington County have granted a 50-year franchise to the Fort Wayne and Southern Traction Company for a line between Huntington and Marion, by way of Warren. All necessary franchises in Huntington County have been obtained.

A company is being organized by citizens of Marion and Kokomo to build an electric line between the two cities paralleling the Clover Leaf Railroad through Swayzee and Converse, and a spur from Converse to Wabash.

The Evansville and Mount Vernon Traction Company has asked for a franchise to enter Mount Vernon. When granted, all arrangements for building the road will be completed. Six lines are now projected, with Evansville as the central point. Two or three will be in operation during the present year.

A Chicago firm is reported to have entered into an arrangement to finance the Muncie-Newcastle line, and will personally direct the work of construction.

The frequency of accidents on surface electric lines is provoking much criticism, and a demand is made that the blame be rightfully placed. The investigation showed that the motorman killed on the Union Traction Company's line in a collision with "Martha," a private special car, was on time and had the right-of-way, and the accident was due to the management sending out the special.

The inside-working electricians of Indianapolis are out on a strike for a raise in wages from 32½ cents an hour to 40 cents an hour. It is thought the contractors will acquiesce in a compromise at 35 cents an hour for all journey electrical workmen who are up to a certain standard in proficiency. The work has been completely tied up, and 250 men are idle. F.

Northwestern Notations.

Minneapolis, January 3.—J. A. Johnson of Fargo, N. D., will establish an electric-lighting plant at Ellendale, N. D., and expects to have it in operation by spring.

The General Electric Company of Duluth, Minn., announces a reduction in rates on electric lighting, ranging from 15 to 25 per cent. The company has made an expenditure of $300,000 in rebuilding its power plant during the last 18 months.

The Light, Heat and Power Company of Northfield, Minn., announces a change of rates, charging by the hour for lights instead of the month to all except those on meters. The charge is one-half cent per hour for each 16-candlepower lamp and five cents per hour for each arc. The company issues a statement to the patrons in which it explains that it has made but one dividend in 10 years, which it attributes to furnishing more light than is paid for, and extra hours with no additional charge.

The citizens of Moorhead, Minn., will vote on authorizing the council to adopt a franchise for an electric street railway to M. E. McDonald, George H. Rice, R. H. Patterson and Frank E. Donnelly, who also have a franchise for a line in Fargo, just across the river.

W. P. Fowler of Morris, Minn., has offered to accept the village order of the village in payment for the electric-light plant, which he owns, if the village will purchase the plant. S. Stewart, who has a small plant in Morris, has made application to the council for a general franchise to furnish light to all parts of the village.

Outside parties propose to develop power from the Zumbro River at Millville, Minn., and generate electricity to be transmitted to Plainview, Minn., and Winona, Minn. A similar plant is projected on the same stream near Mazeppa, Minn., the power to be transmitted to Rochester, Minn.

The patrons of the Woodland line in Duluth, Minn., complain bitterly of inadequate service. On Christmas Eve the crowd after the theater was so great that the single car was jammed to the uttermost, and a number had to get on the roof, although the night was bitterly cold. On Christmas night the single car after the theater was utterly inadequate to carry but half the crowd, and so, in desperation, the people took possession of the car and refused to allow it to proceed until a second car was ordered out to carry the rest of the people. The motorman started the car in defiance of the orders of the crowd, and he was promptly thrown off the platform. He called a policeman, but the latter was unwilling to go against the crowd single-handed and found something to do elsewhere. After a considerable wait, the company sent out another car and the Woodland people all got home.

An expert engineer has examined the electric-light plant at Fairmont, Minn., and reports that it would require about $15,000 to put the plant in a modern state.

George E. Haney, the owner of the electric-light plant at Manson, Iowa, contemplates adding a heating plant to the system.

The Twin City Rapid Transit Company has completed the new auxiliary steam plant in Minneapolis, adding 1,500 horsepower to the motive power of the system and enabling the company to have sufficient power at the rush hours of the day, when the electricity from the waterpower is limited. R.

PERSONAL.

William P. Bowring, secretary and treasurer of the C. H. Worcester Company, Marinette, Wis., was among last week's visitors to Chicago.

E. E. Torry, former superintendent of telegraph for the Michigan Central Railroad Company, will accept a similar position with the Mobile and Ohio Railroad, with headquarters at Jackson, Fla.

B. L. Hagemann, electrician in charge of the Necedah (Wis.) electric-light plant, has resigned that position to assume the management and become financially interested in an electric-lighting establishment at Bedford, near Cleveland, Ohio.

Professor F. B. Crocker, head of the department of electrical engineering at Columbia University, has been chosen to act on the advisory board of the American School of Correspondence of Chicago and also to prepare some of its electrical papers.

Robert C. Taylor, late chief engineer and master mechanic of the Twin City Rapid Transit Company of Minneapolis, was presented a non-magnetic gold watch by the employes on Christmas Day. Mr. Taylor went with the Brooklyn Rapid Transit Company as chief engineer on January 1st.

J. M. W. Burton, late superintendent of the Detroit, Plymouth and Northville (electric) Railway Company, has been promoted to the superintendency of the new Boland electric railway in progress of construction between Battle Creek and Jackson, Mich. E. Richmond, chief engineer of the power house at Plymouth, Mich., has been appointed to succeed Mr. Burton.

George W. Jackson, operating engineer for the Illinois Telephone and Telegraph Company of Chicago, gave a New Years Eve dinner to a number of his friends at Vogelsang's. At 7:30 p. m. the party boarded a tally-ho coach and enjoyed a five-mile ride over the West Side boulevards. Three hours later the guests sat down to dinner. In the party were 18 gentlemen.

A farewell dinner was given at the Union League Club, Chicago, on the evening of January 7th, by representative electrical and railway men, in honor of Mr. Frank Hedley, who leaves next week for New York city to take up his new duties as general superintendent of the Interborough Transit Company. Among those present were Mr. Hedley, his successor, E. C. Noe, B. E. Sunny, Louis A. Ferguson, B. J. Arnold, Edward B. Ellicott, A. C. Frost and Theodore P. Bailey. Letters of regret were read from Clarence Buckingham, John M. Roach, L. J. Wolf, C. A. Knight and others.

James Lyman has been appointed to succeed E. C. Noe as engineer of the Chicago office of the General Electric Company, Mr. Noe having resigned to accept the appointment of general superintendent of the Northwestern and Lake Street Elevated Railroad Companies. Mr. Lyman has been Mr. Noe's assistant, and has been in the Chicago office of the General Electric Company for about two years. Previous to that time he was in the company's works at Schenectady. He is a Yale graduate, a life member of the American Institute of Electrical Engineers, and a man of ability and experience.

Jackson I. Case, son of Jerome I. Case, the wealthy thrashing machine manufacturer of Racine, Wis., died suddenly on January 6th from a complication of diseases. Mr. Case was mayor of Racine from 1891 to 1895, being the youngest mayor in the United States. He was born in 1865, and in his business career was connected with many of the most important enterprises of his city. He was also well known in the electric-railway field, having built and organized the street-railway properties at Racine and Green Bay, Wis. He had been president of the Electrical Installation Company of Chicago since its inception in 1893, and was also an officer of the J. I. Case Plow Works and J. I. Case Thrashing Machine Company of Racine. Mr. Case is survived by a widow and four sons.

The funeral of John J. Dickey occurred on January 2d from the family residence in Omaha, Neb. In addition to a large number of local persons of prominence, about 50 Western Union officials from all over the country attended the service, which was conducted by the Rev. John Williams of the Episcopal Church. The honorary pallbearers were Count Creighton, E. M. Morsman, George F. Bidwell, Senator Millard, Belvidere Brooks, Theodore P. Cook and General Manderson. Among the telegraph officials from other cities were General Superintendents Cook of Chicago and Brooks of New York, District Superintendents C. H. Bristol of New York, F. H. Tubbs of Chicago, I. N. Miller of Cincinnati, G. J. Frankel of St. Louis, and L. McMichael of Minneapolis, and Assistant Superintendents Lloyd of Chicago, Levin of Minneapolis, and Horton of Denver.

ELECTRIC LIGHTING.

The United Electric Company of Jersey City, N. J., has been granted a contract for lighting the streets of that town for five years with electric light.

The Electric Light Company of Lumberton, N. C., which is to have a new plant, is in the market for engines, dynamos, lamps, wire, etc. R. E. Lee, attorney, may be addressed.

The Kimmey Electric Light Display Company of Jersey City, N. J., has been incorporated with a capital of $1,000,000. The incorporators are John Kimmey, Ives Horton and Charles A. Stader.

The National Consolidated Company of Middletown, N. Y., has been incorporated to manufacture gas and electricity for villages in Orange and Sullivan Counties. It is capitalized at $50,000, and its directors are Charles M. Priggin and G. R. Larwill, Brooklyn, and Henry Flov. New York.

The Burlington (Vt.) Light and Power Company, with a capital stock of $1,000,000, and M. W. Stroud as president, has acquired the interests of the American Gas Company in the plants of the Burlington Gas Light Company and the Consolidated Electric Company, and expects to own the plant of the Vermont Electrical Company.

The National Electric Light Association began the new year with 445 active members, an increase of 264 since the Cincinnati meeting of last May. Miss Harriet Billings, assistant secretary of the association, says that much of this increase is due to the manner in which the association has been treated by the electrical journals.

ELECTRIC RAILWAYS.

The General Electric Company is building 64 new and complete equipments for the Central London Railways. This is one of the largest electric-railway contracts ever received from abroad.

The residents of the southwestern portion of Chicago are seeking wider transportation facilities, and have begun an agitation for the extension of a branch of the South Side elevated road in that direction.

The Augusta-Aiken (Ga.) Railway and Electric Company, with a capital of $2,300,000, has been incorporated in New Jersey. The incorporators are Kenneth K. McLaren, H. O. Coughlan and Louis B. Dailey.

After many obstacles and delays it is now positively stated that the work of construction is to be immediately begun on the Buffalo, Niagara Falls and Rochester Electric Railway, better known as the Ridge Road trolley line. The company has finally secured a franchise from the State Railroad Commission. The capitalization of the road has been increased to $3,500,000.

George E. Mansfield of Boston, representing eastern capitalists, has been for some weeks in Oklahoma and Kansas seeking favorable places for the investment of capital in the construction of electric railways or other electrical plants. Mr. Mansfield reports favorably on the building of electric roads in Oklahoma City and Shawnee, and has the promise of a franchise in the latter place.

The Union Traction Company of Indiana, with direct lines from Muncie to Indianapolis and other points, has been using an electric snowplow to break the drifts along the 180 miles of the company's tracks, and so far has prevented any tie-ups on account of snow. The plow, though small, is driven by a 150-horsepower electric motor, one of the most powerful used specifically for this purpose.

Articles of incorporation have been issued to the Bloomington and Joliet Electric Railway Company. The company is authorized to build a series of trolley interurban roads which will connect the principal cities of Illinois. The company is licensed to construct a line parallel to the tracks of the Chicago and Alton Railroad, between Bloomington and Joliet, connecting at Joliet with the electric line now running into Chicago.

At a meeting of the Chicago City Council on January 5th the corporation counsel and the judiciary committee were directed to prepare an ordinance which should provide for interchangeable universal transfers in the city between the different street-railway companies. Mr. Dever, who introduced the resolution, quoted from the report of Bion J. Arnold to the effect that universal transfers would enhance the growth and prestige of Chicago. At the same meeting Alderman Foreman caused to be passed a resolution directing the commissioner of public works not to issue permits for further construction of any tunnels, subways, or conduits until further ordered by the council. The purpose of the order is said to be to stop further work on the Illinois Telephone and Telegraph Company's tunnels until the council has acted on the recommendations of Mr. Arnold in his report on municipal subways.

SOCIETIES AND SCHOOLS.

Fire almost completely destroyed the electrical laboratory of the Rensselaer Polytechnic Institute at Troy, N. Y., recently. The loss is estimated at $30,000.

The latest catalogue of the American School of Correspondence at Armour Institute of Technology, Chicago, is a pamphlet of 76 pages and contains, besides a list of the faculty members and full descriptions of the courses offered, a list of graduates. In the introductory matter of the catalogue are stated the aims and purposes of the school, which has dropped all efforts to secure enrollments through agents and is appealing to the public for patronage through the medium of the press. The catalogue also contains some general information and sample students' examination pages and drawings, showing the instructor's corrections.

PUBLICATIONS.

A mailing card calls attention to the merits of the Garrigus mechanical boiler cleaner, handled by the Mechanical Boiler Cleaner Company of Chicago.

The Hunt electric storage-battery locomotive manufactured by the C. W. Hunt Company of West New Brighton, Staten Island, N. Y., is described in a recently issued folder.

An illustrated circular distributed by the Incandescent Electric Light Manipulator Company, describes its lamp and socket manipulators, handy cleaner and Morse and Webster lamp adjusters.

"An Electrochemical Paradox," a paper read by Carl Hering at the recent Niagara Falls meeting of the American Electrochemical Society, has been reprinted, with discussion, in pamphlet form, from the transactions of the society.

The Shelby Electric Company of Shelby, Ohio, has recently opened up a new arc-lamp department, in connection with its factory, and a recent pamphlet describes the direct and alternating-current enclosed-arc lamp. Both standard and also miniature lamps, the latter employing the smallest carbon ever used in an arc lamp, are illustrated and described.

The Crocker-Wheeler Company of Ampere, N. J., issues a 20-page bulletin on its semi and fully enclosed motors. All the principal features of construction are explained in detail and views are shown of the parts of controllers and of complete motors installed in different ways in a great variety of machine tools, hoists, pumps, presses, etc.

The Secor system of power is described in a pamphlet recently issued by the General Power Company of New York city. This system combines an automatic kerosene-oil engine and an electric generator, and the results obtained are said to be very satisfactory. Plate illustrations are given of various sizes of engines and also of several direct-connected units.

MISCELLANEOUS.

As indicating the material and industrial development of India, it may be mentioned that the number of miles of telegraph in operation in 1857 was about 1,000, and in 1900 52,909, with 170,666 miles of wire and transmitting during that year (1900) 6,237,301 messages.

The Fifth Industrial Exhibition of Japan, to be held at Osaka, this year, is to cover nearly twice as much space as was covered by the fourth exhibition, given at Kioto in 1896. It is to be opened on the first of March next, and on the first of July the presentation of awards and diplomas will take place. Many of the exhibits will be brought to St. Louis at the close of the Japanese Exposition. This country will be well represented at Osaka.

Thomas A. Edison says that the year 1903 will see the solution of many great problems in the field of science, especially in the electrical field. In speaking of his own work he is thus reported: "For myself, my storage battery, on which I have worked for years, will be put on the market in January. It solves the traction problem, and its introduction means that the horse will have to go. I expect to give up practical invention for two years. I am going to experiment. I prefer not to say what my experiments will be. Yes, trying to get electricity direct from coal is one of them."

A magnetic drawing board and T-square is being introduced in England which may be worthy of note. The board in question is fitted with a rubbing strip of soft iron along the working edge, while the T-square has a number of small horseshoe magnets let into the stock, which are attracted by the iron strip aforementioned, and make the square cling to the board. The draftsman can, therefore, have both hands at liberty for his work, without requiring to use one to steady his T-square. The boards and squares are made in all the usual standard engineering sizes. The iron strip, it may be added, is ground to a true surface, and the T-squares are made of mahogany.

A dispatch from Austin, Texas, says the price of Beaumont oil has gone so high that its further use for fuel is practically precluded. In many instances

consumers are having a hard time in enforcing existing contracts, and that uncertainty in fuel supply is causing many manufacturers to go back to the use of coal, after thousands of dollars have been expended in equipping plants with oil burners and other requirements. The lignite coal-mine operators in Texas and Indian Territory are preparing to reopen their properties on an extensive scale. Most of these coal mines were forced to close down or reduce their output when oil came into general use for fuel throughout Texas, Louisiana, and other regions tributary to the Beaumont fields.

TRADE NEWS.

The American Electric Heater Company of Detroit, Mich., has largely increased its facilities by moving into its new factory at Nos. 17 and 19 Spencer Street.

The Nebraska Electric and Fixture Company has been incorporated. The incorporators are Paul W. Horbach, Eugene J. Sullivan and Albert G. Munro. The capital stock is $50,000 and the place of business Omaha, Neb.

The Ironton Engine Company has acquired the rights and business of the Allfree Engine Company, and will hereafter build Allfree engines in all sizes, styles and types, in new and modern shops which are under way in Ironton, Ohio.

Owing to its constantly increasing business the D. M. Fulmer Lumber Company of Florence, Wis., has found it necessary to make its headquarters in Chicago. The company, therefore, requests that all correspondence to it be addressed to the Merchants' National Bank Building, Chicago. The Fulmer company makes a specialty of white-cedar poles and has supplied many telephone, telegraph and electric-light companies. Its yards are located at Florence, Wis., Van Buskirk, Wis., and Wellington, Mich.

It is stated by persons familiar with the trade that certain American producers of insulating material for electrical appliances, who sought entrance to the German market, have made the mistake of giving the exclusive sale of their product to one German electrical manufacturing company, which would import all it could use itself, but not make any special effort to extend sales among other firms or companies, which are naturally its competitors. If, it is added, American exporters would open a direct wholesale branch in, say, Berlin or Cologne, they would secure thereby a large part of the German trade, particularly that of the numerous small electrical manufacturers, who do not like to be dependent for any part of their material upon their more powerful competitors, and so resort to cheap, inferior insulating material, of European origin.

BUSINESS.

The Worcester-Munising Company of Munising, Mich., which owns the timber on about 40,000 acres of land near Munising, is running three camps this winter, employing 200 men and 36 teams, cutting poles for the Western Union Telegraph Company on a contract which calls for the delivery of 67,000 poles 25 feet long and upward. The stock of this company is handled by the C. H. Worcester Company, Marinette, Wis. The Worcester Lumber Company of Chassell, Mich., in connection with its sawmill operations, will cut a small stock of cedar poles. This stock will also be handled by the C. H. Worcester Company.

Buyers of electrical instruments will be interested to know that the Jewell Electrical Instrument Company of Chicago has located a downtown office at 1703 Fisher Building. Some months ago the Jewell company moved its factory to Union Park Court, on the West Side, but since that time the business of the institution has increased to such an extent as to necessitate an office in the heart of the city and somewhat easier of access. The Jewell company's "baby" instruments have met with marked favor on the part of the trade. The company's new type Jewell ammeter and voltmeter has a black japanned iron case, nickeled front, is "dead beat," with permanent magnet and high-grade movement. A new catalogue and price list is just out, too, which the Jewell company will send on application.

The Standard Pole and Tie Company of New York city states that the year of 1902 was one of exceptional activity in the pole and cross-arm line, not to mention large orders which it handled for ties. Although the company has received many large orders from telephone and electric-light companies, it has paid more attention to the equipping of street-railway lines, and points with pride to some 20 or more railways in Ohio, New York, Virginia and Massachusetts which it has supplied. Although the company is composed practically of southern lumbermen, as far as its products are concerned, it has been able to compete very successfully with northern cedar, even in northern cedar territory. It believes its success is due to the extraordinary care it takes to carry out its contracts, as well as to the superior quality of its goods, which are said practically to sell themselves.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office), December 30, 1902.

716,855. Gas Igniter. Hugo Bergner, Frankfort-on-the-Main, Germany. Application filed August 16, 1902.

An electromagnet enters into the operation of the device.

716,867. Means for Measuring the Energy of Three-phase Alternating-current Circuits. Frank Conrad, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed February 14, 1901.

Combined with three interconnected electric circuits, the voltage of any one of which is equal to the resultant voltage of the other two, are two field windings connected respectively across two of the circuits and two field windings respectively traversed by current proportional to that of the two circuits, and jointly traversed by current proportional to that of the third circuit.

716,868. Ground-detector for Electric Circuits. Frank Conrad, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed July 12, 1901.

The ground-detector comprises a movable vane connected to the ground, a number of stationary vanes located in inductive relation to the movable vane and condensers, the conducting elements of which are respectively short portions of the circuit wires and corresponding lengths of metal supported thereby, the latter being connected to the stationary vanes.

716,869. Electric Time Switch. William B. Coulter, Waterbury, Conn. Application filed February 24, 1902.

A clock mechanism is arranged to release a weight which opens the switch.

716,871. Locomotive-cab Electric-railway Signal. Elisha B. Cutten, New York, N. Y., and Arthur C. Fraser, Brooklyn, N. Y., assignors to Arthur C. and George H. Fraser, Brooklyn, N. Y. Application filed June 22, 1891.

A contact wheel is adapted to be displaced bodily by contact with a contact plate along the track.

716,889. Electric Lamp. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 18, 1901.

See page 35.

716,891. Reflector. Horatio C. Hawks, Newton, Mass. Application filed October 17, 1901.

A reflector for electric lamps is described.

716,939. Photographing. Jean Schmidt, Frankfort-on-the-Main, Germany. Application filed December 24, 1901.

The process consists in exposing the object to be photographed to a reflected artificial light of no effective actinic strength, then to a powerful white light of relatively high actinic effect, and finally to a strong instantaneous light of great actinic effect.

716,940. Flashing Apparatus for Use in Taking Photographie, G. M. B. H., Frankfort-on-the-Main, Germany, assignor to Society Vertrieb von Schmidt's Electr. Beleuchtungsapparat für Photographic, G. M. B. H., Frankfort-on-the-Main, Germany. Application filed March 29, 1902.

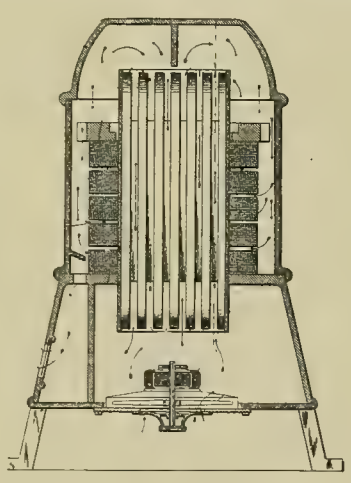
The described flashlight apparatus for use in photography consists of a screen having a reflecting surface, a series of incandescent lamps arranged on the inner edge of the screen, and an arc lamp arranged in the focal axis of the screen.

716,944. Sanding Mechanism for Cars. Nicholas Seibert, Malden, Mass. Application filed May 5, 1902.

A rotary motor is included in the electrical connections and is adapted to impart circular movement to the sanding devices.

716,953. Electric Elevator. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Company. Application filed October 29, 1894.

The inventor describes the combination of a working motor, one or more operative line circuits, and an electrically controlled choking shunt for the working motor automatically closed on failure of an operative line-circuit.



NO. 717,006.—TRANSFORMER.

716,955. Method of Simultaneously Transmitting and Receiving Space-telegraph Signals. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

The method consists in generating the electromagnetic signal waves to be transmitted by producing electric vibrations in an elevated transmitting conductor or conductors, in receiving the energy of signal waves to be received in other elevated conductors and in conveying the energy so received to a conductor or branch that is conjugate to the transmitting conductor or conductors.

716,971. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed May 7, 1902.

The instrument embraces a "movement," a field magnet for the movable element thereof and a surrounding casing provided with interlocking parts, whereby the instrument is prevented from moving when in the casing, by the interlocking action of the parts and the casing.

716,974. Electric Lamp. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 5, 1902.

See page 35.

716,978. Section Insulator. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston, Mass. Application filed August 25, 1902.

In the insulator are combined head pieces to which the line terminals are detachably secured, a center piece interposed between the head pieces, insulators connecting the center piece with the head pieces, a non-conducting piece interposed between the head pieces and provided with auxiliary terminals co-operating with the line terminals, and means for securing the non-conducting piece in operative position.

716,988. Overhead Electric Trolley Wire. Joseph P. Cribb, Southsea, England. Application filed September 8, 1902.

An appliance for interrupting the passage of the current on the breaking of an overhead electric trolley wire is described.

716,995. Electric Railway. Ed W. Farnham, Chicago, Ill. Application filed April 11, 1902.

One claim reads: In an electric railway, in combination, a feeder main, and a contact-rail made up of a plurality of blocks each block comprising a fixed contact-rail, a movable contact-rail, a switch device oscillatory upon a vertical center and having a connection with the movable contact-rail, whereby the switch device is mechanically set by the movement of the movable rail, and means for electrically restoring the switch device to a position of rest.

716,996. Electric Clock. Martin Fischer, Zurich, Switzerland, assignor to Actiengesellschaft Magneta Electrische Uhren Ohne Batterie and Ohne Contacte, Zurich, Switzerland, a firm. Application filed September 3, 1901.

A reversible-current subordinate clock has combined, with the escapement wheel and its anchor, an electromagnet and a right-angular permanent magnet.

717,006. Transformer. Svend E. Johannesen, Edgewood Park, Pa., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed October 30, 1902.

In the transformer are a housing, a core and coils within the housing, air-passages between the coils, means for dividing the air passing between the coils into a number of return currents, and an air passage or passages along the core for the return currents. (See cut.)

717,009. Method of Making Electric Conduits. Amanda M. Lougee, Boston, Mass. Application filed May 31, 1902.

The method consists in preparing different vulcanizable solutions, repeatedly dipping the armor or other articles into the solutions, certain of the solutions when vulcanized giving a hard layer or coating, and others thereof a soft layer or coating, and then applying vulcanizing heat to the whole.

717,015. Automatic Electromagnetic Flasher. Paul E. Oswald, Chicago, Ill., assignor to the Reynolds Electric Company, Chicago, Ill. Application filed February 5, 1902.

A pair of solenoids and their movable cores are combined with a walking beam oscillated thereby, a pair of tubular electromagnetic blow-outs, an electrical contact-making plug adapted to enter either of the blow-outs, and means for automatically shifting the plug from one blow-out to the other.

717,022. Glower for Electric Lamps. Henry N. Potter, Berlin, and Walther Nernst, Göttingen, Germany, assignors to George Westinghouse, Pittsburg, Pa. Application filed September 29, 1899.

See page 35.

717,035. Therapeutic Electrical Apparatus. Ira E. Shaffer, Mount Vernon, N. Y. Application filed March 17, 1902.

The apparatus comprises means to convey a liquid to the part to be treated, and a number of metallic retarders mounted in the channel of the flowing liquid.

717,046. Sounding Mechanism for Telegraph Offices. John C. Stewart, United States Army, assignor of one-half to Andrew S. Burt, United States Army. Application filed March 18, 1902.

Combined with a relay magnet and a sounder of a telegraph-station plant, are a pneumatically operated motor merhanism for the sounder, a valve for controlling the mechanism and an armature for the relay magnet supported directly by the valve.

717,051. Controller for Electric Motors. Harve R. Stuart, Wilkinsburg, Pa., assignor to the West-

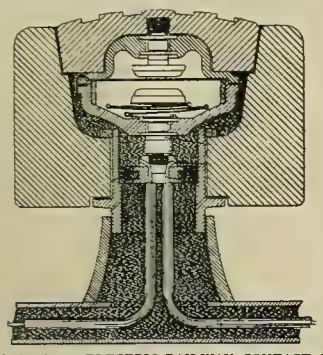
inghouse Electric and Manufacturing Company. Application filed April 2, 1902.

In the controller are combined a shaft, two groups of helically disposed contact-pieces mounted thereon, in combination with two sets of contact-fingers at opposite sides of the drum, each set being so arranged as to engage with each group of movable contacts, according to the direction of rotation of the shaft.

717,065. Distributing Electric Currents. Engelbert Arnold, Ole S. Bragstad and Jens L. la Cour, Karlsruhe, Germany. Application filed December 31, 1900.

717,070. Contact Box for Electric Railways. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed November 30, 1901.

In the contact box are a cable or feeder having a severed barred portion, a conducting member in which the ends of the barred portion are seated, and a screw-plug adapted to seat between the ends. (See cut.)



NO. 717,070.—ELECTRIC-RAILWAY CONTACT BOX.

717,071. Electric Switch. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed April 18, 1902.

The switch has two open-circuit positions, and an intermediate circuit-closing position, an electromagnetically controlled locking device for holding the switch in one of its open-circuit positions, and means for retarding or prolonging the movement of the switch across its circuit-closing position.

717,072. Magnetotherapeutic Apparatus. John Burry, Brooklyn, N. Y. Application filed May 8, 1901.

A number of solenoids surrounding a common space and electrically independent of each other are combined with terminals for each of the solenoids, and a movable carrier provided with several series of contacts connected and arranged to coact with the terminals to connect the solenoids individually and in various combinations with a source of electric energy.

717,107. Secondary Battery. William Morrison, Chicago, Ill., assignor to King Upton, Chicago, Ill. Application filed May 19, 1900.

In the battery are a suitable electrolyte, and negative and positive elements immersed in the electrolyte, one of the elements having a paste formed by mixing lead oxide with hydro-fluoric acid.

717,108. Secondary Battery. William Morrison, Chicago, Ill., assignor to King Upton, Chicago, Ill. Application filed August 5, 1901.

The battery comprises a negative plate carrying a paste of minimum, a positive plate carrying a paste of litharge, and an electrolyte in which fluorine is present.

717,112. Electrical Signaling System. Alexander C. McKnight, Brooklyn, N. Y., and Alexander C. McKnight, Jr., Orange, N. J. Application filed March 7, 1902.

In the system, combined with the track blocks, are a signal-operating instrument having separate signal controllers for home and distant block signals, separate local circuits for each of the controllers, a primary track circuit including a battery and electromagnetic circuit-closing devices normally responsive to the battery and co-operating with one of the local circuits, and a secondary track-circuit including a supplemental normally open battery circuit and an electromagnetic circuit-closer unresponsive to the battery of the primary track circuit and co-operating with the other of the local circuits.

717,123. Electricity Meter. Paul Rouget, Paris, France, assignor to Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils, Paris, France. Application filed January 30, 1902.

In the meter are a series of magnets arranged in separated groups in parallel to the flux, whereby none of them can be influenced by the field created by an intense current, even in short circuit.

717,137. Electric Signal Gong. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed July 29, 1902.

Upon and during the energizing of the magnet by the usual push-button and the attraction of the armature thereby, the circuit may be made and broken as often as vibration of the hammers occurs.

717,152. Method of Generating Independent Electric Currents. Engelbert Arnold, Ole S. Bragstad and Jens L. la Cour, Karlsruhe, Germany. Application filed January 13, 1902.

717,194. Arc-light Switchboard. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 16, 1901.

The switchboard is provided with two sets of insulated conductors crossing one another at an angle, one set connecting with the machines and circuits at their ends, and means for cross-connecting the two sets of bars at the points of intersection.

717,201. Cut-out. John W. Howell, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 2, 1901.

A cut-out for a translating device is described. It comprises two flat metallic surfaces having interposed between them a thin film of a dielectric material, the whole being bound together so as to be handled as a unit.

717,203. Induction Coil or Like Instrument. Otto H. Huebel, Brooklyn, N. Y., assignor to the Manhattan Electrical Supply Company. Application filed January 21, 1902.

In the instrument are a magnetizing helix and operating circuit, a plate, a contact-point supported thereby in electrical connection with the helix, a vibratory conductive interrupter secured to the plate and insulated therefrom, and an electrical connection between the interrupter and the helix.

717,212. Protective Apparatus. William Kaisling, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 8, 1901.

The apparatus combines with a pair of superposed line-conductor terminal springs or strips, a grounded plate upon which the springs are mounted flatwise and from which they are insulated, a block of insulation between the face of the plate and the forward end of the outer spring to hold it stationary, the inner spring being free to move, a device between the springs forming part of the circuit and held in a state of stress thereby, and means for grounding one of the line conductors by the inner spring actuated upon the giving away of the device.

717,218. Telephone Transmitter. Thomas C. Knowles, Denver, Colo. Application filed April 1, 1902.

Combined with a telephone-transmitter standard are an arm pivoted thereto, a receiver permanently carried at the free end of the arm, a set of teeth formed on the circumference of the pivoted end, and suitable means carried by the standard for engaging the teeth for locking the arm in a given position.

717,219. Train-control System. Samuel L. G. Knox, Milwaukee, Wis., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 5, 1902.

Electromagnetic means are provided for operatively connecting the motor to the movable member of the controller. A switch operated by the movable member of the controller is arranged to open the circuit of the electromagnetic means, and means are arranged for determining the point in the movement of the controller at which the switch shall be operated.

717,227. Electrical Switch. Henry Lomax, Ralph Lomax and John Tomlinson, Darwen, England. Application filed October 18, 1901.

A snap switch is described.

717,233. Holder for Electric-lamp Carbons. Potter F. Maines, Philadelphia, Pa., assignor to the American Electrical Manufacturing Company. Application filed March 14, 1902.

The carbon-holder comprises a suitable support having an opening therein to receive the carbon and a second opening adapted to receive a cam-shaped member. A cam-shaped member pivoted in the openings is adapted to hold the carbon in the first-named opening.

717,234. Synchronizing Apparatus for Alternators. Samuel W. Mauger, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 8, 1900.

Means for synchronizing alternators comprise two primary circuits, means for connecting them with the bus-bars and each of three or more machines respectively, and a common secondary circuit including phase-indicating devices.

717,262. Multirate Metering. Eustace Oxley, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 27, 1899.

The system comprises a three-wire distributing circuit, a single control wire, meter-operating circuits having one terminal of the rate-determining circuit of the several meters connected respectively to wires of different potential and the other to the control wire by continuously completed electric paths, and a switch at a control station for changing the potential character of the control wire.

717,277. Compounding Alternators. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 8, 1900.

The method of regulating an alternating-current dynamo-electric machine feeding a reactive circuit, consists in setting up an alternating current having an electromotive force which varies in the same proportion as the variation of electromotive force at the receiving end of the circuit or at some other chosen point on the circuit, deriving therefrom a direct current, and utilizing the direct current for regulating the dynamo-electric machine.

717,285. Lightning Arrester. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 27, 1901.

A device for breaking electric arcs is described. It comprises contacts between which an arc may be formed, in combination with a definite resistance, and means which automatically cut the resistance in series with the arc.

717,291. Trolley Connection and Guard for Electric Cars. Joseph G. Sharwell, Newark, N. J. Application filed April 10, 1902.

Mechanical features are described.

717,298. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 19, 1899.

The method of producing phase-differing fluxes from phase-differing currents of different phase displacement from that of the fluxes consists in acting upon each of two magnetic circuits by two magnetomotive forces displaced in phase from each other and related in magnitude in the proportion of the sine and cosine of one-half the difference in angle between the phase displacement of the fluxes and the phase displacement of the currents, and combining the fluxes to form a third flux.

717,300. Current Protective Device. William A. Taylor, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 3, 1901.

A thermal arrester comprises a rod of relatively high-resistance material, and low-resistance terminals rigidly and directly connected therewith through the medium of low-fusing material, the low-fusing material being softened or melted by the concentrated heat of the high-resistance material when an abnormal current passes to permit the separation of the rod and one or both terminals.

717,303. Speed-limiting Device for Series Motors. Leonard A. Tirrell, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 5, 1902.

Combined with a series motor are a controlling switch therefor, a coil in circuit with the motor and operating to maintain the switch in its "running" position, and means opposing the magnetism of the coil, the magnetism of the coil and the opposing means being so relatively adjusted as to release the movable member of the switch whenever the speed of the motor reaches or exceeds a predetermined limit.

717,310. Rheostat or Electric Heater. George P. Wisdom, New York, N. Y., assignor to Harold H. Pratt, Westfield, N. J. Application filed August 6, 1901.

The rheostat consists of the combination of a pile of slightly curved metallic sheets sufficiently yielding to be flattened into plane sheets, and sufficiently elastic to regain their curved shape, and means for compressing the sheets together gradually from a curved condition to sheets having approximately plane surfaces in contact with one another.

717,322. Insulator for High-potential Lines. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 30, 1901.

The insulator is composed of a metallic cap having a screw-threaded hole in its bottom, a screw-cap having a central hole, a disk provided with a stem having a screw-threaded head and insulation between the cup and cap and the disk and stem.

717,324. Support for High-tension Trolley Wires. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 24, 1901.

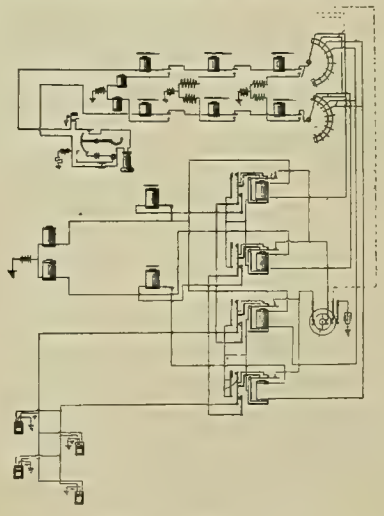
Two or more high-tension line conductors lying in substantially the same plane have a frame carrying two rows of insulators arranged outside of the line conductors and on opposite sides thereof and wires connecting each pair of opposite insulators with one of the line conductors.

717,325. Apparatus for Automatically Block Signaling on Railways. Fritz B. Behr, Twickenham, England. Application filed March 5, 1901.

A solenoid-operated system is described.

717,327. Automatic Electric-exchange System. William R. Binkley, New Bedford, Mass. Application filed July 14, 1902.

An automatic exchange system for party-line telephone systems combines exchange mechanism embodying banks of contacts having dissimilar points connected, a motor-generator, ringing relays connected in pairs, circuit connections between the contacts and different sets of relays, circuit connections between the line generator and relays, means for energizing the magnet of one of the relays of a pair, a switch operated by the armature of the energized magnet to throw the generator into and out of circuit of the line through the armature and circuit connections of the other magnet to transmit a current impulse to operate a signal at a called station, and means for restoring the parts to their normal positions. (See cut.)



NO. 717,327.—AUTOMATIC EXCHANGE SYSTEM.

717,331. Synchronizing Apparatus for Alternators. Thomas D. Boyles, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 27, 1900.

The means comprises synchronizing bus-bars, a phase indicator for each machine, means for imposing potentials derived from sources to be synchronized in series relation to the phase indicator of the machine being synchronized, and a voltmeter in parallel with any phase indicator connected in circuit.

717,351. Storage Battery. Charles H. Clare, Quincy, Mass. Application filed March 1, 1902.

In the battery are a number of independent porous plates, interposed lead plates and active material, and exterior insulating plates to cover the end joints and bottom joints between the plates, whereby the active material is held from escape between the plates.

717,358. Frequency-compensating Means for Electric Meters. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 21, 1900.

Combined with an electric meter of the induction type are means associated with the main current-carrying winding thereof for automatically compensating for errors in registration due to change in frequency of current passing through the meter.

717,359. Rotary Transforming Apparatus. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 26, 1900.

One claim reads: In a transforming device for interchangeably transforming alternating and direct current, a plurality of magnetic circuits, alternating-current windings in inductive relation to the circuits, a common return for the magnetic circuits, a winding in fixed relation to the common return, and a commutator connected to the last-mentioned winding. (See cut.)

717,376. Electric Recording Instrument. Walter C. Fish and Frank P. Cox, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed June 12, 1901.

The instrument has a movable member free to assume without restraint any position within its range of indication, a mechanically actuated curve-drawing device, and means for controlling the device by the indicating instrument.

717,389. Third-rail Insulator. Ernest Gonzenbach, Wheaton, Ill. Application filed September 24, 1902.

In the insulator are a supporting base or standard, an insulating ring having a laterally extending flange forming a petticoat, the ring supported over the base or standard, and a cap arranged to inclose the ring.

717,394. Electric Battery. Henry Halsey, New York, N. Y., assignor to the Halsey Electric Generator Company, Jersey City, N. J. Application filed April 18, 1902.

The method of regulating the output of a battery consists in brushing one of the elements and varying the rapidity with which the brushing is carried on.

717,395. Electric Battery. Henry Halsey, New York, N. Y., assignor to the Halsey Electric Generator Company, Jersey City, N. J. Application filed April 18, 1902.

In the battery are combined the electrolyte, two oppositely disposed elements, a radially mounted arm adapted to rotate in the electrolyte between the elements and parallel thereto, and a brush of flexible material carried by the arm.

717,398. Trolley-wire Support. Ebenezer Hill, Jr., Norwalk, Conn. Application filed April 18, 1902.

The support is made from two plates of sheet metal and has a socket to receive the wire and a cavity above the socket to receive solder for the attachment of the wire thereto.

717,401. Trolley Stand. Henry Holland, Detroit, Mich. Application filed March 7, 1902.

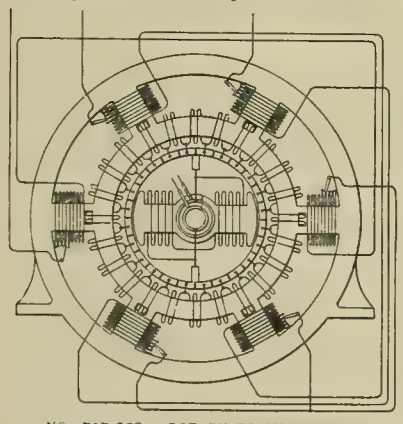
A pivoted trolley stand has a radially extending spring-bearing arm, a wheel and shaft therefor.

717,406. Railway Electric Signal. Slaughter W. Huff, Baltimore, Md. Application filed December 6, 1898.

The invention consists of a number of signals, relays for controlling the signals, continuous main-circuit conductors between which the relays are introduced, batteries for the respective signals arranged in multiple between the main conductors, and an initiating relay for each signal having contacts arranged to open the main circuit as the rolling stock approaches each signal and to cut out the battery at the signal.

717,414. Trolley Stand. Washington H. Kilbourn, Greenfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed April 1, 1902.

A cylinder mounted on the trolley base has a piston connected with the trolley arm, the piston having a fluid passage extending through it. A valve is adapted to close the passage, the valve being provided with means whereby it is held open when the fluid pressure is normal, and is closed by an increase of fluid pressure.



NO. 717,359.—ROTARY TRANSFORMER.

717,416. Secondary Battery. Isidor Kitsee, Philadelphia, Pa. Application filed April 10, 1893.

An electrode comprises a conducting strip bent so as to provide a series of spaces capable of expanding, independently formed blocks of active material arranged within the spaces, the blocks being provided with holes or apertures, and means surrounding the electrode and located opposite the face surfaces of the blocks for holding the blocks in place.

717,423. Trolley Stand. Otto F. Lidke, Detroit, Mich., assignor to the Detroit Trolley and Manufacturing Company, Detroit, Mich. Application filed December 14, 1901.

An improved trolley base is described.

717,428. Telephone Receiver. Kempster B. Miller, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 22, 1900.

In the receiver are combined a suitable casing or shell and the magnet contained therein, an insulating wall or support carried at the rear end of the magnet and secured thereto, binding posts or connecting devices for the electrical connections mounted thereon, a removable cap between which and the insulating support the electrical connections are adapted to be contained, and a suspending cord passing through an opening in the cover or cap and carrying a cord adapted to be secured to the insulating part to remove the strain from the electrical connections.

717,429. Telephone Receiver. Kempster B. Miller, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 22, 1900.

A permanent magnet within the casing has a screw-threaded part at its forward end adapted to engage a like part in the interior of the shell to secure the same firmly in position therein.

717,442. Electric Radiator. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed January 16, 1896.

A concavo-convex plate comprising the rear portion of the resistance-enveloping casing is adapted to be attached to the riser of a car seat.

717,443. Combined Magnetic and Mechanical Brake. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed July 14, 1899.

In the brake are combined a magnet, means for limiting the rotary movement of the magnet, a strap-brake with a means for conducting a current of electricity to the magnet, so connected up that the magnet will tend to draw the strap-brake in contact with the movable portion of the axle to which it is applied, with independent mechanical means for loosening the strap from contact with the movable portion when the current is cut off from the magnet.

717,451. Current Director. James Reid, Jr., Watervliet, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed September 15, 1899.

A special type of snap switch is described.

717,464. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed August 19, 1899. Divided and this application filed March 31, 1902.

A transformer having three legs of equal cross-section, two of which are acted upon by magnetomotive forces due to currents differing in phase by 90 degrees, and a secondary coil located on each of the legs is described.

717,466. Electrical Igniter for Gas Engines. Elliott J. Stoddard, Detroit, Mich., assignor to Charles F. Burton, trustee, Detroit, Mich. Application filed October 10, 1901.

Means are provided for breaking the circuit to produce the spark at the point where the circuit is broken two or more times in so short an interval of time that a spark shall be formed at each break, due to the energy imparted to the coil during the time at which the circuit is complete before the circuit is broken.

717,467. Method of Electrical Distribution. John S. Stone, Cambridge, Mass. Application filed August 4, 1902.

The method of relaying signals received by a tuned receiver of an alternating-current telegraph system consists in causing such signals to effect the sending of similar signals by currents of a different frequency.

717,468. Electric-current Controller for Incandescent Lamps or Motors. Herman A. Strauss, New York, N. Y. Application filed November 12, 1902.

An electric-current controller and socket comprises a resistance coil formed as a hollow cylinder and has the contact surfaces of the terminals for the socket portion of the device mounted within the cylinder.

717,477. End-cell-switch Indicator. Arthur C. Walther, East Orange, N. J. Application filed February 17, 1902.

The indicator combines a series of lamps, a main lamp-circuit conductor and wires leading from the conductor to each lamp, a switchboard, wires connecting each of the lamps and the switchboard, a main lamp-circuit conductor leading from the switchboard, a conductor leading from the switchboard and connected with the first conductor, a resistance included in the conductor and switch mechanism constructed and arranged to connect each lamp with the conductors alternately, whereby the resistance may be included in and excluded from circuit from each lamp successively. (See cut.)

717,488. Method of Transforming Alternating Currents. Jonathan E. Woodbridge, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 28, 1900.

The method consists in generating electromotive forces and connecting the electromotive forces corresponding to two of the three phases of a three-phase system so as to produce an equilateral parallelogram of electromotive forces, whereby the resultant electromotive forces corresponding to diagonals of the parallelogram bear a quarter-phase relation to each other.

717,496. Method of Measuring the Energy of Three-phase Alternating-current Circuits. Frank Conrad, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Original application filed February 14, 1901. Divided and this application filed January 6, 1902.

The method of measuring the energy of three interconnected, alternating-current circuits consists in separately measuring the products of the currents and voltages of two of the circuits and at the same time measuring the product of the current of the third circuit by the voltages of the two circuits.

717,497. Electric Arc Lamp. Hermann Cuénod, Geneva, Switzerland. Application filed July 10, 1902.

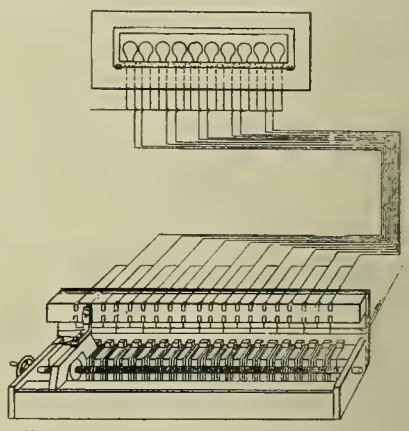
The lamp is characterized by the combination of two metallic drums with two electromagnets, the branches of which surround the drums, and two iron cores maintained inside the drums and having their ends suitably slotted and provided with a metallic band or frame soldered in short-circuit around one portion of the slotted end of the core.

717,507. Exciting Alternator. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed June 8, 1900. Divided and this application filed June 6, 1902.

An alternating-current dynamo-electric machine is combined with lines extending therefrom, series and shunt transformers connected to the lines, a circuit connecting the secondaries of the transformers in series, a rotary converter fed from the circuit, and means controlled by the rotary converter for regulating the dynamo-electric machine.

717,509. Apparatus for Relaying Space-telegraph Signals. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

In a space-telegraph apparatus of the elevated conductor type are two telegraph systems, each comprising a transmitter and receiver and a relay adapted to be set in motion by the receiver of one system and thereby to operate the transmitter of the other, the receiver and transmitter conductor or conductors being so electrically organized and disposed respectively that the receiver will not be operated by signals sent by the transmitter.



NO. 717,477.—END-CELL-SWITCH INDICATOR.

717,510. Method of Relaying Space-telegraph Signals. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

The method consists in so electrically organizing and associating therewith the transmitter of a second space-telegraph system, operated by a relay set in motion by the receiver of the first, that the transmitter, while affecting the receiver of the second system, will not affect the receiver of the first.

717,511. Method of Tuning Vertical-wire Oscillators. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

The method consists in increasing the natural inductance or natural electromagnetic inertia of the oscillator by surrounding the conductor with a sheath formed of a medium of greater permeability than the air, but not conductively connected with the conductor, and balancing the increased inductance thereby obtained by a suitable capacity.

717,512. Tuned Electric Oscillator. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

In the electric oscillator are a conducting wire surrounded by insulation, a longitudinally discontinuous paramagnetic sheath inclosing the conductor and a capacity.

717,513. Method of Relaying Space-telegraph Signals. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901.

The method consists in receiving the signals to be relayed in the receiver of one-space telegraph system of the elevated-conductor type, causing this receiver to operate the transmitter of a second system, and so respectively electrically organizing and disposing the receiver and transmitter conductors that the receiver will not be operated by signals sent by the transmitter.

717,514. Apparatus for Relaying Space-telegraph Signals. John S. Stone, Boston, Mass., assignor to Louis E. Whicher, Alexander P. Browne and Brainerd T. Judkins, trustees. Application filed January 23, 1901. Renewed February 24, 1902.

In this apparatus the receiver is tuned to a certain given frequency. The transmitter of a second system is tuned to a different frequency and a relay is adapted when set in motion by the receiver of the first system to operate the transmitter of the second system.

717,515. Method of Electrical Distribution. John S. Stone, Cambridge, Mass. Original application filed August 4, 1902. Divided and this application filed November 17, 1902.

The method of absorbing the energy of currents of one frequency traversing a main line to the exclusion of the energy of currents of other frequencies traversing the main line is described.

717,518. Means for Transforming Alternating Currents. Jonathan E. Woodbridge, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed July 28, 1900. Divided and this application filed June 17, 1902.

In a system of phase transformation are combined a winding, two other windings connected in delta relation to an intermediate portion of the first, and a system of multiphase mains, two of which are connected to the terminals of the first-mentioned winding and a third to the junction of the other two windings.

WESTERN ELECTRICIAN

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Electric Searchlight on the Fireboat Illinois.

The use of electric searchlights as auxiliary apparatus for fighting fires has been demonstrated with more or less success in this country and in Europe, and recently tests of such an appliance have been made in Chicago. However, instead of using it in connection with the wagons and engines of the fire department, the experiments were made with the city's fireboat, Illinois. The lamp was mounted in the bow of boat, as illustrated in Fig. 1, and from this position the beam of light could be turned in any desired direction. So much construction work, in the way of building new bridges, docks, warehouses, etc., on the Chicago River, is going on that it has become almost an absolute necessity for the Illinois to have some means of lighting up the channel when she is called out for a fire at night. Accordingly, the tests of the searchlight above referred to were begun and they are being carried out under the supervision of Fire Marshal Musham and City Electrician Edward B. Ellicott. The lamp throws a beam of light, which, multiplied by the parabolic reflector is estimated to have an intensity of 60,000 candlepower. The lens is 22 inches in diameter, and has been especially constructed to throw a beam which at a distance of 400 feet will be 200 feet wide, the average width of the river. A universal joint is to be provided for the mounting of the lamp, so that the light may be cast in any direction, and thus enable the boat to pick out the banks and docks of the river and also to assist the firemen in landing and carrying the lines of hose through dark places. An opaque screen is to be provided, which may be placed over the lens or any portion of it, to shield the light from approaching vessels, as it would otherwise blind the crew.

The lamp used is of the Edwards railroad-headlight type, and is connected on a 30-volt current, taking about 35 amperes. At this low voltage the violet rays so noticeable in the common arc lamp are practically eliminated, and a very clear white light results. The upper carbon is five-eighths inch in diameter and is of soft, low-resistance carbon. A rolled-copper rod is provided for the negative. The goggle glass is of heavy French plate, cut into strips to provide for expansion, due to heat from the arc.

A unique feature of the searchlight equipment is that the lamp is supplied from a steam-turbine-driven generator. This turbo-generator unit is a small and compact set and is located out of the way in the engine room of the boat, as seen in Fig. 2. The turbine operates on 125 pounds steam pressure and develops a speed of about 1,900 revolutions a minute when the light is in operation. A governor secured to the end of the turbine shaft controls the speed.

Direct-connected to the turbine is a direct-current multipolar dynamo, the armature being chordal-wound. The field cores are differentially wound, the object of which is to provide automatic regulation, maintaining the amperage and voltage practically constant. This winding also has the advantage of neutralizing all current should a short-circuit occur anywhere in the working circuit, thus preventing the machine from burning out. Should a short-circuit occur the machine will operate properly as soon as it is removed.

The regular equipment of the fireboat Illinois includes a direct-connected generating set, which is shown at the left in Fig. 2. This unit consists of a five-kilowatt, direct-current, 110-volt dynamo and a six-horsepower marine-type engine. About 50 16-candlepower lamps are distributed throughout the boat and are used whenever the boat is actually in service. The wiring for these lamps, as well as for the searchlight, is carried in iron-armored conduit.

The result of the experiments with this searchlight equipment on the Illinois will probably determine the question now being considered of providing a searchlight apparatus for use on the streets of the city. Should such an equipment be secured, it would undoubtedly consist of a similar lamp operated by a turbine-driven generator, and the turbine in turn would be supplied by a small steam boiler, such as is used in steam automobiles. An apparatus of this description could be made in compact form and would be of considerable assistance in the workings of the fire department.

Fig. 1. Fireboat Illinois.

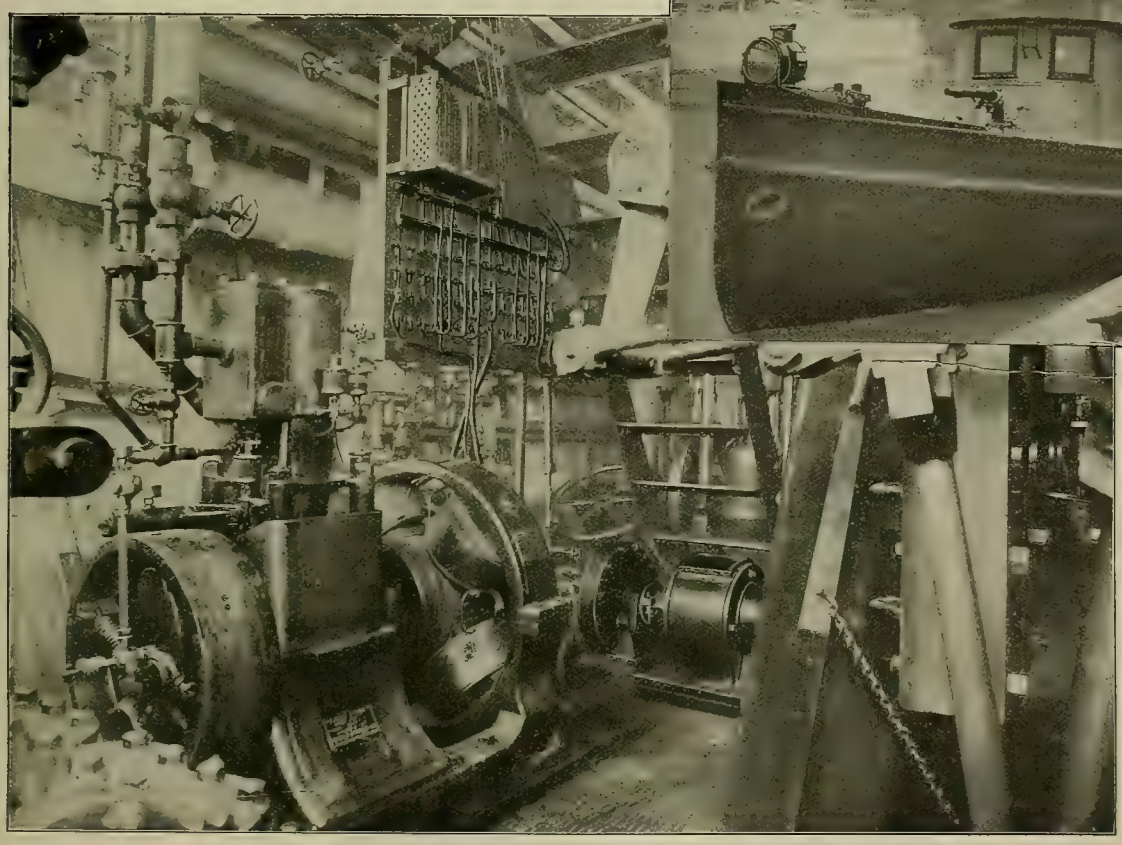


Fig. 2. Turbo-generator for Searchlight and Lighting Unit in Engine Room of the Boat.
ELECTRIC SEARCHLIGHT ON THE FIREBOAT ILLINOIS.

Electric Power Development in India.

A hydro-electric power development possessing some interesting features is located on the Cauvery River, in the territory of Mysore, in India. The Cauvery is one of the principal rivers of Southern India, being fed by six large tributaries and draining a district computed at nearly 6,400 square miles before it reaches the site of the power development. The plant was built to supply power to the Kolar gold fields, 92 miles distant. At the location chosen for the operations the river enters a gorge and divides. Each branch of the river includes a falls—one in the west branch called Gangan Chucki, and one in the east branch called Burr Chucki. The west branch of the river was chosen as affording the best possibilities for a power development and was surveyed with a view of securing what head could be obtained. By building a dam some distance (1½ miles) above Gangan Chucki Falls and locating the power plant a distance (1½ miles) below it, a total head of somewhat over 400 feet was realized. To insure the greatest possible water supply during the dry season, a low masonry dam was built farther up stream at the divide, diverting the water of the east branch of the river into the west branch. This dam, like the power dam below it, is low, so that in flood times the surplus waters will flow over the dams without doing any damage.

Immediately above the west-branch dam two power canals were started. These two canals parallel each other for a distance of a trifle over three miles, after which they enter the forebay to the penstocks, located on the top of a high bluff, at the foot of which lies the power house. The power house is, of course, situated on the immediate bank of the river. These two canals are provided with sluice gates at different points along their lengths to provide for a means of handling overflows. Two were built in order to insure a certainty of water supply and to afford a means of cleaning without shutting down the plant. These canals are revetted throughout their length with stone backed with six inches of gravel. The depth of water is five feet; fall, one in 5,000; width of bed, 18 feet; side slopes, one in one. The calculated discharge of each of these supply channels was 250 cubic feet per minute, but the tests made on them showed that, under minimum conditions as regards initial head, this was exceeded by 50 per cent.

As stated above, the tail ends of these channels enter the aforementioned forebay, located on the bluff something less than 400 feet above the power house and 900 feet distant from it. All the water-governing apparatus and also the electrical output controlling mechanisms are located in a static-transformer house built at one side of the forebay. The controlling apparatus was installed on the bluff in order to give the operating engineers the benefit of the purer air of the elevation, the locality not being as healthy as could be desired. From the forebay the water is carried to the power house through

three steel penstocks 45 inches in diameter at the top and 36 inches at the bottom. On entering the power house, each penstock bifurcates, serving two impulse turbines 60 inches in diameter of 1,250 horsepower each and each direct-connected to a revolving-field type, three-phase, 25-cycle, 2,200-volt, 1,000-horsepower generator. Thus it is seen there are six 1,000-horsepower units in the power house. The waterwheel governors are guaranteed to regulate the speed to within eight per cent. on a variation of load of 50 per cent. The rated output of the generators is 720 kilowatts each, making a total output of 4,320 kilowatts when all six machines are running. The present requirements leave one turbine and generator idle. The field excitation for these generators is supplied by two 75-kilowatt machines, each direct-connected to its own turbine of identical pattern, but smaller size than the main turbines. The generator speed is 300 revolutions per minute, and that of the exciters 465.

The transformer station located on the top of the bluff contains 12 400-kilowatt, air-blast static transformers, arranged in four rows of three each, one row serving as a reserve. These transform the current from 2,200 volts, generator potential, to 30,000 volts, line potential. Two transmission lines are built from this transformer station to the Kolar gold fields, 92 miles distant. Each line is made up of three No. 0 B. & S. gauge copper wires, strung to form an equilateral triangle, 40 inches to a side. The two transmission lines are parallel and 60 feet apart. The average span from pole to pole is 130 feet, with the longest span across a river, 525 feet. The minimum height of the lower wires above the ground is 20 feet. The poles are combined steel and timber, the tops being timber 17 feet long and bottoms being steel 13 feet long. These poles are set into the ground six feet.

On reaching the Kolar gold fields the lines enter a second transformer station, in which the current is transformed to 2,300 volts for distribution purposes. All motors of 100 horsepower or over work on this potential, while those below that work on current reduced to 220 volts. The total horsepower delivered to the gold fields at present is 4,185 horsepower. This power operates motors ranging in capacity from five to 400 horsepower. The present contracts for power call for a constant delivery of 4,000 horsepower for a period of 10 years. The rate per horsepower per annum varies during the first five years from $90 to $145, the average being about $100. During the second period of five years a uniform rate of $50 per horsepower per annum is to be paid. The total outlay of money for the completed installation approximated $1,700,000; the time required to finish the work was 22 months, and the greatest number of workmen employed at any one time was 5,000.

A unique feature of this power development is the distribution of the contracts for the apparatus. The General Electric Company of the United States secured the contract for the electrical equipment; Escher, Wyss & Co. of Zurich, Switzerland, the contract for the hydraulic plant, the penstocks coming from Mecham & Sons of Scotstown, Glasgow. The timber for the pole lines came from Australia and is the celebrated Australian redwood "jarrah."

The plant was constructed under the inspection of experts appointed by the Mysore government, which at the end of six years will have received the full amount of money outlayed by it in the building stage. After this time the government will receive about 10 per cent. on the sum invested. The facts above given were obtained from articles in the London Engineer and Cassier's Magazine, the latter written by Capt. J. H. Thomson.

Independent Polycyclic System of Distribution.

For the different applications of electric alternating currents, phases and periods of different numbers are most suitable in relation to the separate objects. As examples, for driving motors a multiphase current of low frequency is best. For arc-lamps and incandescent lighting a single-phase current of higher frequency is most advantageous. Frederick Bedell has already shown how these advantages are gained by means of superposing alternating currents of different frequency, while currents of different character can be introduced and withdrawn at points of equal potential of a motor-circuit, his invention being protected by letters patent of the United States, Nos. 645,907 and 647,741. These arrangements of Bedell, by which the direct current or superposed alternating current is introduced at points of the winding of the generators, motors, transformers, or choking-coils of the main system have the disadvantage with alternating currents that the alternating current introduced into the windings of transformers or choking-coils sustains a great drop of potential on account of the self-induction of such current if the windings are not arranged without self-induction.

The method hereinafter described, which is patented by Engelbert Arnold, Ole Sivert Bragstad and Jens Lassen La Cour of Karlsruhe, Germany, will serve, it is claimed, to obviate the above disadvantages without the employment of non-inductive windings, because electric currents of different character are not introduced in one and the same wire by means of conduction, but by means of induction. This is effected by means of the superposition of magnetic fluxes in one and the same transformer. Hereby not only is the immediate end gained, but the additional advantage that the same transformer can be used for simultaneously transforming the superposed alternating current of different character.

The principle of the invention consists, in brief, in the simultaneous transformation and introduction or further transmission of alternating currents of different numbers of period and phase over the conductors of a motor circuit by means of the employment of transformers having two different kinds of inductive primary windings, which in certain circumstances can be reduced to one, and having only one induced secondary winding, and in the simultaneous transformation and withdrawal of the currents of the transformers with a primary and two secondary windings. Because the currents must be of different frequency and because the drop of potential of any one of the superposed currents in the

Fig. 1.

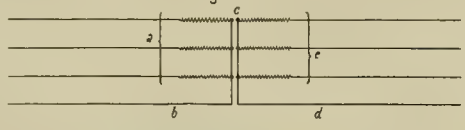
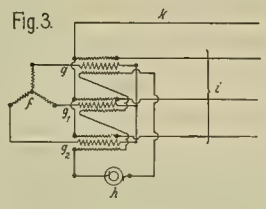


Fig. 2

Fig. 3.



POLYCYCLIC DISTRIBUTION SYSTEM.

conductors and transformers is independent of the drop of potential of any other superposed current such a description of system for conducting may be entitled "An independent polycyclic system of distribution." The simultaneous transformation, besides lessening the cost of plant, has this further advantage, that however increased the total output may be, the maximum induction in the transformers can, by means of a suitable choice of the superposed currents, be reduced, and because of this the hysteresis loss is also reduced. The transformers will be correspondingly smaller.

In the accompanying drawings, Fig. 1 illustrates the simultaneous transformation of a three-phase current and of a superposed single-phase current by a three-phase transformer with magnetic return. Fig. 3 illustrates the introduction and withdrawing and simultaneous transformation of a superposed alternating current by the transformers of the main system.

In Fig. 1, (a) represents the three main conductors, and (b) the neutral conductor, of a three-phase system. Besides the three-phase current the conductors (a) carry a superposed single-phase alternating current, the return-wire of which is formed by (b). The four-core transformer (c), its iron frame being shown in Fig. 2, serves for the simultaneous transformation of the three-phase current and of the superposed single-phase alternating current. As the alternating current flows similarly through the three primary windings, and thus produces a magnetic force which flows similarly in the three cores, a fourth core is necessary as a return for the fluxes produced by the superposed current. The three secondary conductors (e) serve simultaneously to carry away the transformed three-phase current and for leading out the transformed alternating current which flows back through the neutral conductor (d). If the ratio of transformation of the three-phase current be determined beforehand, then it is made possible to make the ratio for the single-phase alternating current as large as may be desired by the insertion of windings in the neutral conductor. These windings are wound on the fourth core of the transformer.

Fig. 3 illustrates the employment of the three one-phase transformers of a three-phase system serving as main system for simultaneous transformation and introduction of a superposed single-phase alternating current; (f) denotes the three-phase generator for the generation of the three-phase current; (g g′ g″) are the three single-phase transformers, each of which possesses two primary and one secondary winding. Three of these primary windings, each of which belongs to a transformer, are star-connected and serve to receive the three-phase current, while the three remaining primary windings are series-connected and serve to receive a single-phase alternating current generated in the generator (h).

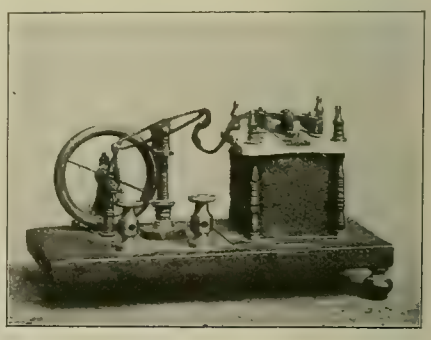
In the star-connected secondary windings of the transformers a three-phase and a single-phase current are simultaneously induced. Contrariwise the two primary windings have no inductive action on each other. In (i) is represented the three main conductors of the three-phase motor circuit, while (k) denotes the neutral conductor of same, which serves as return-wire for the superposed one-phase alternating current. This arrangement can be applied to a main system with whatever number of phases—for example, (x)—may be desired, while (x) separate star-connected transformers are employed.

Instead of (x) separate transformers one (x)-phase transformer which provides a magnetic return for the magnetic fluxes excited by the superposed alternating current may also be used. On the iron core serving as return a primary, as well as a secondary winding can be wound in which flow only the superposed currents.

In another patent to the same three gentlemen is described a system of electrical distribution for the simultaneous transmission of alternating electrical currents of different character, in which the simultaneous generation of a polyphase and a single-phase current is in one and the same armature winding, whereby the single-phase current is of a frequency, which is a multiple of that of the polyphase current, and which is used as the superposed current. The method consists in the operation of two pole systems on one armature. The first pole system possesses a number of poles corresponding to the frequency of the polyphase current, while the second possesses a number of polec corresponding to the frequency of the superposed current. The pole systems are so arranged relatively to each other, that in each phase of the armature electromotive forces are induced, which possess the same wave form, as if both pole systems were arranged side by side.

Old Miniature Electric Motor.

In 1851, just eight years after the introduction of telegraphy, Joel Ettinger, an original mechanical genius, who lived in York, Pa., and devoted no small share of his time to the study of electricity, constructed a miniature oscillating electric motor, which was among the first produced by American inventors. The motor was very simple in its mechanism and was capable of producing power sufficient to operate several small pieces of miniature machinery. In the same year Ettinger exhibited the invention at the annual exhibition of the York County Agricultural Society. The sight of the then unique mechanical toy in operation caused the simple country folk who visited the exhibition to marvel, and the general impression among them was that it was a work of magic. Some of them even went so far as to attribute to its inventor satanic power. At the outbreak of the Civil War Ettinger went to Virginia, entered the Confederate army and was never heard of thereafter, though his motor was his hobby, and, prior to his departure, he had frequently expressed his intention to improve it and exploit it for practical purposes. The original model was left in the possession of George W. Shock, a student of electricity, who was among the earliest Western



OLD MINIATURE ELECTRIC MOTOR.

Union Telegraph Company's operators in York. Mr. Shock retained possession of the machine until recently, when he presented it to the York County Historical Society. It is now in the society's collection, and is to-day in perfect order. A galvanic battery was used to supply the motor with power.

American Institute of Electrical Engineers.

The next regular meeting of the American Institute of Electrical Engineers will be held in New York city on the evening of January 23d, where the general subject of "Telephone Exchanges" will be discussed. Thomas D. Lockwood, electrical engineer and advisory electrician of the American Telephone and Telegraph Company, will read a paper on "The Evolution of the Telephone Switchboard." The discussion will be opened by J. J. Carty, chief engineer of the New York Telephone Company, and will be continued by F. A. Pickernell, engineer of the American Telephone and Telegraph Company; B. Gherardi, Jr., chief engineer of the New York and New Jersey Telephone Company; Kempster B. Miller, engineer of the Kellogg Switchboard Supply Company; E. F. Sherwood, superintendent of construction of the New York Telephone Company; William J. Hammer and L. W. Stanton, consulting electrical engineers; J. F. Crook, engineer of the Strowger automatic-telephone system, and others.

Arnold's Report on the Transportation Problem in Chicago.

PART II.

An estimate of the cost to produce the system of subways outlined, known as Subway Plan No. 1, including the cost of the rearrangement of all underground utilities and the reconstruction of all sidewalks disturbed and the relaying with asphalt of all street pavements on streets where the open-cut method of construction is resorted to, is given at $16,000,000. In this estimate is embodied the cost of lowering and reconstructing the three existing tunnels and the construction of two new tunnels leading to the North Division.

The subway system above described has been carefully designed, and it is believed that it will best fulfill the conditions necessary for the successful operation of a combined surface and subway-railway system which is practicable without interfering with existing low-level improvements.

Its chief advantage, from an operating standpoint, is that it keeps all through traffic, both north and south, and west to south, and west to north, off the surface of the streets, and will permit rapid running time for such traffic to be made through the business district of the city.

Plan No. 1, as outlined, does not meet all the conditions for a complete and satisfactory solution of the transportation problem, even if used in connection with any system of surface terminals that can be devised.

In order to overcome the objections, Mr. Arnold submits a complete and ideal solution of the transportation problem, known as Subway Plan No. 2. All of the advantages of through routes, in all directions, of Plan No. 1 are retained, its objections are fully overcome, and its use makes it possible for the city to demand from the railway companies a universal-transfer system, without injustice to them. It, however, is submitted as an ideal solution of the situation, with the full understanding of the difficulties which will be encountered in its construction, and in full recognition of the fact that the cost of a subway system built under this plan ($20,000,000) will be somewhat in excess of that required by the previous plan, and that more difficulties will be found than would be encountered in the adoption of Plan No. 1.

This plan retains the same north and south trunk-line system of tunnels as shown in Plan No. 1, except that the line on Wabash Avenue is moved over to Michigan Avenue, and run underneath the edge of Lake Front Park. In order to get the West Side lines through to Michigan Avenue and ultimately farther east under the Lake Front Park, should future extension of the park make this desirable, or if it should be thought best to connect the various passenger and freight depots of the steam railroads, a series of low-level loops are provided. These loops would extend eastward from the river at as high a level as practicable to keep underneath the north and south subways, and where they intersected the streets occupied by north and south subways, double-decked stations could be provided, as shown in Fig. 5. In this station, as designed, all of the business would be done on the first floor below the street surface, and the lower section of the station would consist only of platforms from which passengers would board the trains. From the lower-level platform to the platform of the upper subway would be provided stairs at one end, and, if found advisable, elevators or escalators at the other end, thus making the ascent easy for those who desired to use them.

By the construction of the three or more north and south subways and the three or more low-level east and west loops, the entire street-car traffic of the business center of Chicago could be kept below the surface for some years to come, except the traffic which would be handled by the surface distributing loop extending between the depots, thus eliminating the necessity of constructing a large part of the underground-conduit electric construction at the present time, and if some independent-unit system of operation should be adopted for this surface-distributing system, the necessity of underground-conduit construction in Chicago would be entirely eliminated until such time as it became necessary to put additional surface tracks on the streets.

It will thus be seen that the business center of the city would, if this plan were adopted, be underlaid with a series of subway tracks intersecting each other at right angles, and at a sufficient number of points to enable passengers to travel from almost any point in the business district to almost any other point with the least inconvenience, and at the same time make it impossible for passengers to use transfers improperly.

The chief objections that can be made to Plan No. 2 are: First, its relative cost as compared with Plan No. 1; second, the passengers in the low-level subways would be about 40 feet below the surface of the street, thus necessitating the use of elevators between low-level and high-level subways at station points, a distance of about 20 feet; third, the engineering difficulties and risks that would be encountered in its construction; fourth, the fact that it would interfere, and, to a large extent, destroy, existing and contemplated low-level improvements.

In whatever subway system is adopted, due consideration should be given to making the electrical operation of cars through it as safe as possible, which has been partially taken care of by a previous recommendation to the effect that the cars which pass through the subways should be built of non-combustible material. There is one other source of danger in the use of electrically operated cars in tunnels, viz., the liability of injury to passengers from the electric current in case of accident, which would precipitate passengers upon the working conductor, or short-circuit the working conductors by means of the metallic or other parts of the wreckage. To provide for this, so far as practicable, the working conductor, either overhead or underneath, should be divided into sections, each section provided with suitable circuit-breakers, which will automatically open in case of a short-circuit on any particular section, and which can be manually controlled by tower men, located at suitable points, or by the station employes. This method involves no radical improvement in existing electrical apparatus, for the parts necessary are standardized to-day, but attention should be given to this subject at the time of the construction of the subway.

By providing the subway with both overhead and surface-contact construction, all cars of the operating company could be made completely interchangeable, so far as operating through the subway is concerned, and operated through the subway or over the surface of the streets, or in the outlying districts, at the will of the management.

In discussing the electrical-conduit system for Chicago Mr. Arnold says: "It is entirely practicable to build underground conduits for railway purposes in the streets of Chicago, especially within the business district, and provide a drainage system connecting with the city sewers, which will keep the electrical conduits sufficiently free of water at all times to prevent any serious interference with the operation of the railway. Under Chicago conditions, the installation of underground-conduit electrical railway would naturally be confined to limited districts, and to avoid the necessity of having two distinct sets of rolling stock, it would be necessary to devise a mechanism on the cars, and within the track conduit which would permit any car to operate on either underground-conduit or overhead-trolley lines. Such a system of operation is entirely practicable. Mechanism can be applied which will permit of the change being made, at designated points, from underground-conduit to overhead-trolley contact, and vice versa, with practically no delay to the car. The drawing in Fig. 6 is a typical illustration of a system of underground-conduit electrical railway which will be applicable to Chicago conditions. An estimate of the cost to produce one mile of single-track electrical-conduit railway, if built substantially in accordance with the typical designs submitted, is $81,300 (exclusive of paving). This estimate is made to cover the construction of

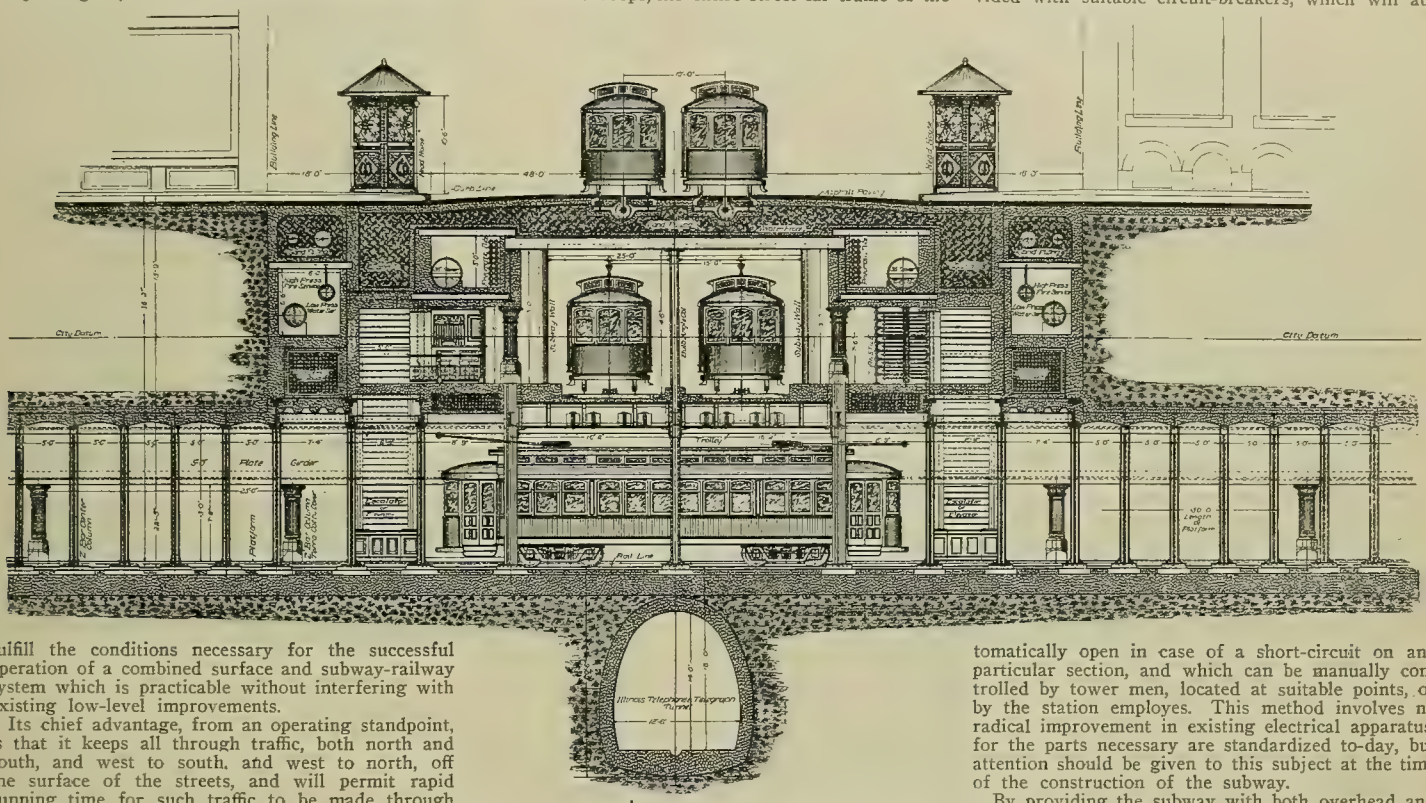


FIG. 5. ARNOLD'S REPORT ON THE TRANSPORTATION PROBLEM IN CHICAGO.—TYPICAL STATION AT INTERSECTION OF HIGH AND LOW LEVEL SUBWAYS

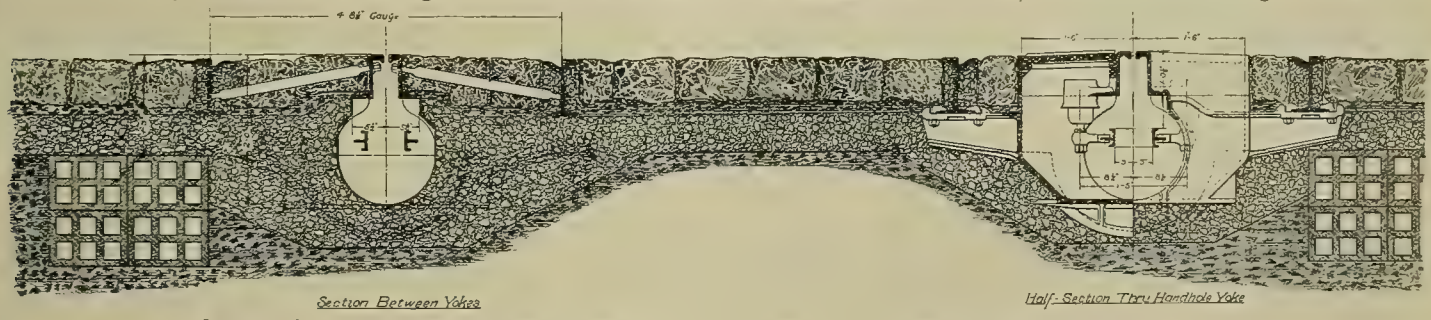


FIG. 6. ARNOLD'S REPORT ON THE TRANSPORTATION PROBLEM IN CHICAGO.—TYPICAL UNDERGROUND CONDUIT RAILWAY CONSTRUCTION.

an underground-conduit line in streets not previously occupied by railway tracks. If this type of construction were placed in streets which are now occupied by cable railways, the cost per mile of track would be reduced by the amount of salvage which could be derived from the sale of old cable material taken out of the street. This sum would be variable, and would probably, under favorable conditions, not exceed $3,000 per mile of single track."

Summarized, Mr. Arnold's conclusions as to the design of track rails which will be practicable for the operation of cars under Chicago conditions and which will best protect the pavements, are as follows: First, for the use on streets that are paved with asphalt, brick or dressed granite, and where such pavements are kept clean, he recommends a rail laid on concrete beam, as shown in Fig. 7, believing that the use of such a rail, under such conditions, is practicable from the street-railway operating point of view, and believing that such a rail will tend to cause vehicle traffic to distribute itself over the whole street surface (thus preventing abnormal wear in one spot), extending, as it does, the least invitation to vehicles to follow the tracks.

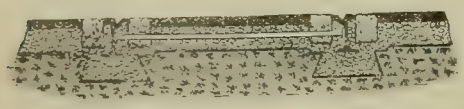


FIG. 7. ARNOLD'S REPORT.—STANDARD TRACK CONSTRUCTION RECOMMENDED.

Second, on unpaved and on poorly maintained paved streets and on streets that are indifferently cleaned, the present girder tram section should be retained, to be replaced only as it wears out or as streets are improved with asphalt, brick or dressed-granite paving.

In the remainder of the report are given unit price estimates of cost to produce single miles of cable, trolley and conduit track, valuation estimates of the existing lines and itemized cost estimates of the subway and surface-traction systems recommended. In the appendices are given the present and recommended routing of cars, schedule of transfer points and tables showing present and recommended trackage. The maps accompanying the report are maps of the whole city or the business portion, and are entitled as follows: No. 1, Present Tracks in Business District; No. 2, Rearrangement of Downtown Surface Terminal Loop Tracks (independent loops); No. 3, Rearrangement of Downtown Surface Terminal Loop Tracks (joint use of tracks); No. 4, Present Routing of Cars on All Streets; No. 5, Subway Routes of High and Low-level Subway, Plan No. 2; No. 6, Location of Present Cars at Time of Maximum Operation; No. 7, Population, Distribution and Density of the City of Chicago; No. 8, Recommended Routing of Cars Under New and Ideal System; No. 9, Location of Cars at Time of Maximum Operation on Recommended Routing; No. 10, Suggested Surface Terminals to Be Considered in Connection with Subway Plan No. 1; No. 11, Subway Routes of High-level Subway, Plan No. 1; No. 12, Subway Map and Profiles of High-level Subway, Plan No. 1; No. 13, Suggested Plan No. 1 for Rearrangement of Union Loop; No. 14, Suggested Plan No. 2 for Rearrangement of Union Loop.

[The end.]

Electric Power Production in California.

In the development of electric light and power California has always occupied a leading position, and one of the first attempts to light a large city by electricity, on a comprehensive plan, was made in San Francisco. That is only about 25 years ago, and now every city, town and hamlet in California is provided with a system of public electric lights. The rapid descent of the drainage from the elevated watersheds constituting the eastern backbone of the state was early recognized as an available source for the cheap production of electric energy. The largest electric power-producing plants in operation in the state were started primarily to relieve the wants of miners, when the lack of fuel to produce steam confronted them. Now, says the San Francisco Chronicle, the big plants which started to serve the mines are lighting cities and towns scattered over great areas, and, besides giving power to an endless number of manufactories, are driving street cars 142 miles from the source of electric generation. The Bay Counties plants, which are generating about 30,000 horsepower, are serving a territory of over 14,000 square miles, while the Standard Electric, with a generating plant of 13,333 horsepower, is serving almost an equal area.

It is impossible to reach a definite conclusion as to the total amount of electric power produced by water and fuel processes in the state, but the following summary will give a fair estimate of the power produced by some of the leading plants: Bay Counties Power Company, 30,000 horsepower; Standard Electric, 13,333; San Joaquin, 2,500; Truckee River, 2,800; Power Development (Bakersfield), 2,500; Mount Whitney, 1,500; Butte County Electric, 1,500.

The chief use now made of electric power in California is for the operation of urban and suburban street railways and the lighting of towns and cities. Electric power has also entered the domain of irrigation, as a small pumping plant reachable by a small wire may be erected anywhere on the banks of the streams and operated by a current to lift the water high enough for service on the land.

Manufacturers of electric power are now looking to the waterpower of the state as the chief source of production. An expert electrician who has carefully investigated the watershed of the Sierra estimates that there is, on the western slope alone, at least 1,000,000 horsepower available within reach of San Francisco. This estimate is based on a transmission distance of only 200 miles.

An Electrically-operated Oil Circuit-breaker for High-tension Circuits.

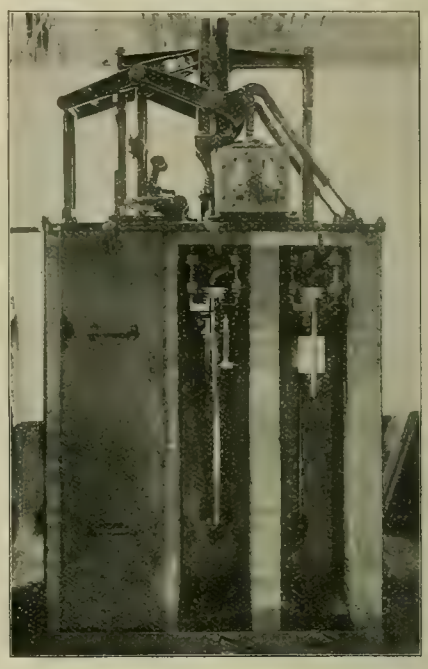
The rapid increase during recent years in the size of central stations and the currents and voltages handled therein has necessitated a great development in the methods and apparatus for controlling and switching electric currents. While a few years ago most alternating-current switchboards were equipped with hand-operated knife switches, it is now found advisable and often necessary to use some means of auxiliary control. This permits the actual current-switching devices to be located with regard to the general design of the station and a satisfactory layout of circuits and apparatus; at the same time it centralizes the control within a small space where the operator may have under his hand, so to speak, the whole station, and before his eye, an indication of the condition of every circuit.

One of the most remarkable pieces of apparatus which has contributed to make this great development possible is the high-tension, power-operated, oil-break circuit-breaker. While the carbon-shunt, open-air type of breaker, in which the arc is ruptured in the open air, has given excellent service in most classes of work, there are many places where, on account of space or other limitations, its use would not be feasible. It is to meet the need of a compact, safe and reliable device for rupturing high-tension circuits that the oil-break circuit-breaker has been developed. The accompanying illustration shows a three-pole, double-break, automatic oil circuit-breaker, operated by electromagnets. The circuit breaker is erected in a masonry structure, with each pole and oil tank in a separate, fireproof compartment. There are two stationary contacts to the pole, one connected to the incoming lead, and the other to the outgoing lead of the same phase, each contact being mounted in a large porcelain insulator. In the illustration, one of the porcelain insulators is visible in the right-hand compartment.

The insulators are fastened to a cast-iron frame which also supports the enclosing oil tank. The frame itself is supported from the soapstone slab at the top of the masonry walls by strain insulators. The movable contact for each pole consists of a U-shaped piece of copper fastened to the end of a stout wooden rod. In the closed position of the switch one of these U-shaped pieces electrically connects the two stationary contacts of each pole. The wooden rods are fastened at their upper ends to a common cross-bar, which extends over the three masonry compartments, and is supported by a system of levers giving a straight-line up-and-down motion. The cross-bar is raised by the enclosing magnets, assisted at the beginning of the motion by a pair of balancing springs. The springs and the case containing the magnet are shown at the upper right-hand corner in the illustration. A toggle joint, shown at the left in the illustration, automatically locks this system of levers when the circuit-breaker is in the closed position.

The toggle joint is released by a blow from the tripping magnet, whereupon the cross-bar, under the influence of gravity, and a powerful spring quickly drops, opening the contacts. The break takes place first at the main contacts, and then afterward at a removable plug attached to the stationary contact which enters a hole on the movable contact. The plug thus receives all the effects of any arcing that there may be, and, since it is removable, is easily replaced. The current for the closing and tripping magnets is derived from the exciters, storage battery, or other source of low-voltage, direct-current supply. If necessary, the circuit-breaker can easily be operated by hand without disturbing the mechanism in any way. The oil tanks, one of which is to be seen in the middle compartment, are constructed of heavy sheet metal and the interior is lined with insulating cement, which is molded to fit closely about the terminals and moving contact piece, leaving just room enough for the free movement of the parts in oil. By this means the amount of oil is reduced to a minimum. When the circuit-breaker is open, the wooden rod interposes an effective barrier between the two terminals of each pole. Suitable levers are provided for handling the tanks, which may be lowered away from the contacts and removed without disturbing the rest of the circuit-breaker. The entire circuit-breaker may be set in place and all parts adjusted before the oil tanks are placed in position. When necessary, the tanks may be filled without removing them from their position. The oil level is easily seen by means of a small sight gauge. The tanks are insulated from the circuit, and, all the live metal parts being immersed in oil, there is no possibility of receiving a shock from touching the breaker.

Mounted on each circuit-breaker is a small double-pole, double-throw knife switch, which is used with the indicating and tripping circuits, and is operated by the motion of the levers of the circuit-breaker. The controlling and indicating devices consist of a controlling switch, an electromechanical, tell-tale indicator and a lamp. These are suitably mounted at the operating platform. A polyphase, overload relay, connected to series transformers in the main circuits, is provided for automatic opening. The controlling switch, which is of the drum type, has three positions, namely, "closed," "off" and "open." It will remain of itself in the "off" or the "open"



ELECTRICALLY OPERATED OIL CIRCUIT BREAKER.

positions only. In other words if it is thrown to the "open" position, it will remain in that position when the hand is removed, but if it is thrown to the "closed" position, it will turn of itself to the "off" position, as soon as the handle is free. In the "off" position it connects the control circuit, so that if the oil circuit-breaker opens through the action of any of the automatic devices, the lamp will be lighted on the operating stand to attract the operator's attention. If the oil circuit-breaker is opened by the operator throwing the controlling switch to the "open" position, the lamp does not light.

The mechanism of the electromechanical tell-tale indicator consists of an electromagnet, which attracts a pivoted armature through an angle of about 90 degrees. Attached to the armature is a disk with a pointer, which indicates to the eye the "open" or "closed" position of the oil circuit-breaker.

In the accompanying illustration the closing magnet is partly hidden by the overload relay. This operates on the principle of the single-phase induction motor. Each of the sectors swings between the poles of an alternating-current electromagnet. Part of each pole is surrounded by a short-circuited strip of copper, which acts to retard the magnetic flux, and thus produce a shifting field. This tends to move the counterweighted sectors which carry a contact closing the tripping circuit of the circuit-breaker. The two sectors are connected in parallel and either alone will trip the breaker. The currents for their magnets are derived from the phases of the main circuit by series transformers.

The apparatus described above, known as the type-C circuit-breaker, is manufactured by the Westinghouse Electric and Manufacturing Company. The illustration shows a left-hand compartment closed by an iron door, the oil tank suspended in the middle compartment, and the right-hand compartment without the oil tank. The overload relay is just above the second brick pier from the right, and the tripping device just above the third pier.

City Electrician for Kansas City.

The City Council of Kansas City, Mo., has passed an ordinance creating the office of city electrician. The salary of the office is to be $1,800 a year, and the revenue to meet the expense of the department is to be derived from the taxation of poles and wires, as provided by a special ordinance. The chief purpose of the ordinance is to exercise a supervision of electrical construction, so as to safeguard life and property. In case of fire, the electrician is authorized to cut off and disconnect any wires.

The employes of the Milwaukee Electric Railway and Lighting Company have been given an advance of one cent an hour in wages, the third voluntary increase in the last two years.

The Pennsylvania New York Terminal.

Definite plans for the construction of a terminal of the Pennsylvania Railroad Company in New York city have now been made, and as the necessary municipal authority has been obtained, the work of carrying to completion this mammoth enterprise will be pushed with great vigor. As has already been announced in these columns a double tunnel will extend from the New Jersey shore to the New York terminal structure which will be located on the site bounded by Thirty-first and Thirty-third Streets and Seventh and Ninth Avenues. Four tunnels will connect this terminal with the Long Island terminal at Long Island City, where the railway terminal facilities proper will be located. Certain portions of the Long Island railroad will be changed from steam to electric traction. Two electric power houses, aggregating upwards of 100,000 horsepower, will operate the trains, one being located on Long Island and the other in New Jersey.

The Pennsylvania management has divided the work into four branches—the tunnels, the architecture, the mechanical and electrical engineering and the bringing of the railroad into and through the tunnels—and appointed as a commission of engineers men who were eminently fitted to supervise these different branches. The commission consists of Col. Charles W. Raymond, United States Army, engineer New York harbor, chairman; Charles M. Jacobs, C. E., chief engineer North River section; Alfred Noble, C. E., chief engineer East River section; William H. Brown, chief engineer Pennsylvania railroad, in charge of tracks and terminal yards; Gustav Lindenthal, C. E., bridge commissioner of New York city; George Gibbs, M. E., first vice-president of Westinghouse, Church, Kerr & Co., in charge of mechanical engineering, electric locomotives and traction.

The architectural work has been delegated to McKim, Mead & White, and Westinghouse, Church, Kerr & Co. have been appointed the mechanical and electrical engineers and constructors of the extensive and varied work which follows through many departments of the undertaking. Following upon this appointment the architects made Westinghouse, Church, Kerr & Co. their engineers for this work.

These three organizations, the commission, architects and engineers, will work in conjunction with the chief engineer and management of the road. Westinghouse, Church, Kerr & Co. have also been appointed in a similar capacity by the Long Island railroad.

The commission has been at work since early last spring, while the architects and the engineers have had a large corps of men actively engaged since about June last. There has, therefore, been much more preliminary work carried on prior to the passage of the franchise than has been popularly supposed. The engineers have already substantially completed the plans for the Long Island power house, so that work can be begun immediately upon the same; this has become necessary in order to provide electric power for the Atlantic Avenue division of the Long Island railroad, which will be completed for operation in advance of the tunnel construction. This power house, together with the one in New Jersey, will jointly serve the entire traction system, and each will have provisions for relaying the other and for serving the New York terminal singly and jointly.

The terminal structures in New York will contain much of interest to engineers, through the mechanical and electrical equipment with which it will be supplied, comprising heating, ventilation, lighting, passenger, freight and baggage elevator service, telegraph, telephone and pneumatic-tube service, refrigeration, hot water, cooled water for drinking supply, fire protection and many other features.

Almost as a part of, yet quite distinct from the buildings, will be the terminal proper, of which a general idea may be gained by the fact that the area of some 1,800 by 500 feet between Ninth and Seventh Avenues will needs be excavated to a depth of some 40 or 50 feet, and on foundations therein will rise what corresponds to a train shed in other terminals, with its multiplicity of terminal tracks, crossovers, platforms, waiting rooms, ticket offices, and other paraphernalia of a great railway station, together with the intricate switch and signal systems by which the train movements are regulated and the whole purpose for which a terminal is built is controlled.

Drainage-canal Power Transmitted to Chicago.

The first power generated by the Chicago Drainage Canal waterpower at Joliet, Ill., to be transmitted to Chicago, is now being used to operate the Bridgeport pumping plant that for years has been driven by steam. This plant consists of seven rotary pumps connected to a line shaft and used to elevate water a distance of six feet from the Stockyard's slip of the Chicago River to the Illinois-Michigan ship canal. At each end of the shaft is belted a 300-horsepower, 2,300-volt, three-phase induction motor, and the arrangement is such that each motor drives three pumps regularly, the center pump being capable of connection by couplings to either motor. Power is received over a 30-mile, 31,000-volt transmission line from the Joliet plant of the Economy Light and Power Company, the line following the canal. The step-down transformers consist of three 250-kilowatt transformers, delta-connected, and at Joliet are located three 500-kilowatt transformers, Y-connected, with the neutral grounded.

Pipe and Wiring Tunnel at Detroit Car Works.

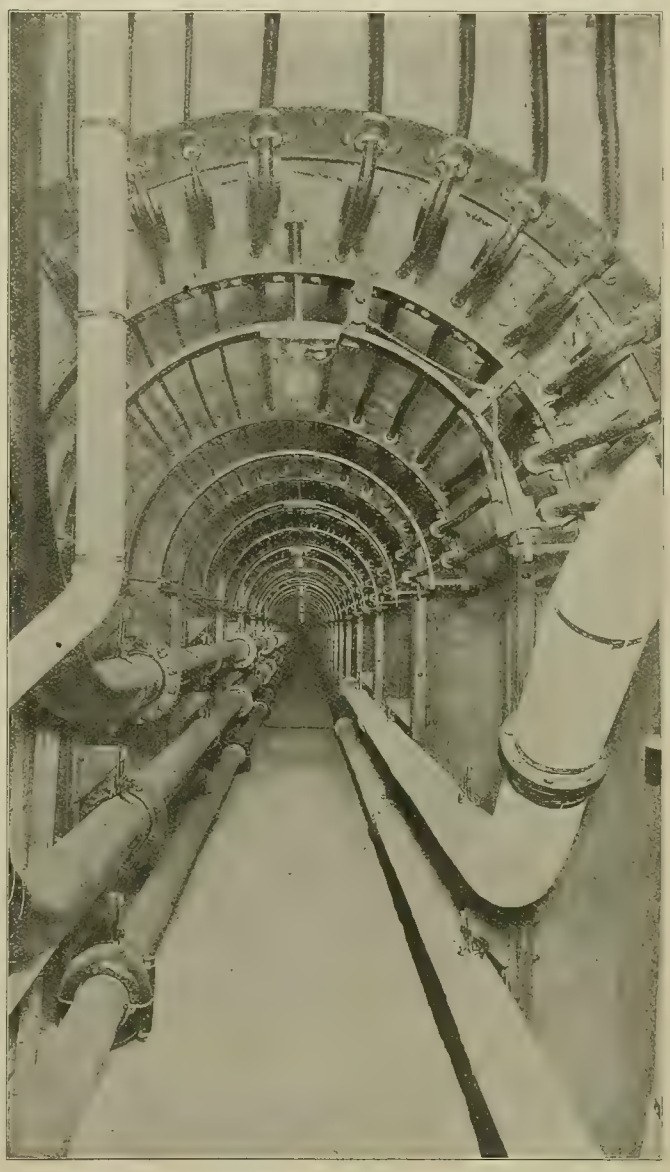
The electric-lighting and power equipment of the new and extensive works of the American Car and Foundry Company at Detroit, Mich., is characterized by many interesting details of construction, one of which is the tunnel for carrying the piping and wiring between the power house and shop, and which is strikingly illustrated in the accompanying picture. The power house is a brick building and is distinct from the main-shop building. Its equipment includes four 300-horsepower Babcock & Wilcox water-tube boilers, fitted with Roney mechanical stokers, and three Westinghouse vertical compound engines direct-connected to 250-kilowatt, multipolar, direct-current generators.

The general system of distribution in use is the 220-volt, two-wire system for both lighting and power. All feeders are of triple-braided, weatherproof copper cable, supported upon pin-bracket insulators, excepting through the tunnel, where special supporting brackets of simple and inexpensive design are used. These brackets are well shown in the illustration. This tunnel is constructed of brick and cement, and extends the entire width of the shop. It has straight sides and arched roof, sufficient headroom being provided for workmen standing in an erect position. Through the tunnel are carried all the electric conductors, as well as the hydraulic, pneumatic and heating pipes, which are supported on suitable iron racks by means of flexible suspensions.

The electric feeders supplying the car and press shop rise from the tunnel at three points, located at the intersections of the tunnel with the two walls and the line of center columns of the building. Along each wall and the line of columns run two independent feeders, for power and light. From these feeders taps extend to the desired location, loricated conduit and rubber-covered wire being used whenever the leads extend under the concrete floor.

The distributing hydraulic pressure main passes from the power house through the tunnel to the car and press shop, where several branch mains are connected, these distributing the hydraulic power to all parts of the shop. The pressure main consists of double extra-heavy wrought-iron pipe throughout, with the exception of some of the smaller sizes, which are extra heavy only. All joints of pipes of sizes 2½ inches and larger are of special form, designed to secure the utmost security against failure. In order to economize water the pressure main is paralleled at every point by a return main, by which, after use in the tools, the water is returned to the pumps, to be again utilized. The return main is standard pipe throughout, of sizes to allow easy flow and prevent gorging, and discharges into a large, steel supply tank in the power house.

The hot-water-pipe mains of the heating system pass through the tunnel and connect the central heater with the radiator stacks at one end of the car shop and with the direct-heating coils suspended in the template shop. The buildings and power equipment for the power plant were designed and the machinery installed by Westinghouse, Church, Kerr & Co.



PIPE AND WIRING TUNNEL AT DETROIT CAR WORKS.

The Sarasota (Texas) Ice, Fish and Power Company, organized for the manufacture of ice and electric power, has purchased the Lyle (Texas) Ice and Trading Company's plant, and will remove to Sarasota, adding a 10-ton plant. W. C. Hayman is president; E. F. Wilson, secretary, and J. L. Wilhem, treasurer.

White House Electrical Plant.

The rehabilitation of the White House in Washington included the installation of a complete new electric plant, and the lighting of the building will be a notable feature of future receptions. There is in all, in the building, about 168,000 feet, or 31 miles of electric wire, all of which is enclosed in iron conduits, each system of wiring being entirely distinct. There is an electric-lighting equipment which supplies current to 3,000 incandescent lights throughout the building, and also a distinct power system which supplies current to ventilating motors, automatic electric pumps and electric elevators. In addition, there is a complete electric-bell system, while an outfit of telephones, both private and public, completes the installation.

The automatic electric elevators are interesting examples of ingenious mechanism. By pressing a button the elevator comes to the passenger's floor and the door opens. After having stepped inside the car, the passenger presses a button corresponding to the floor to which he desires to go, then the door closes, and he is carried to his destination. In the pantry there is a large electrical plate-warming apparatus which has a capacity of, in a few minutes, heating 3,000 plates.

The contract for the installation of the system was let to Harry Alexander of New York, who sent to superintend the work Charles M. Maxwell, an expert electrician. Work on the installation was begun in July, and is just being completed.

Street-railway Master Mechanics' Meeting Postponed.

The meeting for the organization of master mechanics of street-railway companies, which was to have been held at Cleveland, Ohio, on January 12th, has been postponed, it appears. The correspondent of the Western Electrician in that city could learn nothing of such a meeting having been held. Inquiry among street-railway men in Chicago also revealed a lack of knowledge on the subject.

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DATES AHEAD.

Northwestern Electrical Association, Pfister House, Milwaukee, Wis., January 21, 22 and 23 1903.

Kansas Independent Telephone Association, Hotel Throop, Marion, Kan., January 28th and 29th.

Independent Telephone Association of Wisconsin, Hotel Pfister, Milwaukee, Wis., February 11th and 12th.

COLD weather did not congeal the enthusiasm of the pole men at the convention of the Northwestern Cedarmen's Association in Minneapolis on Monday. There was a fair attendance of men interested in this important industry, and subjects of importance to pole consumers as well as pole producers were discussed. Mr. Worcester, the retiring president, conducted the deliberations of the organization with dignity and ability, and was succeeded in office by Mr. Downing of Minneapolis, the former vice-president. A full report of the meeting of the association is given elsewhere in this issue.

POWDER MILLS offer an opportunity for the introduction of electric drive, provided all possibility of danger from fire is removed. For this purpose the induction motor is especially well suited on account of the absence of commutator, slip rings or other moving contacts. It is impossible for the motor to spark or flash, and it may be easily started from a switchboard at any distance from the motor or, if the starting switch is near at hand, the switch may be submerged in some non-inflammable oil, thus rendering the equipment absolutely safe in the presence of explosive or combustible materials. The companies manufacturing ordinary gunpowder, smokeless powder, dynamite or other high explosives are recognizing this fact, and the manufacturers of induction motors are profiting to some extent by this comparatively new demand.

NEXT week will witness the annual meeting of the Northwestern Electrical Association in Milwaukee. This is the home association of the electrical men of the Northwest, and it is deserving of hearty support. Secretary T. R. Mercein has prepared an attractive programme, as will be seen by the brief preliminary article presented on another page. The convention will be held in Milwaukee, as in former years, and as that hospitable city is easy of access from all points in the territory covered by the association, there should be a large attendance. We trust that every reader of the Western Electrician in the Northwestern states who can conveniently do so will make it a point to attend this convention and participate in the deliberations of the association. The society has done much good work in the past for the welfare of its members, and its prestige should be not only sustained but enhanced.

MANUFACTURES now form almost one-third of the exports from the United States—a larger proportion than at any previous time. The figures of the Bureau of Statistics of the Treasury Department for 10 months of the year 1902 show that manufactures formed during that period 32.61 per cent. of the total exports of the country, while the highest percentage in any preceding fiscal year was that of 1900, in which the exports of manufactures formed 31.65 per cent. of the total. Five great staples form the bulk of the exportations of manufactures from the United States to Europe—copper, mineral oil, iron and steel manufactures (in which electrical machinery is included), leather and agricultural implements. The annual exportation of copper, mineral oil and iron and steel manufactures each exceeds $40,000,000. Thus, while agricultural products still form the great bulk of our exports, the place of the United States as a seller of manufactured goods in the markets of the world seems to be well assured.

EXPERIENCE still remains the best teacher, although some of our public-ownership friends seem ready to dispute the point, and so, when Mr. Francis E. Drake, an American who has had a particularly valuable experience in France and Germany with buyers and sellers of machinery, electrical and otherwise, advocates a reasonably rapid adoption of the metric system in the United States, his opinion is entitled to great weight. In a recent article in the American Machinist Mr. Drake mentions the criticism to which American manufacturers were subjected at Paris in 1900 on account of their failure to put metric equivalents in their tables of measures. He suggests that possibly Americans are a little too supercilious in regard to foreign trade. "Instead of forcing the purchaser to accept the standard which is easiest for us," he adds, "it would appear far more commercial and businesslike for us to meet him halfway and furnish him with what he wants." This is true, of course, and we believe that American manufacturers are coming more and more to recognize the advantage of patterns and standards in metric units. Our own position is one of hearty friendliness to the metric system, although we do not believe that it is wise to attempt to hasten its adoption by drastic statutory enactments. It will need a long educational process before Americans think in centimeters, kilograms and liters. But long before that time all American manufacturers who hope for export trade will fluently explain the dimensions and weights of their products in metric measurements.

THE shortage in the coal supply, whatever its cause, has directed renewed attention, in this country, to an increasing use of the power of waterfalls, electrically transmitted to points of consumption. Engineers are more familiar than others with the economic limitations of electric power transmission, but in every case, hitherto, they have compared the cost of the horsepower-hour at the point of utilization with the cost of steam power produced from coal at varying prices. But what if coal were practically unobtainable or if the supply were exhausted? Then, indeed, the importance of the widely scattered "white coal"—to translate a striking French expression—would be enormously enhanced. Fortunately, Nature has endowed this country with almost incalculable resources of falling water as well as great beds of coal, so that we may face the future with equanimity, once the present abnormal conditions are adjusted. But it is evident that the available waterpowers are to be regarded as holding tentative possibilities far beyond immediate industrial necessities. Who knows but that in Alaska, for instance, we have greater potential wealth in the mighty rivers and melting snows than in all the fisheries, fur-bearing animals and mines put together? It may be, as Professor Mason of the Smithsonian Institution says, that "some day in the not distant future the rivers will make all the electricity we require. We shall harness the streams, and they will heat every house, run every wheel, and light every lamp."

REMARKING that there is still plenty of territory for interurban electric-railway extension, a correspondent sends us some interesting observations on the financing of these properties. "It is admitted," he says, "that propositions will be somewhat harder to finance than they have been, but this will only result in the companies being placed upon a better and more solid basis through the larger issues of stock and bonds to those directly interested and the smaller bond issues to outsiders. This is as it should be. One or two new syndicates have been formed lately in the state of Ohio, with plenty of capital to finance their enterprises, and while they may float some of their securities in the money markets, they will be able to put in a large part of the cash themselves. It goes without saying that they will succeed better than if they depended upon the bond houses furnishing the funds. The companies which are having the greatest trouble now are those which did not have enough money furnished by the home people. There are several of this kind, and they are building their roads in a kind of hand-to-mouth way, as they can secure the cash, which in some instances seems to be a slow process. They are in the hands of persons who have not had great experience in the money markets, to be sure, but even if it were otherwise, there would be trouble. There are one or two roads which are being constructed by syndicates whose members go down in their pockets and pay the money as it is used. The stock sold later on will form a surplus capital for operating the road, and it is hardly necessary to state that they will be upon an enviable basis when they are completed." It is too true that while in almost any given territory the electric railway offers the prospect of better and cheaper transportation, too many roads have been projected with the principal idea of affording profits to promotors and financiers. This has resulted in overcapitalization and subsequent disaster in some cases. Steam railroads have had a similar experience, and many of them have passed through the reorganization stage. The promoter of more recent days saw a good thing in electric-railway building, and while we must recognize that much good has resulted from his indefatigable exertions, his after-record is not one of unmixed success. It is gratifying, therefore, to observe the tendency, pointed out by our correspondent, toward a greater contribution of construction money by the "home people."

Electrical Papers at American Association Meeting.

At the recent meeting of the American Association for the Advancement of Science in Washington, an outline report of which was given in preceding issues of the Western Electrician, a number of the papers were of electrical interest. Abstracts of five of these papers are given:

On the Electrical Conductivity of Solutions in Amyl Amine. By Louis Kahlenberg, University of Wisconsin.—Amyl amine has a dielectric constant of 4.5, which is of the same order as that of chloroform and ether. Solutions in the latter solvents are very poor electrolytes; it was, therefore, of interest to determine the conductivity of solutions in amyl amine. Cadmium iodide, silver nitrate and ferric chloride solutions in amyl amine were measured by Kohlrausch's method. The results show that, contrary to what one would expect according to the Nernst-Thompson rule, amyl amine yields solutions that conduct well enough to admit readily of measurement. Again, the change of the molecular conductivity as the solutions are diluted is such that it cannot be harmonized with the theory of electrolytic dissociation.

A Determination of the Frequency of Alternating Currents by the Automatic Adjustment of the Circuit to Resonance. By Carl Kinsley, University of Chicago.—An electric current can be turned to any frequency within a wide range by varying the self-induction of the circuit. This may be automatically accomplished by using a moving core in the coil giving self-induction. If the spring-held core is slightly beyond the position of resonance in the direction of too large self-induction, it will be retained in equilibrium between the force of the spring and the pull of the coil. The plunger will, therefore, rise and fall in the coil as the varying frequency requires a greater or less self-induction for resonance.

Experiments Concerning Very Brief Electrical Contacts. By Herschel C. Parker, Columbia University.—A form of gravity contact key is described, giving times of contact varying from 0.1 to 0.00001 second. The duration of contact was determined by observing the deflection produced by the discharge of a condenser which had been charged during the required contact period. Experiments were also made to determine the time of contact of a pendulum consisting of a steel ball suspended by a wire and striking against a steel anvil. A pendulum four meters long, swinging through an arc of one-half degree gave a contact of 0.00039 second.

The Damped Ballistic Galvanometer. By O. M. Stewart, University of Missouri.—It is usually assumed that a ballistic galvanometer, if well damped, does not give deflections strictly proportional to the quantity of electricity discharged through it. It has been found experimentally, however, that such error, if any, is very small, and that the deflection is proportional to the quantity.

Why the Electromotive Force of the Daniell Cell Changes When the Densities of the Solutions Change. By Henry S. Carhart, University of Michigan.—In a previous paper the increase of thermo-electromotive force between a metal and a solution of one of its salts was applied to the above problem. The explanation has been criticised on the ground that the heat of formation of both zinc sulphate and copper sulphate, in an aqueous solution, decreases as the density increases. This would appear to offer a rational explanation of the change of electromotive force of the Daniell cell without regard to thermo-electromotive force and its variation with the density of the solution.

This question was tested by measuring the electromotive force of a Daniell cell of a special form, containing a concentrated copper-sulphate solution, with, first, a one-sixteenth normal zinc-sulphate solution, and, second, a normal zinc-sulphate solution. The thermal electromotive force was found abundantly large enough to explain the phenomenon.

Further, the most interesting fact about this is, that the observed change of electromotive force of the Daniell cell is exactly the electromotive force of a concentration cell with the two zinc-sulphate solutions. A little consideration shows that such should be the case, but I am not aware that this point has been observed before.

Lighting Statistics of Chicago.

The Chicago Municipal Library and Bureau of Statistics in its quarterly issue for October last gives monthly statistics in regard to the lighting of the city, the figures for September being as follows: Number of gas lights operated, 25,008; number of gasoline lights, 4,861; number of electric lights operated by the city, 4,549; number of rented electric lights, 560; total number of lights operated during month, 34,978. The average number of electric lights operated by the city for the nine months of 1902 ending in September was 4,483, and of rented electric lights 612. The average daily candlepower used for lighting streets for September was 11,510,460. The permits issued for installations of electric-light wires and apparatus for the month of September were 859, and the actual number of inspections made was 1,894.

Northwestern Electrical Association.

Arrangements have practically been completed for the eleventh annual convention of the Northwestern Electrical Association, which will be held at the Hotel Pfister, in Milwaukee, Wis., on January 21st, 22d and 23d—Wednesday, Thursday and Friday of next week. Secretary Thomas R. Mercein has arranged the following programme for the three days of the convention:

WEDNESDAY MORNING, JANUARY 21ST.

Convene at 11:30 a. m. Roll call. Reading of minutes of previous meeting. Annual address by President Irving P. Lord of Waupaca, Wis. Report of Mr. Mercein, secretary and treasurer.

WEDNESDAY AFTERNOON.

Appointment of nominating and membership committees. Applications for membership. Reports of standing and special committees other than the nominating committee. Miscellaneous business.

Paper—"Testing Department of the Central Station," by Professor G. D. Shepardson of the University of Minnesota. Discussion.

Paper—"Metal Preservation," by Professor A. H. Sabin of New York city. Discussion.

WEDNESDAY EVENING.

Theater Party. Those desiring to attend are requested to assemble in Convention Hall at 7:30 p. m.

THURSDAY MORNING.

Questions and Answers.

Paper—"Rates and Methods of Charging," by J. W. Shuster of Wisconsin. Discussion.

Paper—"Association History," by Thomas R. Mercein of Milwaukee, Wis. Discussion.

THURSDAY AFTERNOON.

Report of nominating committee. Election of officers.

Paper—"Automatic Voltage Regulation," by H. C. Wirt of Schenectady, N. Y. Discussion.

Illustrated lecture—"Light and Modern Illumination," by W. D. Ryan of Chicago.

THURSDAY EVENING.

Annual banquet at the Hotel Pfister at 8:30 p. m. Those desiring to attend are requested to assemble in Convention Hall at 8:15 p. m.

FRIDAY MORNING.

Unfinished business. Adjournment.

The sessions of the convention will be held in the convention hall on the second floor of the Hotel Pfister and the exhibits of the different manufacturers and supply houses will be located in rooms on the same and adjacent floors. Manager Severance of the Pfister, who has entertained the Northwestern people for several years, is making a special effort to make the stay of the delegates, supply men and visitors a pleasant one, and indications point to a successful convention. Arrangements have been made for the Chicago party to leave on the Chicago, Milwaukee and St. Paul train at 9 a. m., Wednesday morning. A special car will be provided and will be in charge of James Wolff, Electrical Building, Chicago, chairman of the transportation committee. Mr. Wolff has been energetic in his efforts to secure a large representation from Chicago and vicinity, and it is expected that the attendance from other sections embraced in the association will be fully up to the record of previous conventions.

The present officers of the Northwestern Electrical Association consist of the following-named gentlemen:

President—Irving P. Lord of Waupaca, Wis.

First vice-president—P. H. Korst of Janesville, Wis.

Second vice-president—George D. Westover of Cadillac, Mich.

Secretary and treasurer—Thomas R. Mercein of Milwaukee, Wis.

Board of directors—F. W. Bowen of Kenosha, Wis., A. M. Barron of South Bend, Ind., and E. C. Hay of Springfield, Ill.

Steam Turbine Installed Near Detroit.

Engineers in Detroit, Mich., are much interested in the steam turbine which has been installed in the new plant of the Pennsylvania Salt Company, in Ecorse, a suburb of Detroit. The turbine was set up and started early last week, and since then has been given a thorough test and is said to have proved a success. It came from Newcastle-on-Tyne, England, and is one of the first Parsons steam turbines to be installed in an American plant. The turbine is to drive direct-current generators for the electrical laboratory of the company. Much of the company's chemical work is done by electrochemical process, and the turbine necessary to furnish power for it is a large one of 350 kilowatts. It stands 30 feet long and six feet high and is four feet wide at its widest point. The turbine was erected by A. J. Christie of Pittsburg, Pa.

International Congress of Arts and Science for St. Louis.

The advisory board of the International Congress of Arts and Science, which is to be held in St. Louis, Mo., in 1904, during the World's Fair, met on December 27th in New York city, Dr. Nicholas Murray Butler, president of Columbia University, acting as chairman. The meeting was devoted to a consideration of the theme or subject which should form the central idea of the congress and to the development of which each section should contribute, and also to the consideration of the ways and means for promoting the congress. It was determined to recommend to the exposition authorities that the sessions of the congress be held within a period of four weeks, beginning September 15, 1904, the various groups of scientists to form sections of a single congress, rather than separate congresses.

As a subject which has universal significance, and one likely to serve as a connecting thread for all the discussions of the congress, the theme, "The Progress of Man Since the Louisiana Purchase," was considered by the advisory board fit and suggestive. The advisory board further recommended that the congress be made up from men of thought and of action, whose work would probably fall under the following general heads: (a) The natural sciences (such as astronomy, biology, mathematics, etc.); (b) the historical, sociological and economic group of studies (history, political economy, etc.); (c) philosophy and religion; (d) medicine and surgery; (e) law, politics and government (including the development and history of colonies, their government, revenue and prosperity, arbitration, etc.); (f) applied science (including the various branches of engineering).

It was also decided to refer to a special committee of seven the problem of indicating in detail the method in which this plan can best be carried out. The committee was selected with the purpose of securing reports on this organization from diverse standpoints, and is made up of the following-named eminent specialists: Simon Newcomb, retired professor of mathematics, United States Navy; Hugo Muensterberg, professor of psychology, Harvard University; ex-Assistant Secretary of State John Bassett Moore, LL. D., professor of international law and diplomacy, Columbia University; Albion W. Small, professor of sociology, University of Chicago; Dr. William H. Welch, professor of pathology, Johns Hopkins University;; Elihu Thomson, consulting engineer of the General Electric Company, and George F. Moore, professor of comparative religion, Harvard University. This special committee will report its final recommendations to the advisory board. The selection of a chairman-general for the congress will not be made until the plans of the advisory board are fully determined.

Marconi and His Work.

It is announced that Marconi will soon make a brief visit to the Cape Cod station, where he will test the apparatus and get it in working order. He will then go to England and probably return to Cape Breton by the end of March. President Roosevelt has consented to have transmitted over his signature the first formal message to be sent from the Cape Cod station. It will be directed to King Edward of England. The Cape Breton Marconi station is now continuously sending and receiving messages, and will be open for commercial messages in a few months.

The Marconi Wireless Telegraph Company of Canada has given notice of an application to Parliament for an act of incorporation to transact business all over British North America, the British Isles and Europe, on the Atlantic and Pacific Oceans, and on the islands of the oceans. The application includes a request for power to lease or purchase existing telegraph, telephone and cable companies.

The announcement is made that before long Marconi will make public the details of a recent invention of his in the nature of a portable wireless telephone apparatus, by which a person can communicate, when a considerable distance away, with his home or with others supplied with similar apparatus.

The government of Denmark has negotiated with Marconi to establish space-telegraph stations in Iceland, the Faroe Islands, and Shetland, but the matter is said to be at a standstill, owing to the price asked, which is $150,000 for connection between Iceland and the Faroe Islands, and $50,000 between the Faroe Islands and Shetland, which is dearer than the cost of a cable. If the price is reduced the government may establish wireless stations in Greenland and Denmark.

The Marinette (Wis.) and Menominee Power Company has decided to put in a power plant at Chappie Rapids, four miles from Marinette, and transmit the power to that town to be used by the street railway and for manufacturing purposes. The improvements will cost over $2,000,000.

NORTHWESTERN CEDARMEN'S ASSOCIATION.

The seventh annual convention of the Northwestern Cedarmen's Association was held in the parlors of the West Hotel, Minneapolis, on January 12th. The association has had a most flourishing year and the meeting was one of the most enthusiastic and best attended in the history of the association.

The association was called to order by President C. H. Worcester of Marinette, Wis. Secretary Fred H. Gilman of Minneapolis read the minutes of the preceding meeting at Menominee, Mich., which were approved. The secretary then read the minutes of the board of directors' meeting, which were also approved. Minutes of a preliminary meeting held on the regular date, January 6th, were read and approved. The association deferred its meeting at this time until the 12th. A further meeting of the board of directors, held on January 12th, considered a new classification of freight to be printed and distributed.

President Worcester then spoke of the association's flourishing condition, and of its smooth workings doing away with any subjects of comment.

Secretary Gilman read his annual report. Pole business seems to have fallen away, large telephone, telegraph and electric-railway companies having withdrawn from the market to a degree. Posts and ties have been in good demand. The number of members is improving, all of high character. The association has a total membership of 73, a net gain of 13 in the past year. The rate situation cannot be relied upon. This marks a point in the history of the association, and it has become more of a business organization. Its classifications are more and more accepted. The railroads are relying on it for weights more and more. Last year was the first year in which no meeting but the annual meeting was held, indicating that its business is moving better. Mr. Gilman suggested that the members report to the association two or three times a year as to stock on hand for the purpose of making up totals. This information will be seen by no one else than the secretary and will be of great benefit to all.

Treasurer H. W. Reade of Escanaba reported receipts of $922.55 during the year and disbursements of $1,424.71. There was a balance of $580.42 at the beginning of last year, so that the balance on hand on January 12, 1903, was $78.26.

The secretary reported that the directors had decided not to give the regular banquet, having taken a vote on that subject with a result in the negative, and a smoke social was to be substituted, to be held at the Minneapolis Commercial Club in the evening.

No occasion required the appointment of special committees, and a report was received from the railroad committee. The hope of getting a reduction in the minimum weight on cars was not realized. There were many who had no grievance save an overcharge on weights.

The official inspection committee was called upon but five times. Several times it was asked to settle cases which were not inspected when loaded. As the committee understands the matter, it is not appointed for that purpose, but to settle disputes beween buyer and seller.

The committee on posts and shingles recommends that, with few changes, the old list stand. After considerable discussion, the changes were adopted.

On shingles, the committee recommended Extra Star A should be $2.75; Standard Star A, $2.25; and adding a lowest grade to be known as No. 1, at $1. The addition aroused considerable discussion as to what it might mean in the lack of specifications. On motion, the recommendation of the low grade was dropped, and the prices on Extra Star A and Standard Star A adopted. The piling committee recommended that piling heretofore known as eight to nine-inch top be changed and each be sold as eight-inch piling and nine-inch piling at list prices. This was adopted.

The pole committee reported a disagreement on prices, and asked the appointment of a new committee. Discussion followed on the continued inability of various pole committees to reach any agreement, either on specifications or prices. President Worcester called Vice-president Downing to the chair. A motion was made to adopt the report of the committee of inability to report. President Worcester stated that some dealers sell their poles in a lump to those who sell to consumers, and they cannot agree with a price at which they shall agree to sell, the same to be sold to consumers at the same price. He recommended that the association take a vote on the subject and the majority to rule. The discussion brought out the fact that poles are not sold under specifications nor at retail, and that it seems impossible to make specifications or prices which can be adhered to. On a rising vote, the motion to accept the statement of the pole committee was adopted.

A nominating committee, consisting of H. S. Gilkey, George A. Lang and G. L. Lindsley, was named, and presented the following list of officers:

President—R. H. Downing, Minneapolis.

Vice-president—William Mueller, Jr., Chicago.

Directors—C. H. Worcester of Marinette, Wis., G. L. Lindsley of Chicago, George Nicholson of Manistique, Mich., and H. S. Gilkey of Janesville, Wis.

All were elected unanimously. The board of directors elect the secretary and the treasurer.

President Downing took the chair and expressed his thanks. He spoke of the pole controversy and believed that the association need not fear disruption, so long as it continued to do the most good to the largest number.

The secretary announced that there was to be a concatenation of the Hoo-Hoos on the next evening, and all cedarmen are eligible and were invited to join.

Before adjourning a suggestion was made that the pole committee confer with the different companies having specifications differing from the association. A motion to this effect failed for lack of a second.

The secretary reported a request from the weighing association of the railroads asking for copies of the weights of the association, showing a more amiable feeling toward the association.

After transacting some other business of minor importance the association adjourned.

The board of directors held a meeting at the close of the association's meeting and re-elected H. W. Reade of Escanaba treasurer, and F. H. Gilman of Minneapolis, secretary.

In the evening the members and guests of the association were invited to a smoker, which was held in the spacious rooms of the Commercial Club. Almost every delegate was present, and a most enjoyable time was had. A local entertainment committee consisting of F. H. Gilman, M. H. Coolidge, W. T. Reynolds, H. S. Gilkey, A. E. Darling, R. H. Downing, J. P. McGoldrick, A. E. Whitmore and T. M. Partridge, did itself proud in providing an evening's pleasure. Among other features was an address of welcome by Mayor Haynes, which was fittingly responded to in behalf of the association by Mr. E. H. Valentine of Chicago. W. I. Nolan, a member of the Legislature from Minneapolis, received the plaudits of those present for his admirable efforts in the entertainment of the visitors. L. G. Flourny supervised the remaining part of the programme, and his selections from local talent were well received.

Members and Guests.

Bennett, E. W., Erie Telegraph and Telephone Company ..... Chicago
Bissell, M. K., Erickson & Bissell ..... Escanaba, Mich.
Bowring, William P., C. H. Worcester Company ..... Marinette, Wis.
Brandt, A. W. ..... Faithorn Junction, Wis.
Brooks, C. B., Marshall H. Coolidge ..... Minneapolis
Brooks, Hall L. ..... Tomahawk, Wis.
Bruett, T. A., Wilbur Lumber Company ..... Milwaukee
Chandler, F. H., Marshall H. Coolidge ..... Minneapolis
Chapman, Mr., Holcomb-Lobb Company .. Marinette, Mich.
Church, W. C., Scott-Church Company .. Des Moines, Ia.
Clark, E. L., Valentine-Clark Co. ..... Chicago
Coolidge, Marshall H. ..... Minneapolis
Cross, M. B., Francis Beidler & Co. ..... Chicago
Darling, A. E., Chicago Lumber and Coal Company .. Minneapolis
Downing, R. H., Bradley-Watkins Company .. Minneapolis
Erickson, O., Erickson & Bissell ..... Escanaba, Mich.
Forbrich, C. W., Western Electrician ..... Chicago
Fowler, John H., Fowler-Jacobs Co. ..... Chicago
Fulmer, J. W., D. M. Fulmer Lumber Company .... Florence, Wis.
Gerich, J. E., MacGillis and Gibbs Lumber Company .. Milwaukee
Gilkey, H. S., Pendleton & Gilkey ..... Minneapolis
Gilman, Fred H., American Lumberman .... Minneapolis
Griffin, R .A., American Telephone and Telegraph Company ..... New York
Hayden, J. T., Mississippi Valley Lumberman ..... Minneapolis
Huebel, C. J., C. J. Huebel Company .. Menominee, Mich.
Jacobs, John A., Fowler-Jacobs Co. ..... Washburn, Wis.
Kaufman, E. E., Carney Bros., Company ..... Chicago
Kirkpatrick, J. C., Pittsburg and Lake Superior Iron Company ..... Escanaba, Mich.
Lang, F. J., Wisconsin Land and Lumber Company ... Hermansville, Mich.
Lansing, J. P., Hughes-Mackintosh Company ..... Minneapolis
Lindsley, Geo. L., Lindsley Bros. Company .... Chicago
Martin, L. R. ..... Duluth, Minn.
Mashek, G. M. ..... Escanaba, Mich.
McDonough, W. H., American Telephone Journal .... New York
McGoldrick, J. P., McGoldrick Lumber Company .... Minneapolis
McMeal, H. B., Telephony ..... Chicago
Miller, William, Minneapolis Cedar and Lumber Company ..... Minneapolis
Meek, Ed J., Telephony ..... Chicago
Mueller, William, Jr., William Mueller Company ... Chicago
Naugle, A. T., E. E. Naugle Tie Company ..... Chicago
Naugle, E. E., E. E. Naugle Tie Company ..... Chicago
Nicholson, George, Jr., White Marble Lime Company .. Manistique, Mich.
O'Callaghan, Jas., O. C. Lumber Company .. Vulcan, Mich.
Partridge, H. F., T. M. Partridge Lumber Company ... Minneapolis
Partridge, T. M., T. M. Partridge Lumber Company ... Minneapolis
Perrizo, Edw., Perrizo & Sons ..... Daggett, Mich.
Perron, M. ..... Perronville, Mich.
Reade, H. W., Pittsburg and Lake Superior Iron Company ..... Escanaba, Mich.
Reynolds, W. T. ..... Minneapolis
Rich, L. B. ..... Minneapolis
Robinson, F. W., Robinson-Freeman Company ..... Gould City, Mich.
Schussler, M. H., Coolidge-Schussler Company ..... Floodwood, Minn.
Smith, Elmer E., American Telephone Journal .. Chicago
Thomas, W. B. ..... Manistique, Mich.
Valentine, E. H., Valentine-Clark Co. ..... Chicago
Wagstaff, W. J. ..... Oshkosh, Wis.
Watkins, W. T., Bradley-Watkins Company .. Minneapolis
Werner, F. W., Bradley-Watkins Company .. Minneapolis
Whitmore, A. E. ..... Minneapolis
Wilson, George, E. E. Naugle Tie Company .... Chicago
Worcester, C. H., C. H. Worcester Company ..... Marinette, Wis.
Wright, J. F., Wright Bros. ..... Marinette, Wis.

Convention Notes.

C. J. Huebel, secretary and treasurer of the C. J. Huebel Company, was a familiar figure at the convention.

L. R. Martin of Duluth, Minn., grasped the opportunity to increase his already large acquaintance with the pole men.

Carney Bros. of Chicago were efficiently represented by E. E. Kaufman. Mr. Kaufman was most indefatigable in the interests of his company.

D. M. Fulmer, president of the D. M. Fulmer Lumber Company, Chicago, was unable to attend, but the interests of the company were well taken care of by J. W. Fulmer of Florence, Wis.

Owing to the rush of business, Paul Perrizo, Jr., of Daggett, Mich., was unable to attend, but the interests of Perrizo & Sons were looked after in a most painstaking manner by Edward Perrizo.

Hall L. Brooks, the well-known pole producer of Tomahawk, Wis., was a conspicuous figure at the convention. Mr. Brooks reports a constantly increasing business and considers the outlook most promising.

A. E. Whitmore of Minneapolis mingled with the members of the association and guests. Mr. Whitmore has an excellent supply of dry poles and is already receiving quite a number of inquiries for spring delivery.

James O'Callaghan, president of the O. C. Lumber Company of Vulcan, Mich., was a familiar figure at the convention. Mr. O'Callaghan is a cedarman of wide experience and handles a large number of white-cedar poles each year.

Fred H. Gilman, the popular secretary of the Northwestern Cedarmen's Association, received the congratulations of the members for his untiring efforts in their behalf. Mr. Gilman was here, there and everywhere, and handled his onerous duties with the greatest skill.

A. E. Darling, manager of the Chicago Lumber and Coal Company, Minneapolis, though perhaps the youngest pole man in the business, handled the interests of his company like a veteran. Mr. Darling issued an invitation to the cedar and lumber men to make his offices their headquarters, and quite a number availed themselves of his offer.

George L. Lindsley, president of the Lindsley Bros. Company, Chicago, was among the prominent members of the cedar-pole industry at the convention. Mr. Lindsley, as is well known, takes a most active interest in everything pertaining to the pole business, and is looked upon as one of the most highly esteemed members of the fraternity.

No more popular pole men exist than President J. C. Kirkpatrick of the Pittsburg and Lake Superior Company of Escanaba, and H. W. Reade, secretary and treasurer. Not only is the firm known as one of the largest, if not the largest, producers of cedar poles, but its genial representatives bear the reputation of being the best of good fellows as well.

William Mueller, Jr., secretary and treasurer of the William Mueller Company, Chicago, added greatly to his reputation as one of the most popular pole men in the business. A more genial "good fellow" it would be difficult to find anywhere. Although in constant demand by his associates, Mr. Mueller increased the renown of the Mueller company.

Marshall H. Coolidge of Minneapolis, like many other local pole men, added much to his already enviable reputation by his constant efforts to make the visiting pole men forget that they were not in their own "bailiwicks." At the same time, Mr. Coolidge did not forget that he was in the pole business, and it is said that more Coolidge poles will shortly leave the Coolidge yards.

M. B. Cross, manager of the cedar department of Francis Beidler & Co., Chicago, ably represented the interests of his company at the convention. The Beidler company has contracts for spring delivery aggregating 25,000 poles of 30 feet and over. The company is well stocked with 25-foot telephone poles for rural lines, and will be glad to figure with those in need of this particular length, or other sizes.

John H. Fowler, the popular Chicago pole man, and John A. Jacobs represented the Fowler-Jacobs Company. As is well known, this company carries one of the largest stocks of poles and ships to some of the largest consumers in the country. The ease and grace which have characterized Mr. Fowler's past efforts to help make his fellow members enjoy themselves were more in evidence than ever before at this meeting.

H. S. Gilkey of the well-known firm of Pendleton & Gilkey was one of the hardest workers at the convention in the interests of his associates. This, however, is nothing new, as the members of the association are familiar with Mr. Gilkey's past efforts in their behalf. Pendleton & Gilkey have found it necessary to move to the "metropolis of the Northwest," owing to their constantly increasing business, and Mr. Gilkey received the congratulations and good wishes of his associates. The firm is located in commodious quarters in the Lumber

Exchange, Minneapolis. It has on hand a fine stock of dry poles and will be glad to figure with consumers for the coming season's supply.

The interests of the C. H. Worcester Company of Marinette, Wis., one of the largest producers of cedar poles, were well taken care of by President C. H. Worcester and Secretary and Treasurer William P. Bowring. Words of praise were heard on all sides for Mr. Worcester's able administration of the Northwestern Cedarmen's Association. Mr. Worcester left no stone unturned to make every delegate and visitor to the convention feel at home. As in everything he undertakes, he succeeded.

As is usual at cedarmen's conventions, the E. E. Naugle Tie Company of Chicago was everywhere in evidence. In E. E. Naugle and A. T. Naugle the company has two representatives whom it would be difficult to surpass in energy and efficiency. The Naugle company is preparing for a large pole and tie business and has already on hand a number of large contracts to be filled in the spring. The Naugle Bros. are among the best known in the pole and tie business.

The convention was honored by the presence of two well-known consumers of poles, namely, E. W. Bennett, purchasing agent of the Erie Telegraph and Telephone interests, and R. A. Griffin, purchasing agent for the American Telephone and Telegraph Company of New York. These gentlemen attended the meeting to look into the pole situation, and it is safe to say that they were agreeably surprised at the strength of the association and the proportions of the pole industry in general.

The Valentine-Clark interests were taken care of by the senior member, E. H. Valentine, with the cooperation of E. L. Clark. Mr. Valentine has not attended many conventions of late, but he considered this occasion of sufficient importance to honor the gathering with his presence. Mr. Valentine's well-known reputation as an entertainer did not suffer at this meeting, and his fund of anecdotes was liberally drawn upon for the benefit of applauding listeners. Mr. Clark, of course, was as busy as he usually is at conventions, and he ably seconded his partner in assisting everybody to have a good time.

Prof. J. J. Thomson Chosen Professor of Physics at Columbia University.

Joseph John Thomson, M. A., one of the most eminent scientists of England, and for the last 18 years Cavendish professor of experimental physics at Cambridge University, has been appointed by the trustees of Columbia University of New York city to become head of the department of physics, to succeed the late Ogden Nicholas Rood. Professor Thomson was born at Manchester, England, in 1856, and attended Owens College in that city, and Trinity College, Cambridge. While at the former college, of which he is an associate, he worked in the physical laboratory under the late Professor Balfour Stewart. He entered Trinity College in 1876, was second wrangler and second Smith's prizeman in 1880; was appointed a fellow of his college in that year and appointed a mathematical lecturer in 1882. In this year he gained the Adams prize for an essay on the "Motion of Vortex Rings." In 1884 he was elected a fellow of the Royal Society, and in the same year succeeded Lord Rayleigh to the chair of experimental physics in the university. In 1896 he was elected president of Section A of the British Association. He is a fellow of the Mathematical Society and of the Physical Society, vice-president of the Cambridge Philosophical Society and honorary fellow of the Royal Academy of Turin. He has been given the honorary degrees of doctor of science and doctor of laws by Dublin and Princeton Universities, respectively. Besides his treatise on the "Motion of Vortex Rings" he is the author of "The Application of Dynamics to Physics and Chemistry," "Recent Researches on Electricity and Magnetism," "Elementary Treatise on the Mathematical Theory of Electricity and Magnetism" and of numerous other scientific works.

Poor Showing for Municipal Electric Plant in Richmond, Ind.

[From the Richmond (Ind.) Item of January 6, 1903.]

The report of the Municipal Electric Light Commission for the month of December, was presented to the City Council last night. The expenditures for the month were as follows:

Operating expenses	$2,087.26
Building and equipment	2,663.70
Repair account	24.15
Merchandise	90.91
Total expenditures	$4,866.02

The receipts are given as follows:

Cash on hand December 1st	$ 737.98
Receipts from light and power	2,140.01
Loan from city	3,500.00
Merchandise	27.03
Total	$4 866.02

The excess of the receipts from light and power, including the amount paid by the city for street lighting, which was $488.96 over the operating expenses, was $52.75. Without the city's bill, the operating expenses alone exceeded the receipts $437.21. The total expenditures were $2,698.98, not including the loan of $3,500 from the city treasury. This amount, $2,698.98, is what the plant cost the city for the month of December, nothing being allowed for interest on the investment of more than $150,000.

Electrical Statistics of Twelve American Cities.

A statistical table, with copious notes, prepared by Hugo S. Grosser, city statistician of Chicago, gives interesting and valuable data on the cost of administration of 12 American cities in the year 1901. The 12 cities selected are New York, Chicago, Philadelphia, St. Louis, Boston, Baltimore, Cleveland, Buffalo, San Francisco, Cincinnati, Detroit and Milwaukee. In the mass of information given, that presented under the heading "Electricity and Lighting" is of particular interest to the readers of the Western Electrician.

In New York city the Department of Public Buildings, Lighting and Supplies has charge of the city hall, courthouses, public baths, and other municipal buildings (not including police, fire or schoolhouses), bureau of electricity and bureau of public lighting. The salaries for 1901 ($631,240.86) were for administration, clerks, janitors, cleaners, bath attendants and other employes. The expenses for the year were $3,513.15, while for supplies and repairs to various offices and building the department expended $406,250.87 additional. The cost of lighting for the year was $2,243,468.91.

The Electrical Department of Chicago is in charge of lighting streets, electrical inspection and police and fire-alarm telegraph. The salaries for 1901 were $11,362.85 for administration; $17,318.59 for electrical inspection; $12,468.61 for gas inspection; $8,452.76 for superintendence, etc., of electric-light system; $13,368.58 for lamp-repair shop and $32,308.72 for operation of city plants, a total of $95,280.11. The expenses include $91,112.78 for repairs, renewals, trimming, etc., electric-light system; $5,513.60 for material and supplies of lamp-repair shop, and $114,602.24 for operation, maintenance and repairs of city plants, and amount to $211,228.62. The cost of lamps and lighting was $288,830.64 for gas; $144,855.84 for gasoline, and $68,794.50 for rented electric lights, a total of $502,480.98. Expenditures for extending municipal lighting system, $52,522.44, were not included in this figure. The salaries for police and fire-alarm telegraph were paid by those departments. The expenditures for operation, repairs and construction of telegraph systems were $72,588.09.

Philadelphia shows a salary expense of $95,809.59, which includes $4,700 for the Bureau of Lighting, Department of Public Works; $81,609.59 for the Electrical Bureau, Department of Safety, and $9,500 for the Department of Gas (meter inspection). The yearly expenses, $9,475.23, were for printing, horsekeep and incidentals only. The expenditures for lighting, $1,220,333.67, include $920,362.56 for electric lights and $299,971.11 for naphtha and lighting and extinguishing lamps by the Bureau of Lighting, Department of Public Works.

The salaries of the Electricity and Lighting Department of St. Louis were $21,361.50, and the expenses $4,602.79. The expenses for lighting were $509,248.82, and include $99,547.81 for electric light; $46,436.33 for gas light; $330,131.06 for Welsbach lights, and $33,133.62 for lighting the city hall, police and fire stations, water department and markets.

In Boston the salary expense of $61,712.91 includes $8,373.20 in the lamp department and $53,339.71 in the wire department. The expenses of the departments were $9,367.28, while the cost of lighting was $751,366.26, including $431,357.09 for electric lights and $320,009.17 for gas and naphtha lighting.

The statistics given for Baltimore are made up from the Department of Lamps and Lighting and the Electrical Commission, and the salaries amounted to $48,366.32, and the expenses to $33,116.56. The sum of $301,988.80 was expended for lighting, including $140,077.02 for gas; $144,135.93 for electric lights, and $17,775.85 for gasoline.

The salary item for Cleveland is $3,420.74, and consists of the gas inspector's salary and care of lamps only. The expenditures for lighting, $255,807.16, consist of $87,921.48 for electricity; $76,780.54 for gas, and $91,105.14 for vapor lamps.

The lighting department of Buffalo is in charge of the Bureau of Streets of the Board of Public Works, and its expenses amounted to $1,415.32. The year's expenditures for lighting, $342,308.01, include $241,813.95 for electric lights, $73,596.54 for gas, $13,171.09 for lighting and cleaning gas lamps, $8,425 for lighting public buildings, and $5,001.43 for lighting Pan-American approaches.

San Francisco Department of Electricity showed salaries of $36,811.13, and expenses of $2,209.91, the cost of lighting being $254,577.13. Under miscellaneous expenditures is given an item of $2,352.99 for telephone service.

Cincinnati's salaries of $4,700, include $2,700 in the light department and $2,000 for electrician. The expenses of the department were $1,399.99, and the cost of lighting $337,163.24, the latter item including $277,297.92 for electric light and $51,825.60 for gas and gasoline light.

In Detroit the salaries for the Public Lighting Department amounted to $58,767.78, and the expenses for maintaining the lighting department (the lighting plant being owned by the city) were $45,794.99. There was a further expenditure of $74,638.17 for public lighting construction.

The salary item of Milwaukee, $2,490.75, includes $600 for the electrician and $1,890.75 payroll for lighting bridges and squares. The expenses of the department were $344.34. The lighting cost $207,241.20, including $143,947.83 for electricity, $46,863.24 for gas, $13,591.34 for naphtha and oil, and $2,838.79 for lighting bridges and squares.

Boston Elevated Annual Meeting.

The Boston Elevated Railway Company held its annual meeting in Boston, Mass., on January 5th, and made one change in the board of directors. Quincy A. Shaw, Jr., was chosen to succeed William A. Gaston, who resigned October 1st, before beginning his campaign as the Democratic gubernatorial nominee. The following-named directors were re-elected: Frederick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Francis H. Peabody, James Phillips, Jr., James M. Prendergast, Nehemiah W. Rice, William S. Spaulding, Walter S. Swan and Robert Winsor.

The directors' annual report, covering the year ended September 30, 1902, states that the total number of revenue passengers increased 4.1 per cent. during the year, and the number of persons using the subway increased 14.97 per cent. The company has made contracts with the Boston and Suburban and Boston and Worcester Street Railway Companies, by which the cars of those companies will be run between their terminals and points on the elevated company's lines, by employes of the latter company, thus obviating the changing of cars by passengers. The report refers to the agreement for a lease of the Old Colony Street Railway Company's tracks in Boston, in pursuance of the act passed by the last Massachusetts Legislature.

It is estimated that the Boston Elevated company's cars carried 115,000,000 free transfer passengers during the last fiscal year. The revenue passengers amounted to 222,484,811. During the year the surface track was increased 1.4 miles, the total surface track now amounting to 393.4 miles and the elevated track amounting to 16 miles; 50 cars have been added to the elevated equipment; the company has placed vestibules on many cars, and is continuing this work; the company and the Rapid Transit Commission executed a contract by which the company will have the exclusive use of the Washington Street subway for 25 years from the date of completion, at an annual rental of 4½ per cent. of the cost of the subway.

Gross earnings of the company were $11,321,030; operating expenses were $7,862,571, and net earnings were $3,458,459, of which $2,491,670 was paid under the lease of the West End Street Railway and $600,000 was paid in dividends to stockholders of the Boston Elevated company. The company has a surplus of $21,899. At a special meeting on July 25th last, the stockholders voted to increase the capital stock by $5,000,000. The Massachusetts railroad commissioners would authorize the addition of only $3,300,000, which brings the amount of authorized capital to $13,300,000. The commissioners fixed the stockholders' subscription price at $155 per share. During the year the company has increased its motive power by the addition of two 4,050-horsepower engines, each operating a generator of 2,700-kilowatt capacity. During the year 29,172,150 passengers passed through the subway, an average of 79,923 per day, against an average of 69,516 the previous year.

Virginia Traction Combination.

The Virginia Passenger and Power Company, the control of which was recently purchased by Frank Jay Gould, has held its annual meeting and elected the following-named officers: President, F. Sitterding; first vice-president, Frank Jay Gould; second vice-president, Augustus Wright; secretary and treasurer, Guy Phillips; assistant secretary and treasurer, William Northrup; general counsel, Charles A. Gardiner. The capital stock of the Virginia company is $15,000,000, and the bonded indebtedness $15,000,000. The company is a consolidation of all the street railways, electric-light and power companies in Richmond, Manchester, Petersburg, and surrounding territory, and includes the Richmond Traction Company, Richmond Passenger and Power Company, Richmond and Manchester Railway Company, Richmond and Petersburg Railway Company, Virginia Electric Development Company, Westhampton Park Railway Company, and several other similar corporations.

Electricity for Purifying Drinking Water.

Richard Guenther, United States consul-general at Frankfort, Germany, writes that the city of Wiesbaden, Germany, has constructed extensive ozone waterworks at Schierstein for the purpose of obtaining a drinking water entirely free from pathogenic germs. The works are capable of rendering 250 cubic meters (8,829 cubic feet) per hour at a cost of two pfennigs (a little less than half a cent) per cubic meter. The ozone, generated by electric discharges in an apparatus composed of metal tubes, passes upward through coarse gravel contained in towers, while the water to be sterilized flows down and arrives at the bottom perfectly germless.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Service in Cincinnati and Cleveland.

It is announced that the City and Suburban (Bell) Telephone Company of Cincinnati, Ohio, will erect a new exchange building, which, with the equipment, will entail a cost of between $150,000 and $200,000. This exchange will be used in addition to the one now owned and operated by the company. The new building will be three stories in height and of sufficient dimensions to accommodate a switchboard of 9,000 drops. It will be modern in every particular, and will be centrally located in the business district. The exchanges at Cumminsville and East End will soon be ready to put in operation, and the company also has exchanges at Norwood and Walnut Hills. The officers state that there has been a great increase in the business the last year, and that the new exchange downtown is necessary to accommodate it. The old exchange has a capacity of 6,000 telephones, and it will be kept in operation, the new one being an addition.

The Cincinnati Telephone Company, recently incorporated, has applied to the City Council of Cincinnati to pass an ordinance providing for the regulation of stringing wires, height of poles, arrangement of underground conduits, and other things of that kind. R. McCracken, president of the company, states that the company needs no authority from the city to build and operate a plant, that right being given by the state, under the recent decisions of the Supreme Court in the Zanesville case and of the Superior Court in the City and Suburban case. The only thing the city has anything to do with, according to his idea of the matter, are the regulations spoken of above. The point is an interesting one, and the action of the Cincinnati authorities will be watched by those interested in telephone matters.

President Dickson of the Federal Telephone Company regards Cincinnati as a most excellent city for an Independent plant, according to the following, which recently appeared in a Cleveland paper in the form of an interview with him: "On November 1, 1902, the Bell company in Cincinnati had a total of 6,868 telephones. Cincinnati has a population of 325,902 by the census of 1900. This is one telephone to each 47½ of population. Cleveland has a population of 381,768, and has in both companies 20,174 telephones. This is one telephone to each 18.9 of population. A business man in Cleveland using both telephones, pays $132, which is at the rate of 6½ mills per available telephone. A business man in Cincinnati, where there is no competition, pays $125 for 6,868 telephones, which is at the rate of $.018⅛ per available telephone. In other words, the business men of Cincinnati pay nearly three times as much for their telephones that the men of Cleveland pay, on the basis of the service rendered. Nothing but Independent competition will help Cincinnati."

Independent Telephone Association of Wisconsin.

The Independent Telephone Association of Wisconsin will hold its next annual convention in Milwaukee on February 11th and 12th. It is expected that this meeting will be of unusual importance in many ways, and all indications give promise of a well-attended and successful convention. Many of the prominent telephone men in Wisconsin and neighboring states will take part in the programme. The Wisconsin association is one of the strongest of the state organizations, and its annual conventions will compare with those of any other state and are always voted successes. Nearly all the more important telephone manufacturers and supply houses in the Northwest will make exhibits at this meeting. The convention headquarters will be at the Hotel Pfister, and the sessions will be held in the hotel convention hall. Richard Valentine of Janesville is president of the association and H. C. Winter of Madison, Wis., is the secretary and treasurer.

Kansas Independent Telephone Association.

The annual meeting of the Kansas Independent Telephone Association will be held at the Hotel Throop, Marion, Kan., on January 28th and 29th. All railroads will sell round-trip tickets for one fare, on the 28th, good to return on the 31st. Arrangements for accommodations may be made by writing to B. F. Pankey of Marion. An interesting programme is being prepared. Charles E. Wells is secretary of the association.

Long-distance Telephone System for Porto Rico.

President Roosevelt has transmitted to Congress an ordinance enacted by the executive council of Porto Rico on December 3, 1902, granting to Benjamin J. Horton the right to construct, operate and maintain a system of long-distance telephone lines through the island of Porto Rico and connecting various cities and towns thereof, together with local telephone exchanges in such cities and towns. This ordinance was approved by the president on December 31, 1902.

J. J. Carty Receives Award for Bridging-bell Invention.

At a recent meeting of the Franklin Institute of Philadelphia the award of the Edward Longstreth medal of merit was made to John J. Carty of New York city for his invention of the bridging bell for telephones. The investigation of the invention was made by a sub-committee composed of L. F. Rondinella and E. A. Scott. An abstract of this committee's report states that Mr. Carty's invention is the subject of letters patent No. 449,106, March 31, 1891, and describes a multiple-circuit arrangement for telephone party lines, including at each station a permanent bridge in which is seated a bell magnet with a high coefficient of self-induction and of marked impedance. There are also two other bridges, normally open, and closed only when the station is in use. The telephone circuit, normally open, is closed in multiple arc with its own bell magnet, and, of course, with all others in the line, when in use. The generator-call circuit, normally open when used, forms a second bridge or cross-connection between the wires in parallel circuit with the bridge circuit of its own bell and those of all others in the line. In operation, the tendency of the call circuit to short-circuit is counteracted by using a bell magnet of high self-induction and impedance. This not only prevents short-circuiting, but also effects more even current distribution through the bell magnets of the entire system. By means of the numerous windings of the bell magnets, the small fraction of the call current passing exerts a marked magnifying effect on the cores and a spirited working of the call signal.

The investigators find, after an examination of the prior state of the art, that, "Mr. Carty's work consisted in adapting the bridging bell to party lines by increasing the resistance of the bell circuit to make it opaque to the transmission of voice currents. * * * * and that in the adaptation of well-known electrical-engineering principles to a particular and difficult branch of telephony, it shows professional skill of high order." Since the use of this method has contributed largely to the expansion of party-line telephony, the award of the Edward Longstreth medal of merit is made to the inventor.

Telephone Growth in Idaho.

The last year has been a prosperous one for the telephone companies operating in Idaho and adjacent territory. At Boise, the Independent company, in its official report of the year's work, shows an increase of from 702 subscribers to 1,325. It has also doubled the length of its lines and general capacity for good service, the switchboard at Boise now having a capacity of 2,000. It reports a steady increase in its business on community-farmer lines, and will make that system a feature during the year to come. Never in its history has the Bell Telephone Company accomplished so much in the extension of lines and improvement of service as during the year just past, and the work planned for 1903 for Idaho and surrounding connections in Utah, Wyoming and Montana is very extensive. In Boise itself the switchboard capacity has been doubled, and over 200 more subscribers were added during the year, but the construction of new lines connecting the Idaho capital with San Francisco, Salt Lake, Northern Idaho and Denver, has been the great work of the Bell concern. The new lines to Cœur d'Alene, Thunder Mountain, Star, Emmet, Pearl and other mining camps, have opened communication with the outside world, and been a blessing to the people of those places. The lines planned for 1903 will make communication direct with Utah and Northern Idaho points. All exchanges throughout the small cities of the state report an increase of business for the last year of from 50 to 100 per cent.

Telephone Competition in Virginia.

The Richmond (Va.) Telephone Company has petitioned the council of that city for consent to the transfer of its physical property, including all poles, wires, cables, fixtures, etc., to the Southern Bell Telephone and Telegraph Company, and to be released from any obligation to the city. In making the petition the president of the company, Addison Maupin, adds:

"We wish to state that we have ascertained that public opinion is emphatically in favor of only one telephone system, and we believe a continuance of our system, at the rates which we are now charging, would mean to us financial loss. We are now required to put our wires underground, which will entail increased loss to us, and to the public serious inconvenience and annoyance, while the result would simply be to duplicate facilities which already exist."

The Chicago Telephone Company, according to a recent announcement, has now in operation, including outlying districts, nearly 80,000 telephones. The number of new instruments installed in the city during December was 1,500, bringing the number of telephones used here up to nearly 60,500. The gain for the year approximates 33,000 instruments, showing wonderful progress made with the nickel-in-the-slot machines.

Indiana Telephone Items.

The People's Co-operative Telephone Company of Clarkshill was incorporated on January 9th. The company proposes to construct, maintain and operate telephone lines in Tippecanoe, Clinton and Montgomery Counties, with an exchange at Clarkshill. N. J. Baily heads the board of directors.

The Citizens' Telephone Company of Kokomo has certified to the secretary of state that its capital stock has been increased from $25,000 to $100,000. The increase was accomplished by issuing 1,500 additional shares of the capital stock of the company at the par value of $50 each. Stephen Tuder is president, and Charles Jay, secretary.

The Winamac, Kenawa and Knox telephone plants have been purchased by a Winchester syndicate headed by J. L. Thompson, which will buy a good many of the Northern Indiana exchanges.

The People's Mutual Telephone Company of Silver Lake has had a complete change in management, owing to the dissatisfaction of stockholders with the old management. At the annual meeting Carlin Meyers of Mentone was elected president, to take the place of Henry L. Oldfather. The old management has refused to turn over the books and offices to the new officers, and the difficulty will likely find settlement in the courts.

A telephone war has been declared at Gas City. The Central Union Telephone Company is charged with cutting rates on the sly, against the United company, a new concern, which recently put in exchanges at Gas City and Jonesboro. A good many people deserted the Central Union for the new company, although the rates were the same. It is now charged that the Central Union is giving the free use of its telephones to many people and making very low confidential rates to others.

Judge Curry of Evansville holds that the statute prohibiting profanity may be violated by the use of profane language over a telephone. Sherman Davis of that city used profane and obnoxious language over the telephone, was arrested and fined under the statute against profanity.

It has just been made public that a number of prominent people in Indianapolis guard the numbers of their telephones with much reservedness. They insist on the companies keeping their names and numbers from telephone directories. This gives the exchanges a good deal of additional work, but they are obliged to pander to the conservative element.

If the plans of the city administration of Evansville are successfully carried into effect, it will be less than a year before a municipal telephone plant is in operation, and every wire of any kind within the fire limits is placed in conduits. The mayor and city attorney spent last week in Chicago, to complete arrangements for disposing of stock among supply houses and construction companies. They report success beyond expectation, and now claim it is only a question of a short time until the municipal company will ask for a franchise and work will begin.

It is said that the plant of the Danville Mutual Telephone Company is the largest in the world, considering the population of the town. The plant began operation June 1, 1897, with 99 instruments and one toll line. It now has a telephone for nearly every five of the inhabitants of the city, and 248 farm connections and 21 toll-line stations. The system covers Hendricks County and has telephones in Boone and Putnam Counties. Connections are available with about 78,000 instruments in Indiana. There are three special circuits from Danville to Indianapolis and one that connects Danville, Greencastle and Indianapolis, making it possible for four persons to talk from Danville to Indianapolis at the same time. There have been some clashes between the Danville company and "the free farmers' lines," and the latter claim that they will yet get a line into Danville, the privilege having recently been denied them. F.

Ohio Telephone Notes.

A story comes from Cincinnati to the effect that a company to be known as the United States Telephone Company with a capital stock of $10,000,000, will be incorporated in New Jersey next week and that it will be a consolidation of all the Independent interests of Ohio, so far as long-distance lines are concerned. Furthermore, it is stated that it will include the Everett-Moore interests and will provide for an entry of the Independent lines into Cincinnati. President F. S. Dickson of the Federal Telephone Company declares that no such move was contemplated by the Everett-Moore people, and further said the alleged new company would not be allowed to use the name of the United States Telephone Company for its purposes. He said he was much surprised at such information, and did not seem to know who is interested in the company.

Everything possible is now being done to release the equities of the Everett-Moore syndicate in the traction companies, in order that the new plan of refinancing the telephone properties may be taken up actively. In some instances the work of improving the plants has been taken up already, but this cannot be aggressively done until all other matters are cleared up and out of the way.

The Home Telephone Company of Minster has completed its plant with 75 telephones working. J.

F. Maison of Wapakoneta is the general manager of the company.

A Mr. Cotterman of Deshler applied to the Town Council of McComb for a franchise to build and operate a telephone exchange, and it was passed on the first reading. Miss Anger Fruckey owns and manages an exchange there now. She is one of the very few women in the active telephone business in the United States.

A. C. Driker, representing Philadelphia capitalists, has been in Clarksburg and other West Virginia towns, looking over the telephone possibilities in that state. He states that it is the intention of his syndicate to build lines throughout Central West Virginia and extend them to Ohio and Pennsylvania, where they will connect with other Independent lines.

The annual meeting of the stockholders of the Oberlin Telephone Company, Oberlin, was held on the evening of January 5th. A full board of directors was chosen, and they afterward chose the following-named officers: President, E. P. Johnson; vice-president, M. M. Squire; treasurer, C. K. Whitney; secretary, A. S. Root. The exchange was burned out through the wires crossing the trolley wires some little time ago, but repairs are now well under way.

The New Pineville Telephone Company of Bell County, Ky., has been incorporated with a capital stock of $3,600, to build a line from New Pineville to Flat Lick, Knox County. J. C. Brown, N. M. Gregory and others are interested.

The report of the officials of the Warren and Niles Telephone Company shows a very satisfactory business for the last year. Warren has 935 telephones in operation and Niles and Mineral Ridge 400. The board of directors for the ensuing year is made up as follows: Washington Hyde, Jules Vautrot, Jr., G. B. De Voe, C. W. De Voe, C. C. Clawson, J. J. McClean and C. B. Selby.

The Auglaize Telephone Company of Waynesfield has increased its capital stock from $5,000 to $15,000. Harper Stiles is president of the company.

The Village Council of Ottawa has granted a franchise to the Farmers' Home Telephone Company, which will allow the erection and operation of an exchange in the town. O. M. C.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company expects to add several new sections to its exchanges in St. Paul and Minneapolis and will install modern visual-signal exchanges for Fargo and Grand Forks, N. D.

The average number of calls through the Fargo (N. D.) exchange of the Northwestern Telephone Exchange Company for three days recently was 15,264 per day. Fargo has 1,187 telephones, so it has an average of almost 13 calls per day.

The Badger State Long-distance Telephone Company of Janesville, Wis., has come under the control of Milwaukee parties and will be reorganized.

The Northwestern Telephone Exchange Company has completed two additional wires between St. Paul and Minneapolis and Duluth and Superior, making a total of five wires.

The Twin City Telephone Company has reached St. Peter, Minn., and has opened connection from the Twin Cities to that village.

A rural telephone line is projected into Kindred, N. D., by farmers east of that place.

A proposition is before the council of Little Falls, Minn., for a local telephone exchange to connect with the Twin City Telephone Company. The council does not seem to regard it kindly.

The council of Grand Forks, N. D., has two applications for a franchise to install a competing local telephone system. One is from the Twin City Telephone Company, and the other comes from Chicago parties.

The Chippewa County Telephone Company will extend its wires to Chippewa Falls, Wis., and establish a local exchange. The company touches all important points of the county except Chippewa Falls. The city exchange will be largely underground and will cost about $30,000.

The Bell Telephone Company will establish a local system at Macgregor, Man., at once. The materials have all been received.

The Municipal League of Sioux City, Iowa, will investigate the needs in telephone matters, before indorsing an application for a second telephone system.

The Farmers and Merchants' Telephone Company of Washta, Iowa, has been incorporated. The voters of Washta recently granted a franchise to the company.

The Rocky Mountain Bell Telephone Company plans the construction of a new connection from Montana points with Denver, via Cody, Wyo. The present connection with Denver from Montana is made via Pocatello, Idaho, and Salt Lake, Utah.

The Hawkeye Telephone Company will install a local exchange at Milo, Iowa, in the early spring.

The total cost of the telephone operators' strike in Des Moines, to the labor unions, was $7,568.43.

The Great Northern Telephone Company of Forest City, Iowa, will increase its capital stock to $100,000.

The Clarion and Northwestern Telephone Company of Clarion, Iowa, has decided to increase its capital stock from $10,000 to $20,000.

Farmers of East Platte, near Kent, Iowa, have formed two companies to establish rural lines.

The Rocky Mountain Bell Telephone Company had 2,169 instruments in use in Montana on May 1, 1901. On December 1, 1902, the number was 4,120.

The Burlington and Augusta Telephone Company has completed about 100 miles of rural lines and connects with the Mississippi Valley Telephone Company in Burlington, Iowa. R.

Southern Telephone Developments.

The Southwestern Telephone Company will, it is said, install a new system in Helena, Ark., on account of deficiencies in the present system. A new switchboard and 450 new telephones will be included among the improvements.

The Newton (N. C.) telephone exchange has been sold to W. T. Love of the Piedmont Telephone Company of Gastonia, N. C.

The long-distance line of the Bell Telephone and Telegraph Company, which is being built from Atlanta to Chattanooga, Tenn., has been completed to a point within 17 miles of Chattanooga.

The Independent telephone ordinance has passed the City Council of Chattanooga, Tenn., and the matter is now with the Board of Aldermen.

The Gainesboro Long-distance Telephone Company of Carrollton, Ga., has bought out the local exchange at Cedartown, Ga. An 18-mile connection was recently built to Cedartown.

The linemen of the Asheville (N. C.) Telephone Company, who recently went on a strike, have returned to work. L.

The Talked-of Telephone Combination.

A southern correspondent of the Western Electrician gives some additional information concerning the proposed alliance of the Independent telephone companies of the United States of which the Memphis Telephone Company is to be one of the largest holders. The deal is likely to be consummated under the name of the Memphis Long-distance Telephone Company, headed by Harry Meyers of Covington, Ky., the object of the Memphis combination being to unite with the systems of a number of neighboring cities and prepare for entering a big combination of the South, with connections north and east. Judge J. M. Thomas of New York is said to be at the head of the entire movement.

TELEPHONE MEN.

T. P. Sylvan, local manager of the Central Union Telephone Company at Upper Sandusky, Ohio, has resigned, to accept a better position with the company, and Joseph Hutter has been appointed to succeed him.

William S. Powell, manager of the telephone exchange at Stevens Point, Wis., will be transferred to Eau Claire, Wis. He will be succeeded by R. F. McCleavy, at present manager of the office at De Pere, Wis. W. L. McLaughlin, chief lineman at Stevens Point, will become manager of the De Pere office.

L. W. Stanton, Electric Building, Cleveland, who has recently engaged in business as a consulting telephone engineer, was formerly electrical engineer and superintendent of equipment for the Federal Telephone Company of Cleveland. Previous to that connection he was in the Bell service. Thus he has had a wide practical experience not only in the installation and equipment of telephone apparatus but in line construction and the cost of construction and maintenance. He has already closed several contracts through the Central states for making a systematic inspection of plants and drawing specifications for new equipment, and is rapidly developing the practically new field of consulting telephone engineering.

EXTENSIONS AND IMPROVEMENTS.

A plan is under way to build and operate a telephone system which will include Galena, Carthage, Webb City, Carterville and Joplin, Mo., at a total cost of $100,000.

John McGee, manager of the Nezperce Co-operative telephone system in Idaho, states that his company is about to construct lines from Ilo, Idaho, to Morrow, and connect them with Ferdinand, Idaho.

The Clifton mining district in Utah is to be greatly benefited by the telephone line about to be constructed in Deep Creek, between St. John's and Ibapah, Utah. The actual construction will be 118 miles in length.

The principal work of the Rocky Mountain Bell Telephone Company in Montana for the coming year will be the extension of a line from Red Rock, Mont., to Thermopolis, Wyo., giving direct communication from points in Montana to Denver, Colo.

The Home Telephone Company of Los Angeles, Cal., is about to begin the installation of its new switchboard at Los Angeles, Cal. It is intended to complete the operating room soon after the first of February. One hundred and twenty-five miles of telephone poles have already been placed in position by the company. Officials estimate that the company will be in running order by February 20th.

GENERAL TELEPHONE NEWS.

The Rocky Mountain Bell Telephone Company has just put on uniformed messenger boys at Cheyenne, Wyo.

Congressman-elect D. F. Lafean has been elected president of the York (Pa.) Telephone Company. The other officers are: John McCoy, vice-president; H. H. Weber, secretary; C. C. Frick, treasurer; George B. Rudy, general manager.

The telephone girls of the Butte (Mont.) Bell exchange have formed a union, and demand an increase of pay from $35 to $50 monthly, with chief operators asking a $20 raise from $40 monthly to $60. The matter has been referred to the home office at Salt Lake City.

The La Crosse Telephone Company of La Crosse, Wis., will award a contract for telephone equipment for the La Crosse exchange on January 15th, the ultimate capacity of the exchange to be 3,000 lines. Specifications were prepared by L. W. Stanton, who will also supervise the installation.

An explosion of dynamite in the exchange of the Georgetown (Ky.) Telephone Company almost wrecked the Kerr Block in Georgetown, where the exchange is located. Miss Mamie McCullough, an operator, was also badly injured, having one of her arms broken and her body badly bruised.

At a meeting held at Hopkinsville, Ky., the stockholders of the Cumberland Telephone and Telegraph Company voted to increase the stock from $9,000,000 to $20,000,000, and extend the lines into a great area of new territory. It is stated that an exchange costing $15,000 will be built at Hopkinsville.

A Newark (N. J.) physician, tired out by professional duties, was recently called at midnight, by telephone, to attend a child suffering from croup. "Are you sure the child has the croup?" he asked the anxious mother; "bring it to the telephone and let it cough." This was done and "that's croup, sure enough," answered the doctor, who hurried and prescribed for the baby.

The Sunset Telephone Company of San Francisco is preparing to make a number of improvements in its lines in California. An underground system will be laid in San Jose, Cal., and additional equipment will be put in at the San Jose exchange. Improvements on the line in Oroville, as well as in Southern California, will be made.

At a recent meeting of the Home Telephone Company of Rockford, Ill., it was decided by the board of directors to join with the Interstate Telephone Company. This will necessitate the construction of a line to Beloit, Freeport and Belvidere. The contract will be let at once and work will begin as soon as the weather will permit. This will give the Home company long-distance connection with 6,000 subscribers. The company has 1,650 subscribers of its own, and the list is still growing.

The Washtenaw Daily Times of Ann Arbor, Mich., amusingly tells how a man was appointed to and confirmed in an office by telephone. It became known to the aldermen of that city, while in session, that there was a vacancy in the office of supervisor, and, wishing to fill it at once, the city attorney was requested to telephone the mayor and ask him to send in the name of some person he wished to fill the position. The mayor replied by telephone he did not know whom to appoint, but a man was suggested by an alderman, and the appointment was made by telephone. Thereupon the aldermen unanimously confirmed the appointment.

Notwithstanding the defeat of a special franchise in the city of Detroit having for its object the merging of all Independent telephone companies in competition with the Michigan (Bell) Telephone Company, the Co-operative Telephone Company is establishing an exchange with a switchboard of 12,000 telephones capacity. C. M. Burton, who is at the head of this company, says the exchange will be in working order in a few months, as the financial backing is ample, and in the event of the final defeat of the merger franchise, his company will go on with the installation of 300 telephones in business houses. The conduits of the Edison company or the People's Telephone Company will be used.

MANUFACTURERS AND DEALERS.

The Chicago Pay Station Company of Chicago says it is receiving daily communications from the telephone field, indicating that, in the spring, many of the large telephone companies intend to adopt the measured service to some extent, by the use of "coin collectors," in order to cut off the "dead-head" service, which is so detrimental.

The Western Telephone Manufacturing Company, successor to the Western Telephone Construction Company, Chicago, announces that it manufactures a complete line of high-grade telephone apparatus, producing everything from the raw material into the finished product. The company will be pleased to furnish estimates on switchboards and telephones for central-energy, magneto express, supervisory and transfer systems and power plants, complete or in part; also bridging, series and desk telephones, linemen's test sets, operators' telephone sets, or any special apparatus.

Settlement of Toll Business Between Connecting Companies.[1]

By A. L. Hutchinson.

The ultimate success of any enterprise depends upon the ability of its management to do business at profitable prices and to collect the full compensation when earned. In these times, when competition is so keen that large business concerns must look after the smallest details of their expense accounts that the profit and loss account does not show a balance on the wrong side of the ledger at the close of the year, how much more necessary is it for a telephone company whose gross earnings are made up of a great many exceedingly small sums, to be absolutely sure that every penny earned by it is charged to the proper source and duly collected.

A single telephone company doing business over its own wires exclusively can check its own business and know that every station is collecting and accounting for all services rendered. But with Independent telephone companies fairly swarming over the country which have more or less joint business with each other, their business transactions become as complex as the business transactions between individuals, and we have a problem which calls for the simplest solution possible.

The transactions of business between connecting telephone companies is without a parallel. Railway systems may have joint traffic arrangements, but when a car or train of one company passes to the tracks of another, it only occupies as much of the connecting company's tracks as the rails required to stand upon, or the block in which it is running. Telegraph systems may have joint traffic arrangements, but the messages are transmitted in relays and only the wires of a single company are in use at a time. But when you step into the telephone office at A to tell your wife at B that you won't be home for a week you are monopolizing one complete circuit from A to B, to the exclusion of every other person who wishes to use any portion of that circuit at the same time.

Therefore, a system for taking care of the business of connecting telephone companies, is demanded which will fill the following requirements: The system must have a uniform method of ascertaining the rate between any two points, which should be based upon the air-line distance between those two points, whether the message passes over wires running upon the air-line route or in the most roundabout way, and whether the wires necessary to complete a circuit between the two points belong to two companies or a dozen companies. And there must be a uniform system of dividing the fees received among the connecting companies.

To illustrate: You are in Madison, Wis., and you wish to communicate with Sweet Home. The operator knows only her own sweet home, but you tell her that Sweet Home is in the northwest corner of Hoosierdom, and she turns to a map, lays down a ruler and instantly tells you that you can talk five minutes for $1.20. You are in a rush as your train leaves Madison in 15 minutes. The operator therefore calls for Sweet Home, Indiana, and in a short time you are talking with your wife. To make that connection, we will say, wires of six different companies have been brought into use, and you are monopolizing them all for the time being. There is no traffic arrangement between the company at Madison, Wis., and the company at Sweet Home, Ind., nor with any of the four intervening connecting companies, which we will designate as A, B, C and D, and yet each and every one of those companies must be ready to furnish the use of their wires without stopping to ask how they will get paid for their services, else valuable time would be lost, and you would have to leave for your train without talking, while the companies would be out $1.20. Hence there must be a system by which each company shall share in that $1.20, and that each company will know that its share is looked after without any special effort of its own other than making a record of the message.

It is not the province of this paper to say what the basis of the division of fees should be, nor what should be the schedule for determining the air-line rates for joint messages, but to urge the necessity of a uniform system that shall be recognized by every Independent telephone company in the United States.

In the illustration, the operator at Madison makes a record of your message and at the end of the month reports it and transmits the $1.20 to the proper officer of her company. The Madison company thus far is $1.20 ahead. The operator at Sweet Home also makes a record of your message, and at the end of the month sends it to the proper officer of her company, which, we will say, has its headquarters at South Bend. The two terminal companies thus have records of the message, but of the four intervening companies two checked the message, and the other two, in the rush of business, made no records of it. We will say that the operators at A and B kept a record of the message, but C and D let it pass unrecorded. Now, without a system for handling joint business, C and D would not only not have a record of the business, but would have no information that they had a claim against any company; in fact, would not be apprised that they had performed any services for you.

It follows then that there must be a central office to which the operator at Madison must send a record of your message. It also follows that the operator at Sweet Home should send a message to some central office and it also follows that it is best for each intervening company to have at least one of its operators check and report that message to some central office.

There should be at least one central office in each state. For the present illustration, we will assume that there is one such central office in Wisconsin, Illinois and Indiana. Now, as your message originated in Wisconsin, the record should be transmitted to the central office in Wisconsin, to enable that office to know that the record as received from the Madison company is correct. The central office should also receive a report from the operator at Sweet Home, as well as checking slips from the intervening companies. The central office is then enabled to apportion the $1.20 for your message among the six companies, and if any one of the six companies has neglected to report it, or even if all the intervening companies have neglected to report it, their shares of the $1.20 are determined and credited to their respective accounts.

Now we will suppose that a commercial tourist at South Bend wishes to talk with a customer at Madison. The terminal companies are the same, the joint rate is the same, and the connecting stations are the same. The South Bend operator then reports that message to the Indiana central office, as does the Madison company, and each of the intervening companies.

At the close of the month each central office sends a statement of the joint business to each connecting company as made up from reports received by it. Thus, we will say, the Madison company receives the Wisconsin report showing that it owes the South Bend company 25 cents, A 10 cents, B 15 cents, C 21 cents, and D 14 cents. It also receives a report from the Indiana central office showing that it has a credit of 20 cents for the message sent from South Bend, so the Madison company transmits five cents to the South Bend company, and their account is settled. Both the Madison and South Bend companies then transmit the proper amounts to the connecting companies, and the transaction is closed.

There may be a thousand and one combinations which enter into the work of the central company in ascertaining the balances at the end of the month, but they are all worked out in the same way. Of course, among companies of a single state the system is not as complex, so I have chosen an illustration involving three states. This method enables every company to have its business carefully checked and to know that if some of its operators are negligent, there are others who are watching its business and looking after its interests as carefully as though an officer of the company.

Now what should this central office be, what duties should it perform and what should be its responsibilities? In answering these questions, I shall make use of my own personal experiences, for, no matter how nice a theory may appear, when reduced to plain reading, its utility depends entirely upon actual results obtained by putting the theory into practice.

The central office should be a clearing office in the true sense of the name. All joint messages should be reported to it. The original record slip should be compared with the receiving-record slip, and if more than two companies are involved, the checking slip should be made use of, where the terminal records do not agree. All stations should report to the clearing office at least four times a month, as the earlier an error is detected the easier it is corrected, and all errors should be corrected and the station in error notified of the correction at once.

The clearing office must open an account for every station with every other station to which a message has been transmitted. At the end of the month the separate station accounts must be brought together, and all companies having joint business with each other must be included in a single statement. The balances between the several companies in a single statement must then be brought together and the clearing office must designate what amounts are payable, and to whom payable, to balance the accounts of all companies included in that statement.

While to those unfamiliar with the system of the State Telephone Clearing Company of Wisconsin, all this work would seem to be a complex and laborious task, yet several months' experience with the system of that company has demonstrated that it is simple, it is absolutely correct, and it is so flexible that it may be adapted to the conditions of any schedule or traffic agreements between connecting companies.

I recall one statement for October which showed a total of 738 messages, with a total revenue of $128, divided among 18 companies. Twelve drafts amounting to $13.89, paid by six of the 18 companies to the other 12 companies, settled the entire business for the month.

The cost was one cent per message to each company sharing in the fee of any message, and if each company had attempted to check and settle its own business with each of the other 17 companies, it would have required reports from each of the other 17 companies, it would have been obliged to report to each of the other 17 companies and it would have been obliged to make a monthly balance sheet for each of the other 17 companies. In fact, each company would have to do the same work, and be to the same expense for the settling of its own business as the clearing company for the entire 18 companies.

The clearing company should be a company distinct in itself, and it should not be a mutual affair. I know it is claimed by many that the clearing office should be an office in which all companies should have an interest, but while this might be satisfactory, yet like the mutual telephone company which starts out to do business by compelling every subscriber to be a stockholder, it soon finds it advantageous to take in subscribers who are not stockholders, and as the clearing company is not a company which demands the investment of any considerable capital, and as its duties are to serve all alike, it should be as distinct from the operating company as is the factory which manufactures the instruments. Its business is a business distinct in itself.

The nature of the business is such that the responsibilities are confined to correcting the errors of operating companies, and in apportioning the fees and making correct reports of the same. As each operating company gets an itemized statement of the business done by every station on its lines with every other station on the lines of every other company, and such statements must balance to a cent, each company is informed of the correct balances due it or owing by it, and the company which fails or refuses to pay the balances is the responsible company and liable for moneys had and received.

The clearing company should handle no funds, but it should draw drafts against debtor companies for such amounts and payable to such companies as shown by its statements to be due, and such drafts should be honored and paid by the company against which same are made.

The time has gone by when connecting companies can operate successfully by allowing each company to retain what it collects as its share of all joint toll business. Such methods were practicable and apparently fair when not more than two or three companies were concerned, but with the construction of connecting links, which make a vast network of wires owned by hundreds of companies, the clearing company becomes a company of necessity.

[1] Paper read before the Interstate Independent Telephone Association at Chicago on December 9, 1902.

BOOK TABLE.

Physics for High-School Students. By Henry S. Carhart, LL. D., and Horatio N. Chute, M. S. Boston: Allyn & Bacon. 1902. Pp. (five by 7½ inches), vii., 433, with 323 illustrations.

It would be difficult to produce a better textbook on physics for the purpose for which this is intended—that of serving as a class-room manual for high-school students—than this work. The authors are recognized authorities and have had large experience in teaching physics, one's work being in the university and that of the other in the high school, and the book which they have produced may well be classed as a standard textbook. Seven years ago these authors brought out their "Elements of Physics," a work which has long been regarded as a standard for high-school use. The advances in physics have been so rapid and the point of view from which many topics are now considered is so different from that of seven years ago that the best plan seemed to be to make a new book rather than revise the old one. The different chapters are classified under the following heads: Properties of Matter, Mechanics of Solids, Mechanics of Fluids, Sound, Light, Heat and Magnetism and Electricity—an arrangement differing slightly from that of the former edition. The text is clearly and concisely stated and is explained by the aid of descriptions of experiments, and at the ends of the different sections of each chapter are given a number of questions and problems covering the subjects treated. The subject-matter has been thoroughly revised and brought up to date, the electrical chapter containing such recent developments as Roentgen rays, wireless telegraphy and the Nernst lamp. The typographical features of the book are excellent, the illustrations being numerous and of good quality, while the selection of the type has been made with care.

Pocket Edition of Diagrams and Complete Information for Telegraph Engineers and Students. By Willis H. Jones. New York: The Telegraph Age. 1902. Pp. (4¼ by 6¾ inches), 260, with 126 diagrams and illustrations. Price, $1.50.

This book has been pronounced by practical telegraph engineers to be the best book on telegraphy ever issued, and it is certainly deserving of the marked favor with which it has met. The author, who is a practical telegrapher, is happy in his style of presenting the subject matter in a clear and pithy manner, so that the book can be read with profit by the inexperienced operator, while it is valuable to the skilled telegrapher. The opening chapters are of an elementary character, treating of magnetism and electricity, the dynamo, electrical measurements, etc. The duplex and quadruplex are next taken up together with the solution of problems that arise in connection with their use. The equipment of a modern telegraph office is described, and separate

chapters are devoted to relays, repeaters, storage batteries, switchboards, wiring connections, etc. The telephone is briefly described, and interesting chapters are given to simultaneous telegraphy and telephony, the phonoplex, the Wheatstone automatic duplex and line construction. Wireless telegraphy is very briefly considered. Multiplex and high-speed telegraph systems, such as the Rowland, Mercadier, Delany and Pollak-Virag, are not mentioned, probably for the reason that they have not entered, as yet, into the practical operation of the American telegraph office. The diagrams used throughout the work are of a high order of merit and form an invaluable aid to the explanation of the text. No index is contained in the book, but the contents with list of chapters and subdivisions and an index of diagrams enable one to refer to different subjects readily. The book is neatly bound in flexible leather, of pocket size, and should be useful to every telegraph engineer and student.

Westinghouse Propaganda in England.

George Westinghouse gave the first European demonstration of the Cooper-Hewitt mercury-vapor lamp at the offices of the British Electric and Manufacturing Company in London on the evening of January 8th. A large number of distinguished men were present and the demonstration was a marked success. A notable incident of the occasion was the exhibition of the new Cooper-Hewitt static converter, which converts alternating to direct current and for which great claims are made. After the demonstration Mr. Westinghouse gave a dinner at Claridge's Hotel, at which nearly 100 guests were present, including Lord Kelvin, Lord Rothschild, Lord Morley, Lord Claude Hamilton, chairman Great Eastern Railway, Lord Allerton, chairman Northern Railway, Sir Henry Oakley, chairman Central London Railway, Colonel Mellor, chairman Metropolitan Railway, Emil Garcke, chairman British Electric Traction Company, Colonel Yorke of the Board of Trade, Sir Charles Rivers Wilson, James C. Stewart and Sir Joseph Lawrence. It is understood that arrangements are being made for the manufacture of the Cooper-Hewitt apparatus in the various Westinghouse works throughout Europe and the United States.

The directors of the British Westinghouse Electric and Manufacturing Company, Ltd., of London, England, have recently issued their third annual report, showing a material increase in growth of the company's business and indicating an industrial reawakening in England. Heretofore, orders have been executed at Pittsburg, but now that the company's works at Trafford Park, Manchester, England, are practically completed and about 3,000 men employed, manufacturing operations have begun, and all orders will hereafter be executed there.

A construction department has been organized to carry out building and general construction work, thus enabling the company to undertake the complete installation of large railway, power and lighting plants. This department will be under the management of James C. Stewart of the well-known engineering firm of James C. Stewart & Co.

Many important contracts have been obtained by the British Westinghouse Company during the last year, including those with the Metropolitan District Railway Company, the Metropolitan Railway Company, the Clyde Valley Electrical Power Company, the London United Tramways Company, Ltd., the Bath Tramways Company, Ltd., Exeter Corporation, Newcastle Corporation, and the Swansea Corporation.

The erection and equipment of the works at Trafford Park have absorbed the bulk of the available capital of the company, comprising, approximately, $8,750,000. The extensive business in hand, as well as the new business in prospect—all of which is to be executed at the company's works—will require additional funds, and the directors, therefore, propose to issue $5,000,000 additional stock, one-half of which is to be issued immediately.

Electric Railways for Monterey, Mexico.

The plans for the Monterey (Mexico) Electric Railway Company, as definitely announced by Sperry Jones & Co. of Baltimore, are to build 30 miles of electric railway in Monterey immediately. The company has acquired the Monterey city railway, with a line 13 miles long, and the Monterey and Santa Catalina railroad, known as the Slayden line, 15 miles long; both these roads are operated by mule cars. The company has also acquired the Mackin and Dillon concession for 23 miles of line on other streets, making a total of 51 miles of road. It is also proposed to conduct a freight service. The capital stock of the new company is $1,500,000, but the amount of bonds to be issued is not yet decided.

The Chicago and Milwaukee Railway Company's property between Evanston and Waukegan has been conveyed by deed to the Chicago and Milwaukee Railroad Company, the consideration being $3,400,000, subject, however, to a bond issue of $1,500,000, in which the Royal Trust Company of Chicago and the Cleveland Trust Company of Cleveland are trustees. Of these bonds, which are payable July 1, 1919, at five per cent., the amount of $1,000,000 has been issued.

CORRESPONDENCE.

London Letter.

London, December 31, 1902.—Of the electrical power-distribution schemes now in course of construction, the South Wales undertaking is by far the most advanced. In fact, the details of no less than four generating stations have been worked out, and the following are brief particulars of the two that are being actually constructed: One will contain 24 Niclausse boilers, and five 3,000-horsepower Willans engines, direct-coupled to 2,000-kilowatt Ganz three-phase generators. The extra high-pressure mains will be three-core, paper-insulated, lead-sheathed cables, laid solid in earthenware troughs, the high pressure being concentric, paper-insulated cables, laid direct in the ground. In connection with this generating station there are four sub-stations under construction. The other generating stations actually being built will at first contain three Lancashire boilers and two 360-horsepower engines and two 220-kilowatt Westinghouse two-phase generators.

Last year the London County Council promoted a bill before Parliament to enable either itself or the local governing bodies of London to purchase the electric-lighting undertakings in London upon arbitration terms before the expiration of the franchises to the various companies. The London electric-lighting business is now in a very flourishing condition, and the opinion forced upon Parliament was that the purchase proposed flavored of the impossible. Hence the bill was thrown out, but, ignoring the fact that absolutely no change in the conditions has arisen to alter this opinion since then, the London County Council has again given notice of the promotion of identically the same measure this year. It is these little obstinacies that enable opponents of municipal trading to come forward with a reasonable argument, and just at present the controversy surrounding municipal versus private-company trading, is being waged in certain quarters, apropos of electrical work, with all its old-time vigor.

Electric-tramway officials in many quarters seriously consider the advisability of inaugurating a freight traffic on their cars. In the Potteries district of the Midlands, a certain amount of small-parcel traffic has been managed for some time now, but a much more portentous scheme is being discussed in Liverpool, where there seems every probability of an arrangement being made between the municipal-tramway authorities and the dock company for the transport of the latter's goods over the tramway system, which connects up with the South Lancashire company's electric tramways; these two systems being combined, cover the longest distance of any concerns in the kingdom, by electric-tramway traction.

The Great Northern and City Railway, a tube line running from the city of London to Finsbury Park, a northern suburb some five miles away, is almost completed, and the opening may be looked for almost any day. The whole of the electrical equipment has been supplied by the British Thomson-Houston Company, and the latter concern intends to have a big function on the occasion of the opening ceremony.

The combined trolley and conduit system of tramways in Bournemouth is now operated very successfully. The British house of J. G. White & Co. had the contract.

The tramways in the south of London are now all in the hands of the London County Council, which is busily converting them to the underground-conduit system. In the north of London, however, the lines are still in the hands of a company whose lease expires in 1911, but one of the terms of the lease is that the company shall convert to electric traction at a period when called upon to do so by the council. The council now thinks this time has arrived, and has instructed its engineer to prepare the necessary plans. The system in the north is not nearly so extensive as the southern one, but a far-reaching network of electric lines has been granted to the Middlesex County Council, starting from the termini of those leased by the council to the private company mentioned above.

The Tunbridge Wells municipal-telephone undertaking has now been handed over to the National Telephone Company, and, from subsequent gleanings, it would appear that the municipal management was carried out on very inefficient lines, and without due respect to the designer of the system. More than ever must it be emphasized that this is not a true criterion of municipal trading in Great Britain. W.

New York Notes.

New York, January 12.—It is officially announced that a practical agreement has been reached between the authorities of this city and those of the New York Central railroad, by which improvements are to be effected that will make through and suburban traffic swift, safe and pleasant, at a time not far remote. In the Grand Central terminal of the railroad sweeping changes are to be made, and a bill is to be presented to the sitting Legislature, giving the railroad company power to change from steam to electricity. The new project involves the expenditure, on the part of the railroad, of $25,000,000, and both sides admit that the controversy as to plans and terms has passed the stage when it could become dangerous. With a common understanding virtually reached engineers are now at work on a plan which may be outlined as follows: From Croton, on the Hudson River division, 34.42 miles from the Grand Central station, and White Plains, on the Harlem division, 22.44 miles from the terminal, all trains, express and local, will be operated by electricity. By the new plan it is believed trains will be run down from Croton in 40 minutes and from White Plains in 32 minutes. Big yards will be built in Croton and White Plains, into which locomotives will be run after they have surrendered their trains to powerful electric motors, and also for the accommodation of the hundreds of locomotives which await outgoing trains. This is one of the biggest terminal improvements ever projected in any city, and that mighty hosts of travelers are interested in it may be understood from the statement that in 1902 nearly 16,000,000 passengers were handled in the Grand Central station. By the contemplated improvements and arrangements local New York Central trains loaded with passengers will be able to run down to the Battery through the rapid transit subways, and even over to Brooklyn, discharging passengers at all stations along the line. Outward-bound traffic can also be handled in the same way.

The hearing before the railroad commission of the complaints against the Brooklyn Rapid Transit Company has come to a close. Charles E. Roehr, engineer of power and transmission, testified that the maximum horsepower of the company was 47,500, including the amount purchased from the Edison company. He and Thomas E. Murray, consulting engineer, and Dow S. Smith, general superintendent, said that the company was rendering all the service possible with present facilities. A new power house, in course of construction, will add 54,000 horsepower to the resources of the company. Ex-Judge Dailey, in summing up the case against the company, said it was not a question of what the company had wanted to do, but what it had done. William F. Sheehan, in reply, said that the company would undoubtedly fulfill the promises it had made, and added that the company was under contract to-day to pay within the next 10 months upward of $6,000,000 in cash for betterment and improvements and for the greater convenience and comfort of the public.

The New York Central Railroad Company has made a contract with the Gamewell Fire Alarm Telegraph Company for the installation of fire-alarm systems for the piers, buildings and premises of the company at Sixtieth Street, New York city, and at Weehawken, N. J.

Because of the failure of the Erie Canal to meet the demands of trade Governor Odell, in his annual message, presented the suggestions frequently made that if the canal were enlarged to a nine-foot level, and by the use of the waterpowers of the state and by the introduction of electric motors, that not only the same object could be accomplished, but that sufficient revenue could be derived from the sale of power almost to maintain the canal. The cost of electrical equipment and of providing waterpower would, he says, be much less than under alternative plans proposed, and embracing the improvement of other state canals, and perhaps would accomplish the same results.

Mayor Low, in his message, deals in detail with the progress made last year in the settlement of the transportation problems of the city, telling of the granting of the Pennsylvania railroad franchise to connect the boroughs of Manhattan and Queens by an underground tunnel, and that the rapid transit commission is now busy, through the engineers, with the work of harmonizing and developing all of the transit plans in the interests of the public. By working with the New York Central railroad officials all grade crossings in the borough of The Bronx will be abolished and the city will be paid $25,000 for the new privileges granted to the company. Referring to the agitation for improved facilities for passengers on the elevated and surface roads, the mayor says: "It is a striking fact that the surface and elevated roads of the city of New York carry more paying passengers every year than all the steam railroads of North and South America combined."

According to Bridge Commissioner Lindenthal, the engineer in charge of the bridges over the Harlem River has by experiments been able to reduce the consumption of hard coal from 25 to 50 per cent. The reduction, says Commissioner Lindenthal in a report, is accomplished by a chemical process, and, as explained, is a combination of common salt, permanganate of potash, water and some other ingredients. The same solution, it appears, when applied to soft coal, consumed the smoke and prolonged the fuel's burning powers without decreasing the heat.

Regarding a statement of the railroad commission, to the effect that it would be a wise move to put the rapid transit question in this city in the control of a local board, the Merchants' Association, through one of its members, suggests that Mayor Low commence such proceedings as would be necessary to carry the views of the commission into effect. He believes it would be a wise move for the public authorities to be made responsible for the rapid transit conditions. O.

New England News.

Boston, Mass., January 9.—At the time of the receiver's sale of the Stoughton and Randolph street railway, the purchaser, William A. Clark, Jr., paid 10 per cent. of $50,000, the purchase price, and was given until January 5th in which to pay the remainder. He assigned his claim to Henry S. MacPherson, representing Stone & Webster of Boston, who paid the balance, and the road was turned over to that firm.

Charles A. Milliken of Augusta, Maine, and his son, Carl E. Milliken, who are extensively engaged in lumbering in Aroostook County, Maine, are preparing to install an electric-light plant in Stockholm, that county.

In his inaugural address, Mayor Chapin of Holyoke, Mass., did not express much enthusiasm over the municipal gas and electric-light service just started in that city. There has been long and tedious litigation over the city's acquiring the plant from the Holyoke Water Power Company, and it has cost $823,816. It will require $25,000 to make necessary additions to the electric-light plant.

In his inaugural address, Mayor McNamee of Cambridge, Mass., recommended the combining of the city's street, park, water, sewer, wire, lamp and engineering departments under one controlling power and suggested that these departments be placed in charge of superintendents, who should be accountable to the mayor. Mayor Coulter of Brockton, Mass., a socialist, advocated municipal ownership of lighting and street-railway systems, and declared against the granting of the use of public streets for private profit.

During 1902 the city of Malden, Mass., received $29,506 from street-railway taxes.

The full bench of the Massachusetts Supreme Court has sent down a decision in the case of the New England Telephone and Telegraph Company and the Boston Electric Light Company vs. the Boston Terminal Company, a suit for assessment of damages on account of the discontinuance of streets in which plaintiffs had conduits, when the South Terminal station was built. The plaintiffs contended that, by the discontinuing of the streets, their conduits were rendered worthless. The opinion refers to the statutes under which the conduits were built, and states: "The rights in the streets which are so exercised or enjoyed, are not private rights which are shared in common, although used and enjoyed in different ways by the different members of the public who pass through a street or whose property is carried through it. . . . . The petitioners have no rights of property in the street and their constructions that were built therein were personal property, which they had a right to remove and which could not be subjects for the assessment of damages under statutes of this kind. . . . .The damages to be assessed were only for rights of property in the real estate at the time of the taking. As the petitioners had no such rights, there must be 'judgments for the respondent.'"

At the annual meeting of the Northern Telegraph Company, a subsidiary of the Western Union Telegraph Company, the following-named officers were elected: President, Mrs. Frederick Smyth, widow of ex-Governor Smyth of New Hampshire; clerk, Arthur H. Hale; treasurer, Abraham E. Emerson; directors, Marion C. Smyth, Arthur E. Clarke and Charles H. Anderson. The company declared a dividend of 2½ per cent.

The annual report of Professor P. C. Pickering, director of the Harvard Astronomical Observatory, suggests the use of Mr. Gerrish's system of time signals for the benefit of mariners. Incandescent electric lamps are connected with the standard clock in such a manner as to dim at each swing of the pendulum, except at the minute, when the lamp remains fully lighted for several seconds. The pulsations of a 32-candlepower lamp on Professor Pickering's house can be seen with the naked eye at a distance of four miles. B.

Southern Developments.

Charlotte, N. C., January 10.—Col. M. E. Thornton has bought out the Hickory (N. C.) Electric Company, including the lighting plant, and will enlarge and improve the property, to be known as the Thornton Light and Power Company.

The New Orleans Railway Company has filed a mortgage in favor of the New York Security and Trust Company, pledging the properties of the various street railways to secure a $40,000,000 gold 4½ per cent. bond issue. The trust company will issue bonds to the extent of $7,154,000 whenever they are needed for improvements.

The city of Nashville, Tenn., has paid the last installment of $25,000 on the electric-light plant, which now comes under municipal ownership.

The Chesapeake Transit Company of Norfolk, Va., operating an electric line to Cape Henry, has executed a deed to the Colonial Trust Company of Pittsburg, Pa., to secure a bond issue of $250,000 in $1,000 five per cent. 50-year bonds. The company is interested in building a new union depot.

[illegible] T. S[illegible] superintendent of roads and bridges in Mecklenburg County, N. C., is organizing a $1,000,000 company for the electrical development of Bluitt's Falls, on the Pee Dee River, near Rockingham, N. C., to furnish power to neighboring towns. It is estimated that 12,000 horsepower can be developed. C. W. Tellett, Charlotte, N. C., is a member of counsel for the company.

The town of Mountairy, N. C., has voted $50,000 for water and lights, including a power plant.

The Columbia (S. C.) Water Power Company will put in a new 1,300-horsepower generator and two turbine wheels, to secure additional power.

The Augusta-Aiken (Ga.) electric line will put on an interurban express service and undergo some additional improvements.

The Durham Traction Company of Durham, N. C., has given notice of application to be made soon for a charter to build an electric line to Chapel Hill, 15 miles distant. W. W. S. Butler of the Traction company states that the work may be carried out this year.

President Sitterding of the Virginia Passenger and Power Company of Richmond will, in the future, devote his entire time to the company's interests. Calvin Whiteley, engineer of maintenance-of-way, has also taken charge of all the tracks of the company in Richmond. The company is preparing to expend large sums in improving its tracks. L.

From the Buckeye State.

Cleveland, Ohio, January 10.—The Town Council of Lisbon has granted a franchise to the Youngstown and Ohio River Railway and Light Company to build its line through the town.

In the suit of the state of Ohio against the Southern Ohio Traction Company, in the Montgomery County Courts, in which it was sought to collect a fine of $500 per week because the company had neglected to use a derailer on the order of the railroad commissioner, the state lost, so far as the fine is concerned, but won its contention that its term "electric road" means interurban roads as well as street railroads. The company contended that the term is not broad enough to apply to all roads in which electricity is used as a motive power. The case will be taken to the Supreme Court, in order to have this definition affirmed.

It is stated that the new company which will be formed by the Appleyard interests to operate the Bellaire, Zanesville and Cincinnati road will increase the bonded indebtedness to $2,750,000, in order to secure funds to rebuild the road entirely and change it to an electric line.

The Fort Wayne and Springfield Traction Company of St. Marys is in process of organization by J. H. Koenig and H. J. Hopple of St. Marys, B. A. and William Fedderjohann of New Knoxville, and C. A. Vogt of Wapakoneta. The capital stock will be $250,000 and the proposed line will extend from Fort Wayne to Springfield, Ohio.

It is announced from Cincinnati that the Cincinnati and Columbus Traction Company has made arrangements with the Appleyard syndicate to connect with its Washington Court House line and with the Cincinnati Traction Company for an entrance to the business section of that city. Two good points are thus gained in the air-line plan between the two cities.

Homer T. Bailey has been granted a franchise to build and operate an electric-light plant at Piqua. He says he will furnish lights at a reduced price, and it is said there will be a lively fight between him and the old company.

The Cincinnati, Georgetown and Portsmouth Railway Company is preparing to extend the line from Georgetown to West Union, 21 miles from Hanging Rock, which is the present terminus of the Camden Interstate lines. Bids will be taken at an early date.

The Sterling Electric Company of Warren has increased its capital stock from $50,000 to $100,000. W. A. Smith is president.

An electric saw was used at the City Hospital at Cincinnati a few days ago instead of the trephine, manipulated by hand. A description of the mechanism cannot be given, but a motor was built especially for it, and the saw and other portions of the apparatus were of special design. Instead of making a round hole in the skull, an opening of any shape desired can be made with the electric instrument.

The Northern Ohio Traction and Light Company of Akron has increased its capital stock from the nominal sum of $10,000 to $7,500,000, which was agreed upon when the reorganization took place a week or more since. The Northern Ohio Traction Company has deeded its property to the new company in consideration of $1.

The citizens of Felicity are endeavoring to arrange for the building of a road from that town to connect with the Cincinnati, Georgetown and Portsmouth line, a distance of about nine miles. A Mr. Scott of Felicity is interested in the plan.

The directors of the Lake Shore Electric Railway Company agreed upon a plan Friday for refinancing the company and getting it into good shape again. The company now has $4,500,000 common stock and $1,500,000 preferred five per cent. cumulative stock, with $2,310,000 underlying bonds, besides indebtedness incurred since the road went into the hands of a receiver. The plan provides that the common-stock issue shall not be disturbed, but that the preferred shall be doubled, making $3,000,000 in all. Two mortgages are arranged for, one of $4,000,000, to retire bonds of the Toledo, Fremont and Norwalk line and the Lorain and Cleveland line, leaving $1,750,000 for new bonds, which will be sold to local people at 85. This will be the first consolidated mortgage. A general mortgage of $7,000,000 will also be placed upon the property to cover a bond issue of the same amount. Of this, $4,000,000 will be placed in escrow to retire first consolidated bonds, and $2,000,000 will be used to pay other debts of the company. It is estimated that $1,000,000 of the new preferred stock which will be offered for sale will net about $600,000. The plan will be submitted to the stockholders on February 12th.

The Columbus Railway Company has decided to sell 5,000 shares of preferred stock, now held in the treasury, for the purpose of securing funds to increase its power facilities. The company carried 5,000,000 more passengers in 1901 than the year before and last year 5,000,000 more were carried than in 1901. At the annual meeting the old officers were all re-elected.

The Miami and Erie Terminal Company of Cincinnati, with a capital stock of $10,000, has been incorporated by Thomas N. Fordyce, Daniel J. Ryan and others to build an electric line from Cheapside to the Ohio River. It will be used as a terminal for the canal transportation company.

The Kenton and Southern Railway Company of Kenton has been incorporated with a capital stock of $600,000 for the purpose of building an electric line between Kenton and Bellefontaine. Richard Emory, manager of the Columbus, London and Springfield, and the Dayton, Springfield and Urbana roads, is one of the incorporators.

The Royal Carbon Company of Marietta has been incorporated with a capital stock of $10,000 by O. L. Gard, B. B. Stone and others. O. M. C.

Information from Indiana.

Indianapolis, January 12.—For the first time in the history of Indiana a street-railway and interurban-traction lobby will be present during the Legislature. Speaker Marshall himself has been more or less interested in interurban enterprises, and has close associations with those who are high in power in traction circles. The interurban lobby is present to protect the interests of the traction companies from possible legislation fathered by the strong railroad lobby, which is always present. The prospects for a lively tilt between the lobbies already give great promise, each declaring that it is simply its purpose to see that no harsh burdens are put on them. One bill has been introduced requiring interurban cars to have the same facilities for the comfort of passengers that are found on steam railroads. It is claimed that this bill is aimed at the Shelbyville line.

The owners of the Indianapolis-Plainfield line are asking the taxpayers of Hendricks County to vote a two per cent. subsidy for a nine-mile extension from Plainfield to Danville. The subsidy would amount to $47,000. A second election is to be held in Harrison Township, Henry County, to vote a $10,000 subsidy for the Newcastle-Pendleton line. At a previous election a $16,500 subsidy was defeated by a small margin.

A company is being organized at Laporte to construct an electric line betwen Laporte and Logansport, via Winona. The company will be known as the Logansport and Laporte Electric Railway Company. Twenty Knox, Laporte and Logansport citizens will be the incorporators.

A new company has been organized at Kokomo to construct an electric line to connect the cities, Wabash, Marion and Kokomo. Applications for franchises have been filed in each of the three counties. The promoters are George W. Dukes, O. V. Darby and T. C. Reynolds. The promoters say the line will certainly be built this year.

The commissioners of Grant County have granted a franchise to the Bundy-Clark Electric Company of Marion for an electric line through the county from Marion to Kokomo.

The Indianapolis and Greenfield line has put in service several new types of cars, which, in point of beauty and speed, rival those of any other company entering the capital city. They are geared to 55 miles an hour, and cost each $5,000. The company has ordered seven very fine cars for a limited service between Indianapolis and Dayton, Ohio, to be opened in the spring. One of these will be a handsome private car for President Fauvre, and will cost $10,000. These cars will be geared to 60 miles an hour.

The Union Traction Company has paid the first interurban-car tax to the city of Indianapolis, under the new franchise. The company's cars made 8,791 round trips to the city during the year, an average of 732 a month. It pays five cents a car for each round trip, and the tax amounted to $439.55.

The Citizens' Electric Light, Heat and Power Company of Shelbyville has been organized with a capital stock of $100,000. The company will build a substantial plant this year.

Argument was heard in the federal court at Indianapolis last week in the case of the St. Joseph Navigation Company against the St. Joseph and Elkhart Power Company for an injunction against the building of a dam across St. Joe River, near South Bend. The power company had, up to the time of filing the suit, expended $550,000, and the dam, when completed, will cost $1,000,000. The purpose of the company is to construct a mammoth electric plant and furnish electric light and power to patrons for miles around. It is generally conceded that no re-

straint will be thrown on so valuable an improvement.

A large number of citizens are so much opposed to municipal ownership of the electric-light plant recently erected at Waterloo, that they have transferred their tax outside of Waterloo to avoid assisting in paying for it. By this means they have cut off $50,000 from the city duplicate. F.

Detroit, Mich.

Detroit, Mich., January 10.—Permission has been given by the supervisors of Cheboygan, Mich., to W. A. McArthur & Co. to build a dam and locks in the rapids in Black River for the purpose of establishing a large waterpower plant, to furnish electricity for lighting the city of Cheboygan and furnishing power for various enterprises. The work will be done next summer, and thus open Black River and Black Lake to navigation. This plant will cost about $200,000.

The question of bonding the village of Saline for street lighting will be submitted to the people for their vote.

There is a plan on foot to erect a large dam on the Rifle River, north of Standish, Mich., and furnish enough electric power to operate all the manufacturing plants, mills, factories, etc., in the Bay Cities and Saginaw.

The Seidler-Miner Electric Company has filed articles of association in the Wayne County clerk's office, with a capital stock of $30,000, all paid in. The concern will manufacture electrical machinery, and its headquarters will be in Detroit. The stockholders are B. F. Seidler, F. J. Miner and C. H. Jacob, all of Detroit.

The December earnings of the Detroit United Railway show a gain of $26,246.24, and those of the Rapid Railway, a gain of $2,796.15.

Governor Bliss, in his inaugural message to the Michigan Legislature, speaks of the state regulation of trolley roads as follows: "Their supervision should be vested in the commissioner of railroads, and appropriate legislation to this end be enacted, in order to serve the public interests as fully as possible. No system of transportation, by reason of its form of motive power, should receive any special favor from the state, and, as far as possible, the requirements ought to extend to all alike. The people have a right to expect uniform legislation."

Superintendent Stanley of the Detroit United Railway has been on trial in the Recorder's Court on a charge of allowing a car with a flat wheel to run on the Jefferson Avenue line. This is the first case to be tried under the ordinance passed by the council several months ago.

The Detroit police force may be equipped soon with a novelty in the way of an electric dark lantern, an invention which is termed a "club light." The lamps are a foot long, and may be turned on or off by a switch. When the stick is lighted and held forward in the hand of a policeman the person on whom it is turned can see nothing behind the light. C. G. W.

Northwestern Notations.

Minneapolis, Minn., January 10.—Winona, Minn., has opened bids for the installation of a complete electric-lighting plant. W. I. Gray & Co. of Minneapolis were the lowest bidders for the work complete, at $46,025.

Grand Forks, N. D., is considering an application for a franchise to run a street-railway line in that city. An automobile company has asked a franchise to operate automobiles the same as street cars.

The Twin City Rapid Transit Company has equipped several cars with a magnetic brake and car heater, as a substitute for compressed air, which has been found to produce too many flat wheels.

The Knoxville, Chariton and Southern Electric Railway Company has been formed to build an electric railway from Knoxville to Chariton.

Heirs of Welby F. Wing sued the Washington Electric Supply Company in Seattle, Wash., for $35,000 damages for the death of Wing. He was killed by a bursting pulley. The complaint alleges that an employe of the defendant turned on current into a defective motor, resulting in a great velocity to the pulley, which burst, and a piece crushed Wing's head, killing him.

The cars of the Railway and Light Company of Winona, Minn., have been equipped with doors to enclose the motorman's platform. The company changes ends on its cars, and the doors were believed to be in the way, but they have been put on in obedience to the state law.

Pepper & Register of Philadelphia have been awarded a contract for the construction of the proposed electric interurban railway between Davenport and Clinton, Iowa, for the Iowa and Illinois company.

The Seattle Electric Company of Seattle, Wash., will build a new line out Union Street without delay. The company also anticipates the construction of a line to Fort Lawton for next summer.

W. P. Walsh has resigned his position with the electric-light company of Grundy Center, Iowa, and will soon go to Reinbeck, Iowa, where he will install an electric-light plant.

Interurban electric lines out of Burlington, Iowa, are being urged by local citizens.

The Nebraska City Street Railway Company of Nebraska City, Neb., has increased its capital stock from $100,000 to $150,000. The company is changing to electric power, and will construct an interurban line to a neighboring town in the spring.

The cities of Neenah and Menasha, Wis., may unite in the construction of a municipal electric-light plant.

An explosion of the main street pipe of the electric-light plant in Yankton, S. D., wrecked the power plant and left the city in darkness.

The Electric Light and Power Company of Bedford, Iowa, has been sold to Mr. Burt of Illinois.

W. P. Fowler of Morris, Minn., has made a proposition to sell his electric-light plant to the town for $16,500.

Volkenant & Beise of Lester Prairie, Minn., contemplate putting in an electric-light plant for that place.

S. S. Carter has been granted a franchise in Tenstrike, Minn., for an electric-light plant.

The Cedar Falls and New Hartford Company has been incorporated to build an electric line between New Hartford and Cedar Falls, Iowa, 12 miles. The company has a capital of $300,000. Work is to be started on the line in the spring. R.

Among the Rockies.

Salt Lake City, Utah, January 8.—Tonopah, Nev., the new mining camp, is at last lighted with electricity, but since the starting of the plant the demand has been so great that the company will immediately purchase a larger equipment to furnish the numerous mines with power and light. The capacity of the present plant is 1,000 16-candlepower lights, and nearly 700 have been placed in business houses and residences already. In a week or two all residences and merchants will be supplied, but the mining companies will have to wait. The company states that the new plant, with plenty of light and power for all, will be in position within three months' time.

The Big Springs Electric Company, which was incorporated a few months ago, made its initial run a few nights ago, turning the first electric lights on in Fountain Green, Utah. The lights are being installed as quickly as possible, and the City Council has ordered 50-candlepower lights for the streets.

A corporation called the Central Idaho Electric Light and Power Company has applied for a franchise to furnish light and power to Cottonwood, Idaho, guaranteeing to commence construction on the plant 60 days after the granting of a franchise.

The Truckee River (Nev.) General Electric Light Company is extending wires to Carson City, and will be ready shortly to supply that city. G.

On the Pacific Slope.

San Francisco, January 8.—The Mutual Electric Light Company of San Francisco has closed a contract with the Wagner-Bullock Electric Company for two 1,500-kilowatt, three-phase generators. Each of these will be direct-connected to an automatic engine, which will be constructed in the East. Two 75-kilowatt exciters are included in the contract. Deliveries are to be made next August. The two new units will be installed in the new brick power house, which the Mutual Electric Light Company will erect during the present year on its property at the corner of Stuart and Folsom Streets, San Francisco. A modern three-phase underground distributing system will be used.

The Independent Electric Light and Power Company of San Francisco has planned to increase the size of its main power station during the present year. An additional 1,500-kilowatt engine-type generator is now being constructed by the Westinghouse company for this plant.

General Manager Dimmock of the Pierce County Improvement Company, Tacoma, Wash., has announced that an order has been placed for machinery for a 30,000-horsepower plant to be established by the company on the Puyallup River.

Engineer Porterfield of the Blue Lakes Canal Company at Shoshone, Idaho, is now making preliminary arrangements for the construction of an electric power plant at Blue Lakes, Idaho. The plant will have a capacity of 800 horsepower. The power will be transmitted to Cedars, and will be used in the construction of the company's dam and canal.

The Valdez Electric Light, Power and Telephone Company has filed articles of incorporation at Phœnix, Ariz. The names of the incorporators are C. H. Craemer, D. B. Leavell, S. A. Hemple and J. L. Steele. The principal office of the company is located at Valdez, Alaska. The authorized capital stock is $25,000.

At the last meeting of the board of supervisors of San Bernardino County, Cal., George B. Ellis was granted a franchise for the construction and operation of an electric street railway in that county. A franchise was also granted to the Edison Electric Company for a pole and wire line in Mill Creek Canyon. A franchise for a pole and wire line from Lytle Creek Canyon, south to the Riverside County line, was granted to John L. Campbell. Kohl Bros., owners of the San Bernardino and Arrowhead motor road, have arranged to convert their line from a narrow-gauge steam road into a standard-gauge electic road.

C. A. Baird, Eureka, Cal., has filed the following locations for water in Humboldt County: For 5,000 inches of the waters of Van Duzen Creek, for 4,000 inches of the waters of the North Fork of Van Duzen Creek and for 5,000 inches of the waters of Mad River. These locations are all within a few miles of each other. It is given out that each will be used for a separate power plant, the three to be used to furnish light and power for a large section of Humboldt County. C. A. Baird and Engineer Herbert Richardson are now in Humboldt County at work on preliminary surveys, etc. They are acting in the interests of the Humboldt Light and Power Company of San Francisco, which was incorporated here on November 25th, by Charles P. Doe, San Francisco, Eugene Woodin and B. F. Lambourne of Alameda, James Ganley of Sausalito and C. A. Baird of Eureka.

The Golden States Power Company, San Francisco, Cal., has secured all the water rights and filings on the North Fork of the Feather River, from the Big Bend in Butte County, to Big Meadows, in Plumas County. A large corps of engineers, which has been at work for some time, has practically completed the preliminary work for the new plant. The avowed purpose of the company is to bring power direct to San Francisco. A. S. MacDonald, Oakland, Cal., is president, and Rothwell Hyde, Oakland, is secretary of the new company.

The Oakland Transit Company, Oakland, Cal., has closed a contract with the Electric Storage Battery Company of Philadelphia, for the installation of a battery of Chloride accumulators, to be used in the Oakland Transit Company's street-railway system. The battery consists of 264 cells, having a capacity of 550 kilowatts. It will be installed at the center of distribution of the system, about 2½ miles from the generating station, and will be used to reduce the amount of feeders, otherwise necessary, and to regulate the fluctuations of loads on the generators at the power house.

The United Railroads of San Francisco is preparing to reconstruct the California Street and Cliff House steam line, 8.34 miles in length, into an electric line. The new work will be taken up before the end of January. The new tracks will be standard gauge instead of narrow gauge. The company's San Mateo electric line has now been completed as far as San Mateo, as a single-track line, and the second track has been completed to within two miles of San Mateo. A.

Seattle, Wash., January 8.—The steel-wire span connecting Yatoosh Island and Cape Flattery was broken by a fierce southerly gale which prevailed off the Washington coast. The breaking of this telegraph wire will probably result in the early installation of the wireless system between Yatoosh and Port Crescent, as the government has already erected towers for that purpose.

The telegraph wire between Dawson and Vancouver was down continuously for two weeks in December. Although the linemen worked heroically, they were unable to keep the line up all along the 2,000-mile stretch through the wilderness during the fierce storms and heavy falls of snow. These men have to patrol the line with their cooking utensils, tent, blankets, and line tools, all on their backs, and make their way on snowshoes.

The Board of Public Works has sanctioned three plans for the Seattle Electric Company to improve its service on Queen Anne Hill. One is to build a cross-over at the foot of Queen Anne Hill, which will connect the two tracks of the company at this point. The company now purposes to inaugurate immediately a system which has been tried in St. Paul, and which makes it practically impossible for accidents to occur on the double-track counterbalance system of the company. The new plan is to station a dummy car at the Queen Anne Hill, which will push cars up or will precede them in the descent, helping the passenger coaches down the hill. The dummy will be provided with unusually powerful motors, and will be constantly attached to the rope of the underground car, making it practically impossible for the underground car to get away.

During the last year, 1902, the Seattle Electric Company has built 10 miles of new road within the city of Seattle, bringing the total mileage in Seattle up to 90 miles. The interurban line between Tacoma and Seattle, 36 miles in length, and the line to Renton, six miles long, were also constructed during the year by allied interests. Besides building this amount of road the Seattle Electric Company has made general repairs to the system, and has added 70 new cars to the service, all of the most modern pattern and equipped with the best conveniences for handling passengers.

Labor Commissioner William Blackman will ask the Legislature to take some steps toward making it impossible for any telegraph or messenger company to employ girls as messengers. It is claimed that the employment of girls as messengers is a detriment to the service.

Everett is again fighting the proposed trolley line connecting that city with Seattle. Once before have they overcome a similar plan, and it is to be feared they may be successful this time. The Seattle company will find it a gigantic undertaking, as the right-of-way extends through heavy timber, gulches, and over many creeks. Twenty miles of the route is through a wilderness, not populated by more than six families. There are no towns along the proposed line to act as feeders, and even if they succeed in reaching Everett's city limits, it is a question whether or not they could get in. L. E. C.

PERSONAL.

A. J. Rounds, electrician in the light plant at Norwalk, Ohio, was killed recently by coming in contact with an arc-light dynamo.

Hubert M. Ramp, in charge of a foundry in Buffalo, has resigned his position to take charge of the large foundry of the General Electric Company at Schenectady, N. Y.

N. A. Johnson, who has had charge of the gas and electrical equipment on the Pennsylvania Railroad lines west of Pittsburg, has accepted a position on the Baltimore and Ohio.

C. E. Smith, an electrical and construction engineer of Chicago, has become superintendent of the city lighting plant of Escanaba, Mich. The plant is to be improved so as to meet the demand for light.

Charles Updyke, who has been with the Toledo and Monroe (Ohio) Railway for some time, has been appointed superintendent of the Cleveland division of the Lake Shore Electric Railway Company.

Hon. George Chambers, who has been prominent in the Buffalo Traction Company affairs for a number of years, has been appointed assistant general manager of the International Traction Company of that city.

H. C. Warren, who has been chief train dispatcher and held other positions on the Wheeling and Lake Erie Railroad at Toledo, has been appointed general manager of the Toledo and Indiana electric line.

Miss Mary Virginia Agate, the daughter of Prof. Michael I. Pupin of Columbia University, was married to Winthrop Davenport Smith of New York city, on January 3d, at the Dakota, in West Seventy-second Street.

George W. Dickinson, vice-president and general manager of the Seattle Electric Company, Seattle, Wash., has resigned his position and will devote his entire attention to the Alaska Central Railway Company, of which he is president.

Hon. Frederick Clark Sayles, ex-president of the Crefeld Electrical Works, died of apoplexy at Pawtucket, R. I., on January 5th. He was born in Pawtucket in 1835, was the first mayor of that city and was one of the most prominent mill men in the country.

The Franklin Institute of Philadelphia, through its committee on science and the arts, has awarded the Elliott-Cresson medal to Charles E. Acker of Niagara Falls, N. Y., for his invention of an electrolytic method of making caustic alkali and bleaching powder.

E. D. Ball has been elected inspector of electric wiring by the City Council of Birmingham, Ala., without any salary attached to the position. As the appointment was made at the request of the fire insurance companies, it is understood that Mr. Ball will be paid by them.

George E. Marvin, who has been with the Public Service Company of St. Cloud, Minn., and its predecessor, the Gas and Electric Company, for more than 12 years, has resigned and gone to Dickinson, N. D., where he becomes manager of the Northern Electric Company's plant.

E. M. Stevens, well known in electrical circles and for some time connected with the Westinghouse Electric and Manufacturing Company of Pittsburg, has been chosen general superintendent of the Cincinnati, Georgetown and Portsmouth Railway Company, with headquarters at Cincinnati, Ohio.

Charles B. Horton has been appointed superintendent of the Western Union Telegraph Company for the district of Omaha, Neb., a position made vacant by the death of Colonel J. J. Dickey. Mr. Horton until a few months ago, when he was transferred to Denver, had been assistant superintendent under Colonel Dickey.

Captain G. A. Hurd, who, for eight years, has been with the Crane Company, Chicago, in various responsible capacities, and who for two years has been in charge of the Chicago cut-pipe department, has been appointed mechanical engineer of the Crane Company's Philadelphia branch. Mr. Hurd will be in Philadelphia about February 1st.

W. H. Thurston, who has represented the Minneapolis General Electric Company of Minneapolis, Minn., for eight years, has withdrawn to engage in business as a partner of James H. Leary & Co., Minneapolis, manufacturers of electric signs. His fellow-workers, with the General Electric Company, presented him with a handsome Elks' watch charm.

Michael B. Field, electrical engineer of the Glasgow corporation, Scotland, is making a tour through the United States, visiting the larger cities, for the purpose of noting the progress that is being made in electric lighting and traction development. He spent three days in Chicago last week and was entertained by local electrical interests. While here he inspected the large power plants, electric railways and more important electrical installations.

ELECTRIC LIGHTING.

An electric-light plant has been installed at Harrisville, Mich.

Lehigh, Iowa, is figuring on a proposition for an electric-light plant.

The electric-light plant in Wilmington, Ohio, is to be sold January 23d.

Eminence City, Ky., is negotiating with capitalists for the erection of an electric-light plant.

Electricity for lighting purposes is now being supplied through penny-in-the-slot meters at Eccles, Lancashire, England.

The citizens of Clarence, Mo., at a recent election voted to issue $10,000 worth of bonds for an electric-lighting plant.

The Citizens' Electric Light and Power Company of East St. Louis, Ill., has increased its capital stock from $25,000 to $250,000.

A by-law has been adopted in Guelph, Ont., to "municipalize" the lighting plant of the Guelph Light and Power Company.

Electricity is to be used for lighting the bow, masthead and compass lamps of the British torpedo-boat destroyers now being built.

DeWitt C. Hadcock of Syracuse, N. Y., proposes to erect and operate a large electric power plant to furnish Oneida with light, heat and power.

The Big Four Railroad has adopted the system of lighting its cars by electricity generated from the axles. The Pintsch gas will be kept for emergencies.

The Common Council of Sheboygan, Wis., has appointed a committee to look up the matter of the advisability of the city owning and operating an electric-lighting plant.

The Baltimore-Washington-Annapolis Electric Railway Company is erecting at East Hyattsville, Md., a new power house, to cost $325,000, and will furnish electric light to that town.

The Northwestern Electric Light, Heat and Power Company of Macon, Mo., has been given authority to construct, operate and maintain an electric-light, heat and power plant in Kearney, Neb.

Madisonville, Ky., is without electric lights. The contract with the Bailey Light and Water Company has expired, and the City Council has refused to renew the contract with the company.

The Austin Light, Heat and Power Company of New York, with a capital of $2,500,000, has been incorporated in Delaware. The incorporators are Edward C. Dowling and Harry W. Spence of Brooklyn, and Millard H. France of New York.

An application for a franchise for a gas and electric company in Manistee, Mich., has been applied for by George A. Hart and Walter E. Daniels. They propose to build a coal-gas plant and electric-lighting system, the plant to cost about $50,000.

The Rochester Light and Power company of Rochester, N. Y., has been incorporated with a capital of $500,000. The directors are Edward J. Patterson, Plainfield, N. J.; Harry L. Snyder, Montclair, N. J.; George L. Wakefield, and Samuel S. Perry, New York.

Conferences have been held between ex-Postmaster Gordon and other Chicago men and representatives of public-service corporations in Eau Claire, Wis., for a combination, it is stated, of the interests of electric-light and power and electric-railway and gas-light companies of Eau Claire and Chippewa Falls.

ELECTRIC RAILWAYS.

J. H. Warner, president of the Chattanooga (Tenn.) electric street railway, has, it is reported, received permission from the War Department to make surveys for a line through Chickamauga Park to Cloud Spring.

The Elizabethport, Amboy and Long Branch Railway Company of New Jersey has been incorporated by Judge Andrew Kirkpatrick of Newark, Edward Furman of Sayreville, and W. Parker Runyon of Perth Amboy. The capital is $500,000.

The officers of the Rockford and Freeport (Ill.) electric railroad, a new line to be constructed next spring, have advertised for ties, and with the letting of this contract the last work in getting material will be finished. Weston Brothers, the well-known Chicago engineers, will have charge of the construction work.

The new owners of the Stockton (Cal.) electric street railway have elected the following-named officers: President, ex-Governor James H. Budd; vice-president, H. E. Huntington; secretary, treasurer and manager, ex-Mayor W. R. Clark. Mr. Huntington, who is said to own four-fifths of the stock, is to assume the presidency of the road shortly.

Rival electric-railway companies are now at work arranging for the construction of interurban trolley lines along the Kaw Valley. One corporation is known as the Kansas City, Lawrence and Topeka Electric Railway Company. The other is the Kansas City, Bonner Springs and Topeka Railway Company. The two lines run parallel for a considerable part of the distance between Kansas City, Kan., and Bonner Springs.

The United Railways Company of Baltimore, Md., now controlling all the street railroads of that city, and, with one or two exceptions, the suburban lines, will close a deal soon to get possession of the Baltimore, Sparrows Point and Chesapeake Railway. This is a corporation that will be formed by the consolidation of the Baltimore, Middle River and Sparrows Point Railroad and the Dundalk and North Point Railway Company.

The Milwaukee Electric Railway and Light Company will put into service, some time next month, on its Milwaukee-Waukesha and Racine-Kenosha interurban line about 25 large, new-style electric cars. Each one of these coaches weighs about 25 tons, and is supplied with a 250-horsepower electric motor, while each coach will have a smoking compartment and toilet rooms and be capable of seating 64 passengers. The cars will represent an outlay of $8,000 each.

The Bloomington, Pontiac and Joliet Electric Railroad Company of Pontiac, Ill., has been incorporated with a capital stock of $100,000. The incorporators are J. A. Carothers, J. S. Murphy, J. McWilliams, Jr., B. F. Harber and A. M. Legg. The company purposes to build an electric railway between Bloomington and Joliet, to connect at Joliet with the electric railway now in operation to Chicago. The tracks of the road will parallel those of the Chicago and Alton.

The State Board of Railroad Commissioners of New York is considering the application of the Canisteo and Jasper Electric Railroad Company for a charter to construct a road from Canisteo (N. Y.) to Jasper. The estimated cost of the road is $218,625. The road, when constructed, will have directly tributary to it a thickly populated section of about 48,000 acres. The estimated freight tonnage for the first year will be about 35,000 tons. It is proposed to use 55-pound rails. The distance traversed is about 13 miles. It is believed the road will pay from the start. It was stated to the commission that the International Trust Company of Boston has agreed to take the bonds at 90. The commission reserved its decision, but it is believed will grant a charter without delay.

TELEGRAPH.

Albert Kocouceck has filed suit in the Circuit Court of Chicago against the Western Union Telegraph Company, asking damages because of delay in the delivery of a telegram. The suit grows out of the recent strike of telegraph-messenger boys, and by reason of the failure of the company to deliver to him an answer to a telegram sent from Lincoln, Neb. Kocouceck says he lost a large sum of money.

The secretary of the treasury has submitted to Congress an additional estimate of appropriation of $485,000 under Signal Service of the Army for the fiscal year ending June 30, 1904, for the purchase, installation, operation and maintenance of a submarine cable for connecting the headquarters department of the Columbia with military garrisons in Southeastern Alaska. This cable is to extend from a point at or near Fort Lawton, Seattle, Wash., via Sitka, Alaska, to Juneau, Alaska.

The Western Union Telegraph Company has filed a bill in the federal court in Chicago to restrain the Pittsburg, Cincinnati, Chicago and St. Louis Railroad Company from carrying out its expressed intention to prevent the operation of the complainant's telegraph business on its road after June 2d next. This is another chapter of the fight between the Pennsylvania company and the telegraph company, the latter asserting that if the project is put into operation it will cause great injury to its business and inconvenience to the public.

PUBLICATIONS.

N. W. Ayer & Son of Philadelphia, newspaper and magazine advertisers, have issued their large display calendar for 1903, filled with their usual advertising epigrams. The calendar may be obtained for a small sum.

An attractive wall calendar issued by the Standard Tool Company of Cleveland and New York contains considerable tabular information concerning machine, screw and pipe taps, twist drills, reamers, standard threads, sockets, etc.

A very handsome calendar is being distributed by the Lombard Governor Company, Boston, Mass., to its customers and friends. The subject is a moonlight scene in colors, entitled "Moonlight At Sea," and is reproduced from a painting by W. Weber.

The advertising department of the Western Electric Company of Chicago has produced a handsome 1903 catalogue, which is descriptive of the company's power motors and generators. Encased, semi-encased and open or type-G machines are considered and a good deal of space is given up to the treatment of motors for elevator and back-geared service. The descriptive text is full, and information is also included on the regulation of speeds, types of field winding and their use, accessories, etc. Dimensional drawings and tables are given, and a large number of half-tone illustrations show a great variety of

applications for the motors. The catalogue is printed on heavy paper and the engraving and typographical work on it are excellent, the use of red ink for titles and marginal headings serving to make the book attractive.

"Work Well Done—A Record of British Industrial Enterprise," is the title of an illustrated article by D. N. Dunlop, which appeared in the Imperial Argus last November, and is now reprinted by the Westinghouse Companies' Publishing Department. The article describes the new works of the British Westinghouse Electric and Manufacturing Company at Manchester, England. These works are noteworthy on account of their size and the short time in which they were completed, and also because they embody in one complete and well-arranged plan the experience obtained during many years in many other large works.

MISCELLANEOUS.

Electricians at the Chicago Stockyards have been granted an advance of 15 per cent. in wages. They had asked for an increase of 22½ per cent., giving as a reason that their wages were smaller than those received by electricians employed anywhere else in the city.

Mr. De Laval, "the Edison of Sweden," whose cream separator and steam turbine have acquired world-wide fame, has devised, after many years' experiments, a process of extracting zinc from the ore by means of electricity. Great expectations have been formed of this method, for which a Swedish company is making use of the large Trolhatta waterfall, where already works exist for producing the necessary electricity. Zinc ore exists in great quantities both in Sweden and Norway.

The Monongahela (Pa.) City Council had under consideration an ordinance requiring that every telephone, telegraph, fire-alarm and electric wire, or overhead wires of any description, be placed underground, and that all poles be removed from the public streets before the expiration of one year. The recent fight with the Monongahela Street Railway Company, which tried to string through town a feed wire of high tension without having secured permission, and in direct violation of a city ordinance, is said to be the cause of the ordinance being prepared.

The United States Civil Service Commission will hold examinations on February 3d and 4th, to fill two places in the government service. The first is that of a machinist, at a salary of $1,200 a year, and is open to men over 20 years of age who can pass an examination in general machine construction and installation of electrical power plants. The second examination is for the position of electrical assistant at a salary of $900 a year. The requirements of the position are thorough familiarity with the practical side of electricity as applied to telegraph, telephone and fire-control communications. Applicants must be 20 years old or over.

TRADE NEWS.

The Electric Light Company of Dallas, Texas, C. L. Wakenfield manager, is in the market for the following material for shipment before February 1st: Direct-current dynamos, rheostats, incandescent lamps, switchboards, meters, wire, engines, pumps, direct-current arc lamps, switches, boilers, heaters, etc.

The Pittsburg Engineering Company has been incorporated in New Jersey with a capital of $125,000. The incorporators are Guy P. Thurber, H. L. Kerr and E. P. Hazlewood.

Arthur L. Bosley, Harry E. Karr, John W. Crowley and others of Baltimore have incorporated the Electrical Material Company with capital stock of $30,000, to deal in electrical materials.

The Electric Car Lighting Company, with a capital of $100,000, has been incorporated in New Jersey by Roswell S. Nichols, Lucius E. Varney, Anthony M. Jishera, John M. Scobie and John M. Enright.

The Electric Manufacturing Company has been incorporated in New Jersey, with a capital of $250,000. The incorporators are Frederick A. Feldkamp, Frederick C. Fraantzel and George Heinkel, Newark, N. J.

The Ideal Gas and Electric Fixture Company of New York city, with a capital of $10,000, has been incorporated in that state. Directors are Samuel Tepfer and Henry Forendo, Brooklyn, and Pincus Burger, New York.

The Escanaba (Mich.) Lighting Company is in the market (for shipment up to February 10th) for the following material: Two alternating-current dynamos, rheostats, switchboard, 100 meters, wire, engine, pump, transformers, boiler and heater.

The Utah Light and Power Company of Salt Lake City is in the market for engines and boilers; the Electric Light Company of Granbury, Texas, for a dynamo, switchboard, incandescent and arc lamps, transformers, etc., and the Electric Light Company of Lehigh, Iowa, for an alternating-current dynamo, incandescent and arc lamps, etc.

Daily-newspaper gossip has it that the General Electric Company is earning at about the rate of $10,000,000 a year, or nearly 25 per cent. upon its new capital of $42,000,000. The rumor is also revived and denied almost in the same breath that the General Electric Company will take over the Stanley Electric Manufacturing Company.

A few days ago the entire assets of the Standard Electric Signal Company at Rochester, N. Y., were bid in by J. George Kaelber, who has organized a new company, to be known as the Rochester Signal Company. It will continue the manufacture of fire-alarm apparatus, and on a more extensive scale. The capital stock of $500,000 is paid in. Associated with Mr. Kaelber are Hobart A. Atkinson, E. F. Higgins, Michael Doyle and C. S. Kellogg.

Exports of electrical materials and machinery from the port of New York for the week ended January 10th comprise values as follows. Argentine Republic, $3,911; British Possessions, $17,085; Bristol, $1,900; Brazil, $32,772; British Australia, $10,569; British East Indies, $1,325; Cuba, $1,207; Copenhagen, $1,621; Genoa, $1,700; Liverpool, $20,543; London, $8,776; Manchester, $25,841; Mexico, $8,811; Nova Scotia, $1,394; Peru, $1,886.

The Fostoria Bulb and Bottle Company of Fostoria, Ohio, wishes to correct the impression that its plant has been destroyed by fire and that it is not in a position to furnish inner globes. On the contrary, it says, its production of inner globes is greatly increased and that it is in a position to take the best possible care of all business that comes its way. Another glass factory at Fostoria, Ohio, by the name of the Fostoria Glass and Specialty Company, which manufactured outer globes and shades for arc lamps, was destroyed by fire.

The McKenna Bros. Brass Company of Pittsburg, manufacturer of fine brass work, last week divided with about 100 of its employes 10 per cent. of the last year's profits. Journeymen employes, who had been on the payroll during last year, received $45 to $70 each. It was a complete surprise to the men. The aggregate amount that the company gave to its skilled craftsmen amounted to upward of $6,000. This liberal division of profits was determined on by action of the board of managers of the company a year ago, and will be continued during the business life of the company. The profit-sharing ranges according to the wages drawn by the men during the year.

The Christensen Engineering Company of Milwaukee has opened an office in the Merchants' Loan and Trust Building, Chicago, for the sale of its Ceco electrical machinery. The company has been particularly fortunate in securing the services of Charles G. Burton as the manager of the Chicago agency. Mr. Burton is well and favorably known in the electrical field through his previous connection for several years with the Central Electric Company, and later, for three years with the Westinghouse Electric and Manufacturing Company. He left the latter company in the early part of 1902, to install a power and transmission system, resigning recently to accept his present position with the Christensen company.

BUSINESS.

The Sprague Electric Company supplied a large amount of flexible metallic conduit and steel-armored conductors for the new addition to the White House in Washington, and has also received additional orders for ventilating outfits for the same building.

Of the many improvements in things electrical, there has been none of greater importance, emphatically states the Electric Appliance Company of Chicago, than the Packard vacuum process of transformer insulation. The Electric Appliance Company, which is selling agent for Packard transformers, is prepared to give full information upon request.

The American Conduit Company of Los Angeles, Cal., with Chicago offices in the Manhattan Building, makes the announcement that it enters upon the new year with greatly enlarged facilities for supplying the demands for conduit. In addition to its factories at Chicago and Los Angeles, the company has erected a large and perfectly equipped plant at Chester, Pa., for the manufacture of its improved conduit. With its several factories so distributed as to give desirable shipping conditions, the American Conduit Company is able to take orders for large quantities of conduit and to guarantee prompt delivery. The company's 1903 catalogue gives a complete and elaborate account of its bituminized fiber conduit. The officers of the American Conduit Company are: President, John S. Cravens; vice-president, George H. Barker; secretary and general manager, A. W. Buchanan.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office), January 6, 1903

717,542 Trolley Harp. Frederick J. Caswell and Clarence C. Wood, Woodville, Mass. Application filed February 10, 1902.

The trolley is spring supported and is provided with guards on each side of the pole

717,549. Diaphragm for Batteries. Frank A. Decker and William P. Divine, Philadelphia, Pa.; Divine assignor to Decker. Application filed April 9, 1902.

The diaphragm comprises a thin porous body from which the whole or part of the original surface has been removed, and reinforcing members for the body.

717,558. Contact Device for Time-detectors. Harry W. Durkee and Will L. Cosgrove, Cleveland, Ohio. Application filed April 30, 1902.

Combined with separable portions, such as a door and its casing, is a contact device on each portion adapted to engage when the door is opened. A puncturing needle for a clock dial serves as the armature of an electromagnet and a battery is provided with circuit wires connecting the contacts, battery and magnet.

717,563. Apparatus for Handling Automobile Torpedoes. Bradley A. Fiske, U. S. Navy. Application filed March 10, 1902.

Combined with a ship, is a float adapted to be towed alongside the same when the ship is moving either forward or backward. Electrically operated catches or tumblers are provided to which the tow ropes are attached. The torpedo is suspended below the float, and a circuit extends from the ship to the electromagnets, whereby the tow ropes may be released.

717,583. Trolley Pole and Stand Therefor. Washington H. Kilbourn, Greenfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed March 13, 1902.

The trolley pole is pivotally attached to the stand. A dog is carried by and made rigid with the pole for engaging teeth on the stand and means are provided for applying spring tension to the pole when resistance is applied to the free end thereof.

717,584. Method of Controlling the Supply of Electric Energy to Translating Devices. Harry W. Leonard, East Orange, N. J. Application filed February 6, 1897.

The method of controlling an electric motor consists in supplying the field of the motor from a main source of electromotive force, supplying its armature with a variable electromotive force controlled by a second source of electromotive force located between the motor armature and the main source to vary the speed of rotation of the armature, and reversing the field magnetism of the motor to reverse the direction of rotation of the armature.

717,607. Electrode for Storage Batteries. Leonard Paget, New York, N. Y., assignor to Charles Coster, New York, N. Y. Application filed September 8, 1899.

The plate is adapted to form a storage-battery oxygen electrode and consists of a thin corrugated plate of compressed arborescent crystals of lead with a thin shell of peroxide of lead on the plate and a frame of elastic non-conducting material about the edges of the plate.

717,608. Method of Preparing Storage-battery Electrodes. Leonard Paget, New York, N. Y., assignor to Charles Coster, New York, N. Y. Application filed October 19, 1899.

The process consists in pressing finely divided lead into a thin corrugated plate and depositing thereon before forming a thin shell of peroxide of lead and then forming the plate electrically.

717,609. Storage-battery Electrode. Leonard Paget, New York, N. Y., assignor to Charles Coster, New York, N. Y. Application filed January 10, 1900.

The element consists of a conducting support and finely divided lead on the support compresssd to a density approximately that of sheet lead.

717,610. Storage Battery and Method of Preparing Electrodes Therefor. Leonard Paget, New York, N. Y., assignor to Charles Coster, New York, N. Y. Application filed January 10, 1900.

An intermediate bipolar electrode for storage batteries has the sole electrical conducting connection between opposite sides of the electrode formed by a body of finely divided lead consisting of successive thin layers or films compressed to a density approximately that of sheet lead.

717,656. Brush Holder. Walter W. Beeler, Baltimore, Md. Application filed April 26, 1902.

The holder has a screw for tightening and holding it in whatever angle desired to the pin of the yoke of the commutator.

717,675. Switch Terminal. Gerald W. Hart, Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed June 26, 1902.

The terminal comprises a post, contact members carried thereby, and an opening in the side of each contact member, the contact members partially surrounding the post and being secured thereto by a portion of the metal of the post.

717,724. Electric Switch. William R. Thompson, Norwalk, Conn., assignor of one-half to George N. McKibbin, Norwalk, Conn. Application filed May 28, 1902.

In the switch are combined a base of insulating material having a recess in the bottom of the base and a slot through the base communicating with the recess, a metallic contact terminal carried by the base at one side of the slot, a second contact terminal, and a metallic spring located in the recess and adapted to bridge the terminals, and a projection through the slot to shift the spring.

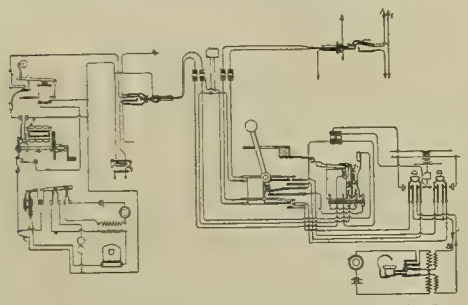
717,755. Automatic Conversation Counter for Telephone-exchange Systems. Johann H. Meyer,

Magdeburg, Germany. Application filed March 28, 1901.

The mechanism comprises a calling station, a central station and a called station a current interrupter and a counter at the calling station, a battery, a relay and switches therefor and a hand switch at the central station, a line between the calling station and central station and one between the called station and the central station. The hand switch upon its movement is adapted to make certain connections between the calling line and the relay-switch points and to operate the relay switch to complete such connections whereby a current will be sent from the battery through the relay, line and calling switch, upon the movement of which switch the current interrupter is adapted through the counter to break such circuit and thereby automatically cut out the relay and battery and connect the called and calling subscriber. (See cut.)

717,756. Candy Machine. William J. Morrison and John C. Wharton, Nashville, Tenn. Application filed May 12, 1902.

The machine has a rotative, circumferentially perforated vessel, and an electrically resistive band or heater, connected to a source of electricity.



NO. 717,755.—TELEPHONE CONVERSATION COUNTER.

717,758. Sign Illuminator. John H. McMullin, Worcester, Mass. Application filed May 2, 1902.

Electric lights or bulbs are secured within the body portion of the device and project toward each other from the ends thereof, and means are provided for securing the illuminator in position on the car.

717,762. Electrically Operated Calculating Machine. Frank C. Rinsche, St. Louis, Mo., assignor to the Universal Accountant Machine Company, St. Louis, Mo. Application filed June 12, 1901.

The machine is operated by an electric motor.

717,763. Device for Casting Justifying Spaces in Combined Type-casting and Setting Machines. Coloman Rozár, Nuremberg, Germany. Application filed November 20, 1900.

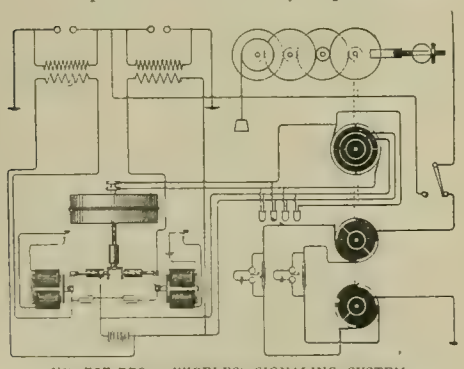
Electromagnets are used to operate the device.

717,765. Wireless-signaling System. Harry Shoemaker, Philadelphia, Pa., and Greenleaf W. Pickard, Boston, Mass., assignors to Gustave P. Gehring, Philadelphia, Pa., and the Consolidated Wireless Telegraph and Telephone Company. Application filed June 22, 1901.

The system comprises a wave-responsive device, a chemical recording circuit controlled thereby, a relay controlled by the first received impulse of electroradiant energy and means controlled by the relay for starting the tape of the recorder.

717,766. Wireless-signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring, Philadelphia, Pa., and the Consolidated Wireless Telegraph and Telephone Company. Application filed December 7, 1901.

The receiver comprises a number of plates in inductive relation means for permanently charging the plates, and a microphonic circuit controlled by the plates.



NO. 717,770.—WIRELESS SIGNALING SYSTEM.

717,767. Multiplex Wireless-signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring, Philadelphia, Pa., and the Consolidated Wireless Telegraph and Telephone Company. Application filed December 23, 1901.

In the system are combined a number of generators, means for throwing the generators into operation successively, means for controlling the circuits of the generators by and in accordance with the signals sent and means for impressing the modified energy derived from the generator upon the natural media.

717,768. Synchronizer. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring and the Consolidated Wireless Telegraph and Telephone Company, Philadelphia, Pa. Application filed April 25, 1902.

The synchronizer has a rotating power shaft, a shaft carrying circuit-changing means means for coupling the shaft together and means responsive to electromagnetic waves for actuating the coupling means.

717,769. Wireless-signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring and the Consolidated Wireless Telegraph and Telephone Company, Philadelphia, Pa. Application filed May 12, 1902.

In the system are a self-restoring wave-responsive device, a source of energy in circuit with the device and the primary of a transformer and a recording device controlled by the secondary of the transformer.

717,770. Wireless-signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring and the Consolidated Wireless Telegraph and Telephone Company, Philadelphia, Pa. Application filed June 16, 1902.

At the several stations of this system are synchronously rotating commutators one of the commutators controlling current supply of a synchronous motor, a plurality of interrupters alternately controlled by the motor, and a plurality of operator's keys controlling the circuit including the interrupters. (See cut.)

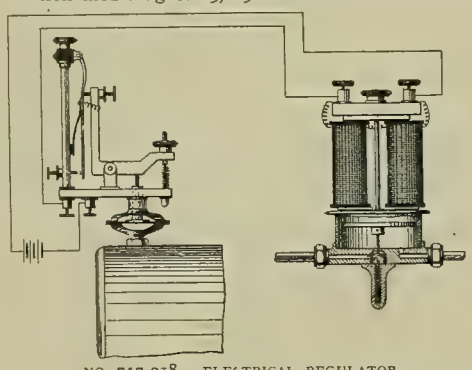
717,771. Signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to the Consolidated Wireless Telegraph and Telephone Company and Marie V. Gehring, Philadelphia, Pa. Application filed August 13, 1902.

A conductor comprises a winding of a length approximately equal to one-half the length of the received or transmitted waves, and has in addition a length approximately equal to a multiple of a quarter wave length.

717,772. Signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to the Consolidated Wireless Telegraph and Telephone Company and Marie V. Gehring, Philadelphia, Pa. Application filed August 19, 1902.

In the system are combined means for maintaining a magnetic field a material located within such magnetic field and having the property of changing its resistance in virtue of change of strength of the magnetic field, means for varying the strength of such magnetic field in accordance with a signal to be sent, a circuit controlled by the material and means in the circuit to produce a signal.

717,773. Signaling System. Harry Shoemaker, Philadelphia, Pa., assignor to the Consolidated Wireless Telegraph and Telephone Company and Marie V. Gehring, Philadelphia, Pa. Application filed August 19, 1902.



NO. 717,918.—ELECTRICAL REGULATOR.

The method of transmitting intelligence described consists in generating and impressing upon a medium trains of electroradiant-energy waves at a selected rate and representing elements of a signal, subjecting a wave-responsive device to the influence of the wave trains, and restoring the wave-responsive device at a rate which is low in comparison with the rate of succession of the transmitted wave trains, the rate of restorations being determined with regard to the duration of the shortest element of a signal.

717,774. Oscillator. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring and the Consolidated Wireless Telegraph and Telephone Company. Application filed November 10, 1902.

The oscillator is calibrated as to frequency.

717,776. Quadruplex Telegraph System. John F. Skirrow, East Orange, N. J. Application filed November 8, 1901. Renewed December 5, 1902.

The system is comprised of a neutral side and a polarized side, the combination of a differentially wound core, a closed local circuit connected to one winding of the core whereby the core is normally magnetized, an open local circuit connected to the other winding of the core, means operated by the neutral relay for closing this latter circuit through the second winding of the core, an armature normally held by the magnetized differentially wound core and adapted to be released when the circuit is completed through the second winding of the core, a signal-receiving instrument, and a circuit connected thereto and adapted to be closed by the release of the armature from the differentially wound core.

717,778. Electric Conducting Cable. Russell Spaulding, New York, N. Y., assignor to the Trust Company of America, trustee. Application filed February 5, 1902.

The cable comprises a braided core and an insulating covering.

717,821. Trolley for Electric Cars. William A. Daggett, Vineland, N. J. Application filed April 22, 1902.

The trolley is mounted to rotate upon a spindle between side plates, and contact brushes bear against each side of the trolley and are secured to each of the side plates.

717,895. Telephone-receiver Holder. James B. McClain, Washington, Pa. Application filed October 6, 1902.

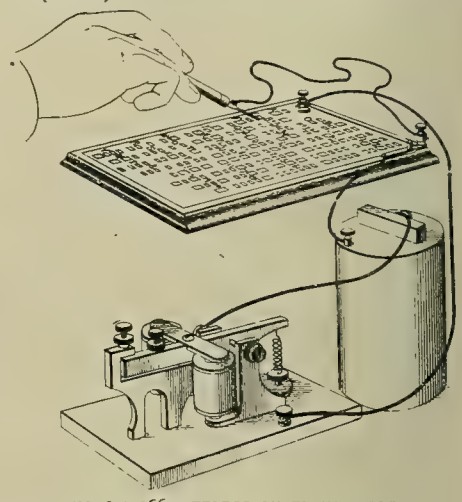
The holder consists of a telescopic supporting bar or arm a ball-and-socket member secured thereto, the ball member adapted to be contracted to permit adjustment of the arm, and means to contract the same, and means for supporting the receiver secured to the other end of the arm.

717,902. Electric Igniting Device for Internal-combustion Engines. Frank R. McMullin, Highland Park, Ill., assignor to the McMullin Motive Power and Construction Company. Application filed February 7, 1902.

In the igniter are a stationary contact, a movable contact, and means for moving the movable contact.

717,918. Electrical Regulator. Charles P. Philbrick, Wymore, Neb., assignor of one-half to John A. Reuling, Wymore, Neb. Application filed June 13, 1902.

The regulator comprises a boiler, a member for controlling the fuel supply thereof, a magnet for actuating the member, a pressure motor connected with the boiler and actuated by pressure therefrom, a source of electricity, a contact connected with the magnet and with the source of electricity, the contact being normally open, and a bell-crank lever provided with an adjusting screw for engaging the contact and connected with the pressure motor. (See cut.)



NO. 917,966.—TELEGRAPH TRANSMITTER.

717,966. Telegraph Transmitter. Charles T. Bourk, Lima, Ohio. Application filed January 26, 1901.

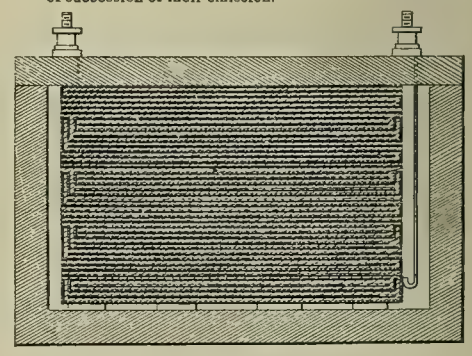
The instrument has a base of non-conducting material with an upwardly extending continuous surrounding rim to form a pocket, a conductor plate of metal disposed in the pocket and equal in area to the latter, small and larger contact points or segments connected permanently to the plate and corresponding to telegraphic dots and dashes and arranged in alphabetical order in vertical series, a stylus having a non-conducting handle and a thin flexible metal brush to engage the segments, and electrical connections for the stylus and metal plate in the pocket, the connections including a telegraphic sounder. (See cut.)

717,973. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed April 5, 1901.

In the system are combined a telephone line having a plurality of testing terminals, testing apparatus including a plurality of testing contacts, a relay common to the contacts and in circuit therewith, and a responsive device controlled by the relay and actuated whenever a testing current flows over the testing circuit from any of the contacts.

717,978. Wireless Selective Signaling System. Cornelius D. Ehret, Rosemont, Pa. Application filed July 3, 1902.

The method consists in emitting in a predetermined order of succession energies differing in properties, and subjecting a wave-responsive device at the receiver to the energies in an order of succession corresponding with the order of succession of their emission.



NO. 718,045.—STORAGE BATTERY.

717,994. Electric Crane. John H. Holland, Columbus, Ohio, assignor to the Case Manufacturing Company, Columbus, Ohio. Application filed November 19, 1901.

In combination with a traveling bridge, wheels upon which it travels and short shafts carrying the wheels are a counter-shaft extending the length of the bridge and having reducing-gear connection with each of the short shafts, an intermediate short shaft having reducing-gear connection with the counter-shaft, a sleeve supported by and turning on the counter-shaft, having at one end reducing-gear connection with the intermediate short shaft, an electric motor and reducing-gear connection between the shaft of the motor and the other end of the sleeve.

718,024. Trolley. Joel T. Rice, Hot Springs, Ark. Application filed March 20, 1902.

Combined with a plurality of independently mounted trolley poles is a spring disconnected from both poles and movable to position to support either pole in operative position.

718,045. Electrical Storage Battery. Henry K. P. Barham, Portsmouth, England. Application filed December 2, 1901.

In the device are series of strips of metal each folded upon itself with saturated absorbent material between the folds thereof, and forming a tray intermediate the ends thereof. (See cut.)

WESTERN ELECTRICIAN

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Electrical Features of the St. Louis Exposition.

Portions of the Electricity Building, now under construction at the St. Louis Exposition, have been depicted in previous issues of the Western Electrician, but the accompanying illustration is a reproduction of what is undoubtedly the best and latest photograph of this interesting structure. The point of view is the bed of the Grand Basin, and the south and east walls are shown. The contractor is pushing the work on the building, which, as the picture reveals, is well advanced toward completion. Indeed, little remains to be done on the exterior but to cover it with its shell of staff and to finish the window glazing.

Illumination and Lighting Effects.

The first publication outlining the plan and scope of the Louisiana Purchase Exposition stated: "The progression of the exposition will be most especially manifest in the manner and extent of its use of artificial light, both for purposes of illuminating and as a means of decoration. Electric lighting in the latest, most striking and most effective form, as well as all other new and efficient modes of illuminating, will be so liberally employed that the exposition grounds and buildings will blaze with light at night, and their beauties successfully rival the attractions of daylight." This was in September, 1901. Ever since this date the exposition has been striving to accomplish a spectacular arrangement of its night illumination, and Henry Rustin, chief of the Department of Electrical and Mechanical Engineering, has outlined a plan which will undoubtedly accomplish results in most attractive form.

Sources of Energy.

The exposition will have a plant of a capacity of 8,000 kilowatts, installed in the Machinery Building. This plant is complete with its complement of boilers and engines, and will probably use coal for fuel. In addition, the exposition will rent 7,500 kilowatts from an outside source, which will be delivered at the exposition fence lines, where it will be taken and brought to the general switchboards in the Machinery Building. The current supply from these two plants will be three-phase, 25-cycle, 6,600-volt, and will be so provided with switching apparatus and devices as to make each plant interchangeable, in whole or in part, with the other.

Furthermore, the exposition has laid down a very liberal policy in its installation of exhibit machinery and has already solicited and obtained propositions for furnishing large steam units of both the reciprocating and turbine type, as well as gas engines, of considerable size, each completed with its electrical and boiler complement. The boiler units will be placed in a general boiler house. The size of this building will be, approximately, 300 by 350 feet. This entire exhibit installation is to be used in the service of the exposition for whatsoever will serve to demonstrate electrical and machinery practices to the best advantage. The engines, generators and apparatus already obtained on an exhibit basis guarantee that this plant will be of at least 14,000-kilowatt capacity, and a determination is being rapidly made as to what purpose each complete outfit will be applied to in the exposition's service.

Because of the size of the exhibit buildings, it has been necessary to establish a transformer substation in each. In these sub-stations will be located whatever transformers and rotaries are necessary to the service in this particular building.

The apparatus in these stations will be suitable for transforming from 6,600 volts to the pressure required, and as this approaches high-tension line practice, the switchboards and controlling devices must be of a high order of apparatus and not like the outfit usually installed in exposition work.

All the work of installation and operation will be done by the exposition itself, except such wiring as is necessary to take care of the individual requirements of the concessionaires, exhibitors and other customers on the exposition grounds. Their work, it is proposed, shall be done by whomsoever they choose to select.

General Lighting.

Incandescent lamps, for the most part, will be used for outside illumination, and the greater number of these will be attached to the building structures themselves in such manner as to bring out the architecture at night in keeping with the general architectural scheme.

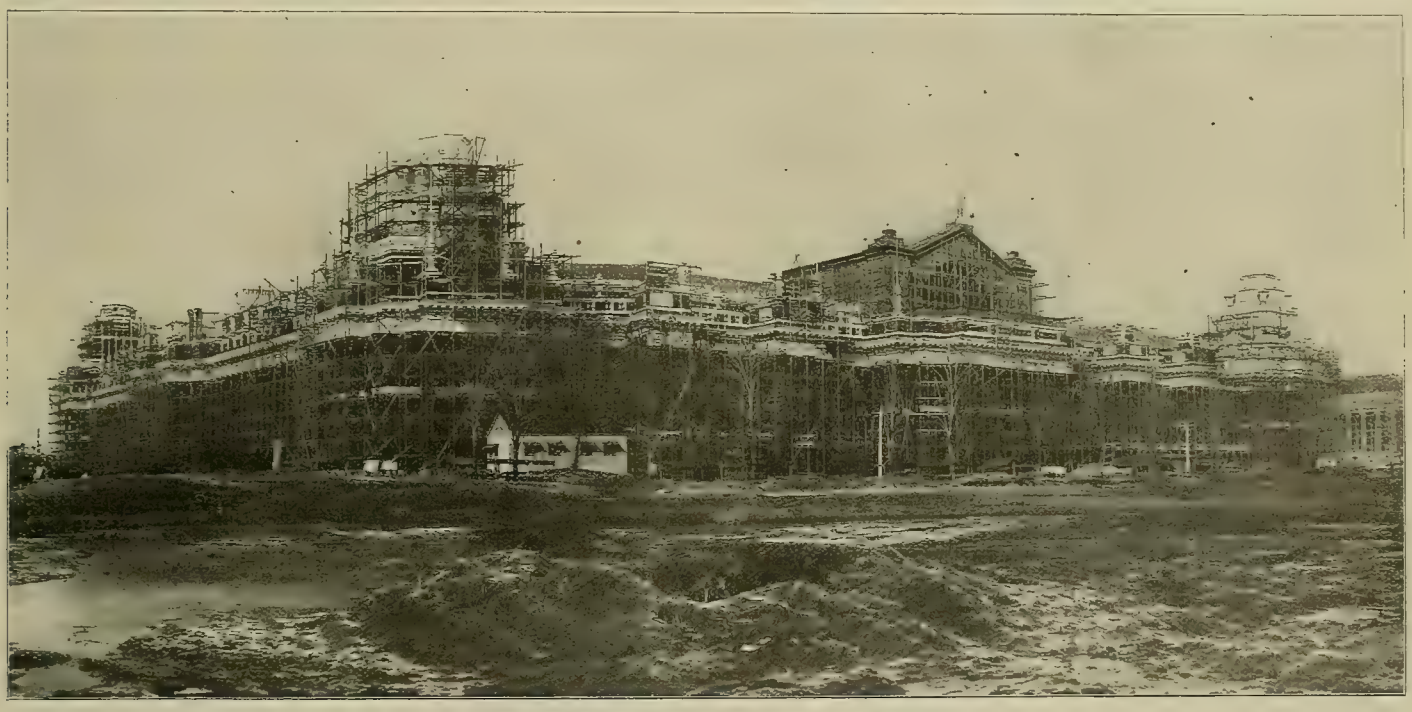
The effect of a great number of incandescent lamps showing off the lines of the buildings emphasizes the extent of the structures themselves, as well as lends itself to an effective appearance. The same quantity of light given off by arc lights, projectors, or other large candlepower methods of illuminating would give a cold feeling not in keeping with the idea of an exposition. The lighting of so vast an area by means of incandescent lamps is in itself a problem requiring considerable thought. It is not merely the question of considering illumination from the basis of the unit candle-foot; but the question of the appearance of all as a total when viewed from a distance and the question of harmonizing the emphasized architectural lines are both of great importance in the consideration.

The waterways of the exposition are in themselves of great extent and must be thoroughly illuminated for the reason that they will be used for boat traffic at night as well as in the daytime, and to light such a surface without erecting posts or other structures in great numbers is difficult of accomplishment. The question of the interior illumination has not yet been definitely decided, although in all probability it will be largely handled by means of arc lamps or other lamps of high candlepower. On interiors, the question of decoration in light does not appear to such a large extent as it does on exterior work, and the question of economy of illumination comes into prominence; for this reason larger lighting units are permissible and effective.

Cascade Lighting.

The main picture of the exposition covers a territory of 600 acres, and is arranged in a setting shaped not unlike a lady's fan. Three courts radiate from a common center. This common center is occupied by a territory known as the Cascades, made up of architectural, sculptural and hydraulic features, extending in a curve over a distance of about 3,000 feet. Three architectural features, very ornate in design, are placed along this curve and are connected by a colonnade known as a Terrace of States. The central place of this architectural setting is occupied by Festival Hall, while the larger structures on each side are known as the Restaurants. In front of each of these three buildings is to be placed a motif, from which a cascade of water will issue, tumbling over a series of falls and finally reaching the lagoon. These cascades are flanked on both sides with sculptural conceptions in keeping with the surroundings, and in each of these is embodied an opportunity for a water figure or fountain.

The daylight appearance in this territory relies for its effect on the skill of the artist and engineer in combining water effects with an architectural or sculptural setting. At night it is intended that this whole territory shall be brilliantly and spectacularly treated with combinations of different lightings. It is intended also that the entire territory of the Cascades shall be treated simultaneously with light effects. The intention has not been simply to trim structures and objects with lights, but it is desired, and it is possible of accomplishment, that the entire territory shall be built up, as it were, of light itself. In order to convey the idea, perhaps it would be well to recall the display of the Electric Tower at



ELECTRICITY BUILDING AT THE ST. LOUIS EXPOSITION.

Buffalo. This structure at night did not appear as a structural shaft treated with light, but appeared as if the structure itself were incandescent. In the same manner the entire territory of the Cascades will partake of the color of light applied, by rendering the buildings as if they were light itself, and not simply the effect of light.

One effect sought for will be to make the entire territory the color of an amethyst crystal; while at the same time the cascades will appear as illumined by vari-colored lights for projector lamps. At another time, when the entire hillside is an emerald color, the water will take on the phosphorescent hue of the Cooper-Hewitt lamp. Again, when the entire cascade territory appears as a solid incandescent thing, the waters of the cascade will appear as sheets of molten silver.

In order to gain a proper conception of what is to be produced, it must not be inferred that these effects will be "commutated." That is to say, they will not be ever-changing, like some operator was simply turning a crank to produce constantly recurring results in automaton fashion, but certain effects, prearranged, will be arranged for each evening, or portion of an evening, and the effects dissolved from one effect into another, according to programme.

The Cooper-Hewitt light has been selected for one of these effects, because of the peculiar quality and feeling which it imparts to water; the impression made on one by seeing a large quantity of rippling water thus illuminated is not to be conveyed by words.

Experiments are being made from time to time to try the values of lights of other qualities, and considerable encouragement has been received in these experiments. The unit of light has been established on such a scale that competitive lights from nearby sources can hardly decrease the effect on the cascade territory. No expense is being spared by the exposition to make this the most attractive night display ever shown.

Cascade Pumping.

The pumping machinery will be located beneath one of the side cascades, and will have a capacity sufficient to elevate 90,000 gallons per minute to a height of, approximately, 154 feet. These pumps will be of the centrifugal type, operated by induction motors of approximately 2,000-horsepower capacity. In order to accommodate themselves to the speeds of the pumps, these motors will have to be of special design and be planned for operation on 25-cycle, three-phase current. This will probably be the largest pumping outfit ever used for such a purpose.

The water is taken from the lagoon and canal systems, and is used over and over again. Provision is being made to filter the water properly on its initial introduction, and the bottoms and sides of the canals will be protected so that practically no foreign matter will be in suspension.

In order to provide a circulation for the canal system, the suction intake is carried down about 1,500 feet from the pump house. Because of the fan-shaped plan of the Cascade structure, the different waterfalls have different lengths of wait. The lowest fall to the center cascade is 168 feet in width; over this water will flow to a depth of 4½ inches. At the upper cascade, where the weir is narrower, the depth of water over the top fall will be 11½ inches.

It requires a 90-inch pipe to supply the pumps at the suction side.

Education Building.

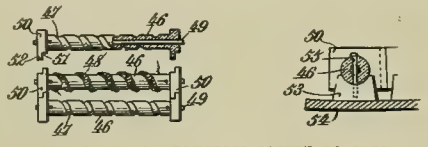
The Department of Electrical and Mechanical Engineering has begun the work of wiring the Education Building and will have the building ready for a test in a few weeks. The exterior of this, as well as all of the buildings in the main group, will be lighted with incandescent lamps of eight and 16 candlepower, while arc lamps will light the interior. The effect of this building at night will be that of a massive cornice of light, supported at the four corners and at the centers by giant pavilions of light, while the beautiful facade of fluted columns will be silhouetted against a screen, which will be a dazzling blaze. This effect will be obtained by inserting in the rear fluting of the columns a row of incandescent lamps, the reflection from which will cause the screen to be strongly lighted, although no lamps will be placed on it, nor will the direct rays from the lamps in the flutings be visible from the front of the building. The lamps on the cornice will be spaced 10 inches apart, and 20,000 will be needed to carry out this scheme of illumination.

Space Telegraphy at the World's Fair.

There is every reason to believe that wireless telegraphy will occupy a prominent position in the Electricity Building of the World's Fair. The recent successes of Marconi and others make it certain that working exhibits will be installed, in conjunction with commercial stations, in the large cities of the Middle West, and it is even possible that communication may be established with New York. The interest manifested by those working in this field of research is indicative of a very complete, comprehensive and highly organized scheme of exhibits for 1904, and the inventors of the different methods of syntonizing and selective signaling will have a good opportunity to demonstrate the practical working of their apparatus, surrounded, as they will be, with sending and receiving stations of other systems. The first application received by the Department of Electricity was that of Patrick B. Delaney, and the most recent that of the DeForest Wireless Telegraph Company of New York city. In a recent interview Clarence G. Thompkins, general manager of the latter company, said: "We intend to place a wireless plant on exhibition for the information of visitors, and communication will be established and maintained between St. Louis and Chicago, or St. Louis and Minneapolis. By the time the World's Fair is opened, wireless telegraphy will be a commercial factor. It will have passed the stage of experimentation, yet there will be thousands upon thousands who will visit the World's Fair who will there have an opportunity to see just how wireless communication is maintained. When I say that we shall establish communication with Chicago or Minneapolis from the fair grounds, it does not mean, of course, that we shall confine our operations to these cities, but either one of these two will be in continuous communication for the benefit of visitors."

Roasting Coffee by Electricity.

Electric coffee roasters have been used to some extent, but the devices which have been put upon the market have been the subject of some criticisms from practical men, and it is to overcome these objections and provide a successful roaster that can be operated as well as heated by electricity that George C. Lester of New York city has invented and patented the apparatus illustrated herewith. Fig. 1 is a vertical longitudinal section of the roaster. Fig. 2 is a view showing, partly in section and partly in elevation, a set of three heaters. Fig. 3 is a detail cross-sectional view of one of the heaters, and Fig. 4 is a diagrammatic view showing the circuit connections.



FIGS. 2 AND 3. ELECTRIC COFFEE ROASTER.

The main frame of the machine may be of any suitable form and construction. Mounted therein is a rotary drum or receptacle (1), in which the coffee is roasted, the same being adjustably secured to a horizontal shaft (2), having suitable bearings in the main frame and provided with gearing on one end, which meshes with a pinion on the armature shaft (8) of an electric motor (9). The motor (9) and the connections between the same and the gear are suitably supported on the main frame of the machine. The drum (1) has a cylindrical metallic wall (10) and a circular metallic head (11) at one end, these two parts being connected to each other, as clearly shown. The end of the drum opposite the head (11) is open, but is normally covered by a face-plate (12), secured to or forming part of the main frame. This face-plate has openings for supplying coffee to the machine and for removing the roasted coffee.

Beneath the discharge opening (16) is a car (19) for receiving the coffee from the drum and for the convenient delivery of the same to any suitable point. This car is provided with a foraminous bottom (20), having a passage (21) beneath the same, provided with a spout or nozzle (22), by means of which the same may be connected with a suction-fan or other exhausting device for drawing air through the mass of coffee on the bottom (20), and thereby facilitating the cooling of the same.

The head (11) and the cylindrical wall (10) of the drum (1) are both covered by a layer (26) of asbestos or other like heat-non-conducting material, and the asbestos is itself covered by a cylindrical copper or other metallic sheet (27), extending around the cylindrical wall (10), and a circular copper or other metallic disk (28) outside the head (11).

Located within the drum (1), parallel to the cylindrical wall (10) thereof, is a foraminous diaphragm or partition (29), the same being constructed of perforated sheet metal, wire netting, or other like material. This partition forms within the drum (1) a central cylindrical receptacle (31), in which the coffee is roasted, and a surrounding annular chamber (32), in which the electric heaters are located and from which the heat is transmitted through the foraminous diaphragm to the coffee within the receptacle. Located within the receptacle (31) are spiral flights or ribs, designed for the purpose of agitating and keeping in movement from end to end of the receptacle the coffee contained therein. This

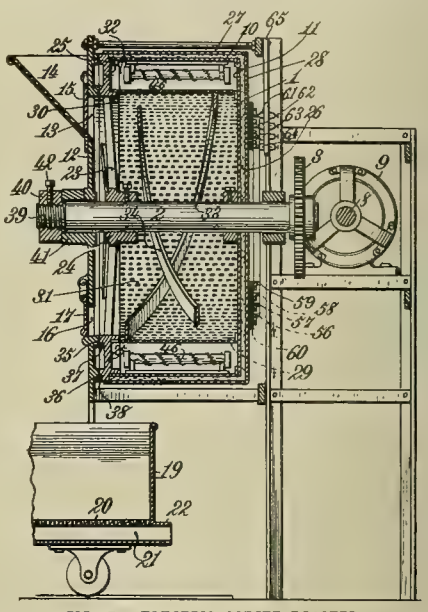


FIG. 1. ELECTRIC COFFEE ROASTER.

chamber is completely closed on all sides except that covered by the diaphragm (29), so that the air heated therein must necessarily pass therefrom through the openings in the diaphragm (29) to the interior of the receptacle (31), in which the coffee is roasted. These heaters are arranged in sets at various points around in the chamber (32), the members of each set being designated by the reference numerals (43) (44) (45). (Fig. 4.) There are four sets of heaters and three heaters in each set.

Each of the heaters consists of a hollow cylindrical spool (46), (Fig. 2), having a spiral groove (47) on its outer surface, around which the heating coil (48) is passed and in which the coil is seated. Each of the spools has a metallic core or stiffening rod (49), extending therethrough, and is provided with rectangular heads (50). The heads (50) are rabbeted, as shown at (51), to provide overlapping lips or flanges (52). When the heaters are assembled within the annular chamber (32), the same are supported upon recessed blocks or standards (53), (Fig. 3), secured to base plates (54), attached to the inner cylindrical wall (10) of the drum (1). The heaters are held in place upon the blocks or standards (53) by means of screws or pins (55),

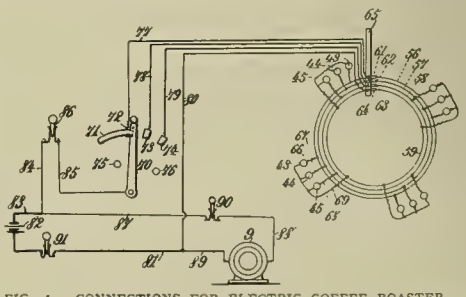


FIG. 4. CONNECTIONS FOR ELECTRIC COFFEE ROASTER.

which extend through the spools (46). When in place, the flanges (52) on the heads (50) of the adjacent heaters overlap each other, and the same are thereby secured in place without danger of accidental derangement. The metallic core (49) in each of the spools (46) serves to stiffen and strengthen the spools, and in the event of the breakage of the porcelain of which the spools are made serves to prevent the broken parts thereof from falling away. The heating coils are thereby prevented from falling down and short-circuiting through the other coils.

To provide means for supplying current to the various heaters arranged in the annular chamber (32), there is arranged upon the outside of the metallic disk (28), a series of contact rings (56)

(57) (58) (59). These contact rings are mounted upon an annular band (60) of insulating material, secured to the disk (28). Coöperating respectively with the contact rings (56) (57) (58) (59) are the brushes (61) (62) (63) (64), carried by a hanger arm or support (65). The heater (43) of each set of heaters is connected through the wire (66) with the outer ring (56). The heater (44) of each set of heaters is connected through the wire (67) with the contact ring (57). The heater (45) of each set of heaters is connected through the wire (68) with the contact ring (58), and all of the heaters of each set are connected through the wire (69) with the contact ring (59). It will thus be seen that the heaters (43) of each set are connected up in multiple, as well as the heaters (44) of each set and the heaters (45) of each set.

Coöperating with these parts is a switchboard or controller comprising a pivoted switch arm (70), having a segmental contact strip or bridge piece (71) thereon, and the contacts (72) (73) (74), designed to be engaged by the strip (71). Stops (75) (76) limit the swinging movement of the switch arm (70) in opposite directions. The contact (72) is connected through the wire (77) with the brush (61). The contact (73) is connected through the wire (78) with the brush (62), and the contact (74) is connected through the wire (79) with the brush (63). The brush (64) is connected through the wire (80) with the common return wire (81) of the system. The switch arm or lever (70) is connected with the generator (82) or other source of electrical supply by way of the wires (83), (84) and (85), the wires (84) and (85) having interposed between them an ordinary switch or cut-out (86). The motor (9) is supplied from the generator (82) through the wires (87), (88) and (89), the wire (89) being connected with the general return wire (81). Between the wires (87) and (88) is interposed an ordinary switch or cut-out (90). In the return wire (81) is interposed an ordinary switch or cut-out (91).

By the construction just described it will be seen that the motor (9) and the heaters are supplied from a common source of electrical energy. The connections between the generator (82) and both the motor and heaters may be cut on or off by the switch (91). The supply to the heaters through the switch arm (70) may be cut on or off independently of that to the motor (9) by means of the switch (86), and the supply to the motor (9) may be cut on or off independently of that to the heaters through the switch arm (70) by means of the switch (90). By a simple manipulation of the switch arm or lever (70), one or more of the heaters of each set may be cut into or out of the circuit and the heat generated within the roaster thereby increased or decreased.

When the drum is rotated the coffee within the receptacle (31) is kept in motion and has a longitudinal motion imparted to it by the spiral flights or ribs. At the same time one or more of the heaters (43), (44) and (45) of each set is thrown into operation, and the air within the annular chamber (32) is raised to the requisite degree of heat for roasting. This air passes from the chamber (32) into the receptacle (31) through the foraminous diaphragm (29) and acts upon the coffee contained within the receptacle to roast or parch the same. As the heaters (43), (44) and (45) are located in the chamber (32), which is separate from the receptacle (31), in which the coffee itself in located, it will be observed that there can be no direct contact between the coffee beans and the heaters, which would serve to spot or unequally heat the same. Furthermore, as the coffee is roasted by means other than the cumbustion of suitable fuel, there are no noxious gases to come in contact with the coffee bean, and thereby deteriorate or contaminate the flavor or aroma thereof. Furthermore, as the coffee is roasted in a chamber which is closed on all sides there is no opportunity for the escape of vapors or aroma from the coffee, which are in other forms of apparatus allowed to go to waste. In other words, all the vapors, flavors and aromas which are contained in the original green coffee bean are retained in the same after the coffee has been roasted. No artificial moistening of the roasted bean is necessary, as none of the original moisture contained therein is driven off.

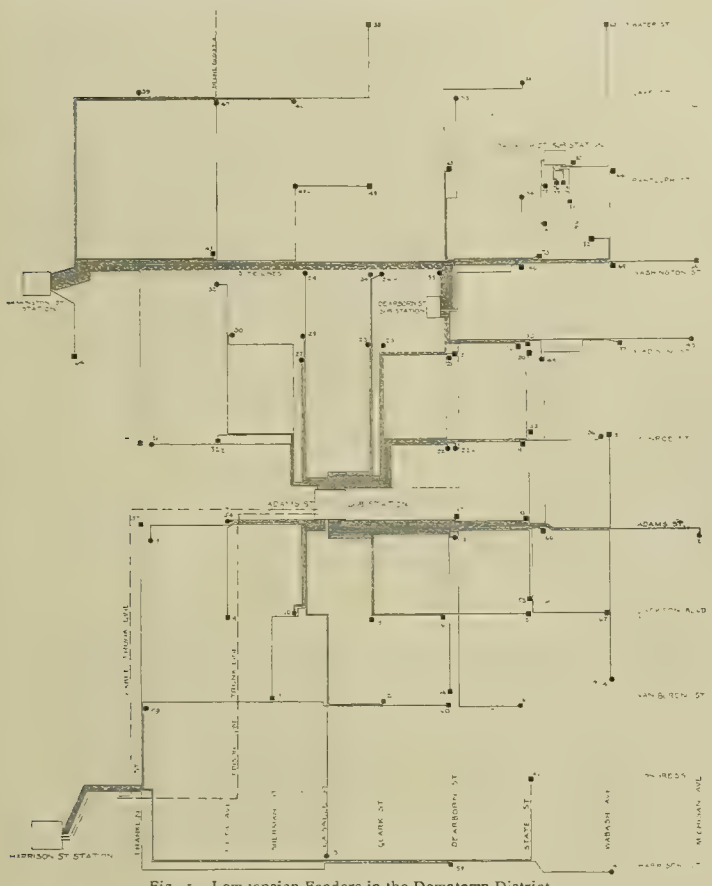


Fig. 1. Low-tension Feeders in the Downtown District.

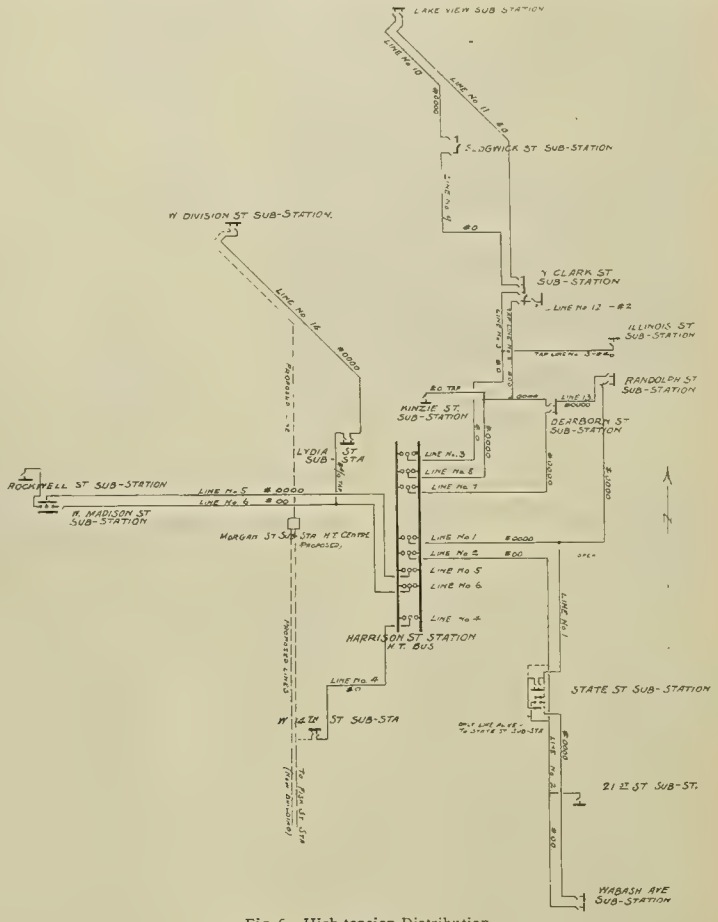


Fig. 6. High-tension Distribution.

UNDERGROUND WORK OF THE CHICAGO EDISON AND COMMONWEALTH ELECTRIC COMPANIES.

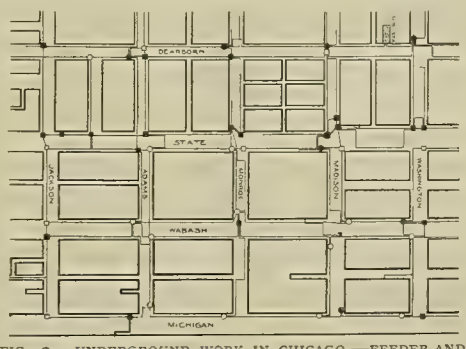


FIG. 2. UNDERGROUND WORK IN CHICAGO.—FEEDER AND MAIN DISTRIBUTION.

Underground System of the Chicago Edison and Commonwealth Electric Companies.[1]

By W. G. Carlton.

The most of you are probably familiar with the general scheme of operation of the Edison and Commonwealth companies. Service is furnished on the direct-current Edison three-wire system at 115 or 230 volts, also on the 60-cycle, single or three-phase alternating system at the same voltages. These two classes include about 85 per cent. of the total business of the two companies. The balance is made up of direct current at 500 volts for power purposes, high-tension series arc, and alternating current at 9,000 volts and 25 cycles for operating rotary converters for one of the elevated railways.

A considerable part of the direct current is distributed from rotary-converter sub-stations, these sub-stations being fed from 9,000-volt, 25-cycle lines. In general, the 60-cycle lines in the territory outside of the central part of the city run overhead and the 25-cycle and low-tension direct-current lines run underground, although there are exceptions to this in the case of the 60-cycle and direct-current lines. The 9,000-volt lines are all underground. The series-arc and 500-volt systems will not be considered, as they form a small part of the total, and as they are gradually being done away with.

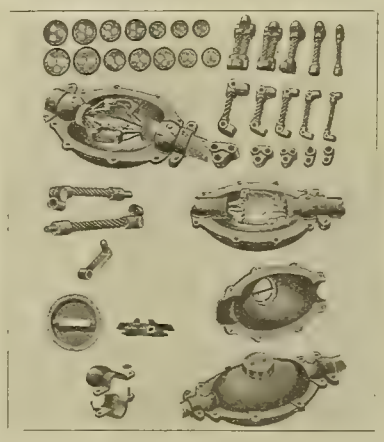


FIG. 3. UNDERGROUND WORK IN CHICAGO.—EDISON TUBE DETAILS.

The Edison three-wire system is used in the ter-

1 Paper read before the Chicago Electrical Association on January 16, 1903. Mr. Carlton is assistant to the chief operating engineer of the Chicago Edison and Commonwealth Electric companies.

ritory between North Avenue and Thirty-ninth Street and west from the lake for a distance of from one to two miles. Until about five years ago, current was supplied from four generating stations. Since that time rotary-converter sub-stations have been installed, so that there are at the present time 15 stations and sub-stations supplying direct current. Fig. 1 shows a portion of the business district, with the underground lines of the direct-current system. The mains from which services are taken are generally on the side of the street near the curb. At street intersections these are connected to junction boxes. These mains form one interconnected network for the entire direct-current system. Feeders

FIG. 4. UNDERGROUND WORK IN CHICAGO.—EDISON TEE BOX.

are run from the stations and sub-stations to supply current to this network wherever it is needed. Where the load is heavy, several feeders may be needed at one street intersection, while in sections with lighter load there may be several blocks between feeder ends. Feeders are also sometimes run to the middle of the block. Fig. 2 shows the feeders in the downtown district as they were about six months ago.

Until 1895 all of the low-tension direct-current lines of the Edison Company were built of Edison tube. Since that time lead-covered cables have been used for feeders and in many cases for mains. Fig. 3 shows sections of feeder and main tubes, and also some of the fittings used. These tubes come in 20-foot lengths and consist of iron pipes containing three copper rods. The rods are wound with rope on a coarse spiral, and the bunch of three is also wound with a rope. The rope acts as a spreader to separate the tubes from each other and from the pipe. The tube is filled with asphaltum, the ends being closed with hard-rubber plugs. Fig. 4 shows a tee connection from an Edison tube, such as is used for a service. Fig. 5 shows an Edison junction box to which the tubes are connected at street intersections. This box contains three copper rings which are connected, through fuses, to cables running down to the iron-pipe stubs. The tubes are connected to these stubs.

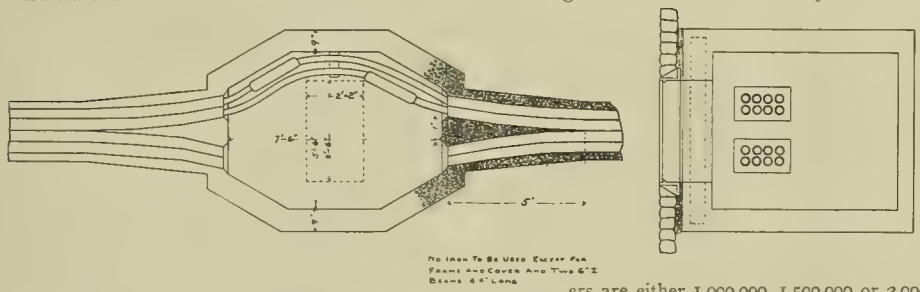
Edison tube is convenient to use for mains on account of the ease with which services may be installed. It is also cheaper than cable in conduit where but a single line is wanted. Some of the objections to its use are that its carrying capacity is less than that of cable of the same cross-section, owing to the low melting point of the compound used in the tubes and boxes. The life of the iron pipe is comparatively short, depending largely on the nature of the ground in which it is laid. It also usually requires longer to locate and repair trouble on a tube than on a cable line. Edison tube is made in varying sizes, ranging from 100,000 to 500,000 circular mils per conductor for mains, and from 250,000 to 1,000,000 circular mils for feeder tubes. In the main tubes the three conductors are of the same size, while in the feeder tubes the neutral conductor is approximately one-third the cross-section of the others. The feeder tubes also contain three small pressure wires. Tailleur junction boxes are used for cable lines and are installed in manholes.

When cables were first installed, rubber was used for insulation, but for several years paper-insulated cable has been used exclusively except for submarine work. Paper cable is cheaper than rubber, and also has a greater overload capacity. A conduit system is used entirely, no cable being laid in the ground, as is common practice in Europe. Cable is used in sizes varying from 26,000 (No. 6 B. & S.) to 2,000,000 circular mils. For low-tension work nearly all cables are single conductor. The thickness of insulation on low-tension cables is regulated by mechanical reasons, while on high-tension cables the thickness of the paper wall is determined by the voltage to be used. A low-tension cable feeder as installed, would, if the ends were satisfactorily protected, operate safely at 2,000 volts. The thickness of insulation in low-tension cables varies from four to six thirty-seconds of an inch, depending on the size of the cable. For smaller cable than No. 2, solid wire is used, and for sizes from No. 2 to 1,500,000 circular mils the

FIG. 5. UNDERGROUND WORK IN CHICAGO. EDISON TEN-WAY JUNCTION BOX.

cable is concentric stranded. For sizes larger than 1,500,000 circular mils, a rope stranding is used, to give a greater flexibility; 2,000,000 cable is about as large as is practicable to use.

Services vary in size from No. 6 to 2,000,000 circular mils. In case of a large load to be taken care of, several services are generally installed. For Marshall Field's retail store, where there is a connected load of approximately 75,000 16-candlepower equivalent, 19 services were required. Eighteen feeders were run from the sub-station in the Boyce Building and in the Masonic Temple. These feeders are either 1,000,000, 1,500,000 or 2,000,000-circular-mil cable.



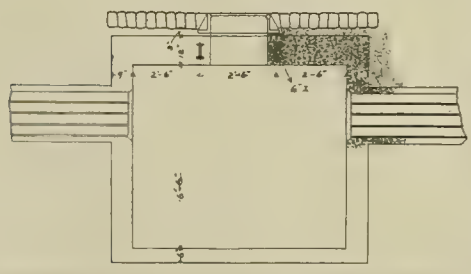


FIG. 7 UNDERGROUND WORK IN CHICAGO.—CONCRETE MANHOLE FOR THROUGH 9,000 VOLT LINES.

The total number of feeders required to take care of the entire low-tension load of the Edison company is 175. The total cross-section is 140,000,000 circular mils on each side of the three-wire system and 29,000,000 circular mils on the neutral. These feeders vary in size from 250,000 to 2,000,000, the smaller ones having been installed several years ago. It is seldom that feeders smaller than 1,000,000 are installed at the present time.

The rotary-converter sub-stations are fed by 9,000-volt, 25-cycle, three-phase lines. At present these all run from the station at Harrison Street and the river. These lines vary in length from one to five miles, and are all three-conductor cables. Some cables supply only a single station, while others are tapped or looped into two or more sub-stations. A single cable may carry as much as 3,000 kilowatts, so you can readily see that it is necessary to take all means possible to have these installed in a safe manner. Where they pass through manholes, they are covered with two layers of heavy asbestos paper, and this is wrapped with brass tape 0.025 inch thick and one inch wide. This is done to protect these cables from fire caused by other cables or by gas. The more important sub-stations are fed by two or more lines, so that the failure of one line would not cause a shutdown of the sub-station. As far as possible, the two lines for one sub-station are run by different routes, so that trouble in one manhole would not affect both lines. Fig. 6 shows the 9,000-volt lines now in use. In the case of two sub-stations in the same territory, which are not large enough to warrant two independent lines, it is usually possible to run a tie line between the sub-stations and to make this tie line serve as the duplicate line for both sub-stations.

Joints on these cables are covered with paper tape and a lead sleeve, the sleeve being wiped to the lead sheath of the cable and filled with paraffin or an insulating compound called Minerallac. A great deal of care has to be taken with these joints. The making of one joint, including the fireproofing of the cable in an average-sized manhole, costs from $10 to $15. As soon as cables are pulled in the ends are sealed to keep out moisture, but the making of the joint requires several hours, and during that time more or less moisture is absorbed by the paper insulation and the jute filler from the air and from the jointer's hands. It is necessary to remove all of this, and it is done by "boiling out," as it is called. The sleeve is filled with an insulating compound heated to about 175 degrees Centigrade, the pouring being continued and the compound allowed to overflow from the vent until the joint is heated throughout and all moisture driven out. After the joint has cooled, a final pouring is made, to be sure that the sleeve is full, and the openings through which the pouring was done are sealed. Out of six or seven hundred joints made in this manner in the last two years, we have had but one failure in new cable, and that occurred when the line was first tested out. It was found that this trouble started from moisture. We had some cable originally installed for 4,500 volts and later used for 9,000 that developed trouble near the ends of the cable. This was supposed to be due to the ends of the cable not being cut back far enough before the wiped joints were made, the first joints not being wiped.

The insulation used on the 9,000-volt cables is of the split type, there being a wrapping over each conductor and a common wrapping over the three conductors. The specifications call for a six thirty-seconds-inch paper wall over each conductor and

FIG. 8. UNDERGROUND WORK IN CHICAGO.—OBSTRUCTIONS TO MANHOLE BUILDING.

four thirty-seconds inch over the three conductors. We have cables that were originally installed for 4,500 volts that have insulation of five thirty-seconds and three thirty-seconds inch. These are operating satisfactorily at 9,000 volts.

After the 9,000-volt cables are installed they are tested at 18,000 volts, between conductors, and 11,000 volts between conductors and ground for about 10 minutes. The neutral points of the machines supplying the 9,000-volt system are grounded, and consequently the voltage between conductors and ground is only 58 per cent. of that between conductors. Insulation tests are made weekly with a galvanometer, and show an insulation resistance of about 400 megohms per mile. These tests include the insulation of switches at each end of the lines, so that it is fair to assume that the insulation of the cable is considerably higher. The large part of the 9,000-volt cable is No. 0000, and this is about 2½ inches in diameter—as large as is convenient to install. The loop method is used for locating trouble, and it has been found satisfactory, the trouble being generally located to the nearest manhole.

In connection with the subject of high-tension cables, it may be of interest to compare our work in Chicago with that in other cities. Of four companies in New York city, two are using 6,600 volts and two 11,000 volts. Providence is using 12,500, Buffalo 11,000, Milwaukee 13,200 and St. Paul 25,000 volts. So far as I know, St. Paul is using a higher voltage than anyone else on underground cables. Of the companies included in the above list, nearly all are using paper-insulated cable, although some have both paper and rubber. It is, I think, quite generally conceded that paper cable is more satisfactory than rubber for higher voltages. Comparing the thickness of insulation per 1,000

volts on the paper cables used by the different companies mentioned, we find that it ranges from 67 to 22 mils between conductors and from 57 to 19 mils between conductors and ground. The average thickness per 1,000 volts is 40 mils betwen conductors and 38 mils between conductors and ground.

The three-phase, four-wire system is used for 60-cycle work, current being generated by star-connected 2,300-4,000-volt machines. The larger part of these wires run overhead, but it is occasionally necessary to put them underground. Some two and four-conductor cables have been used for this work, but single conductor has been found to be

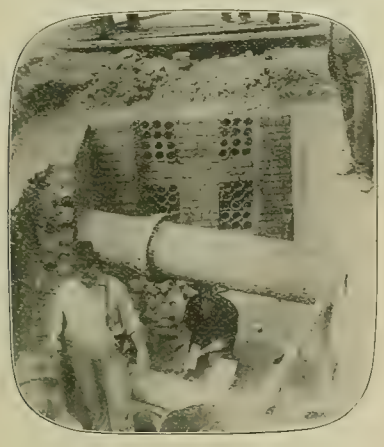


FIG. 9. UNDERGROUND WORK IN CHICAGO.—MANHOLE CONSTRUCTION.

more satisfactory. Trouble with these cables is most apt to develop at the point of connection to the overhead lines, and it is easier to make a safe job on a single than on a multi-conductor cable. Paper cable is used for this work with a wall six thirty-seconds-inch thick.

The conduit work of the Edison company is of a varied character, due to several causes. Considerable of it consists of lines laid several years ago by the Edison company or the companies which it has since absorbed. Some of the materials used were wooden pump log, iron pipe, Dorset (a multi-duct conduit made of tar and gravel compound), Lithosite (a cement pipe made on a burlap form), concrete, cement-lined iron pipe and vitrified clay of various kinds. Vitrified clay is apparently the best material for conduit work now on the market. It is fireproof, durable, a non-conductor of electricity, has a smooth interior surface that will not injure cables, and is cheap. For electric-light and power purposes a single-duct tile is better than a multi-duct one, since it allows of breaking joints, although it is more expensive to lay.

Conduit is laid at various depths, as occasion demands, but never closer than 30 inches to the

FIG. 10. UNDERGROUND WORK IN CHICAGO.—ROOF CONSTRUCTION OF MANHOLE.

surface of the ground. It is laid in cement mortar and surrounded on all sides by a layer of concrete three inches thick. It is not a good plan to concentrate too much power in one line, and for this reason lines of more than 30 ducts are seldom laid. Manholes are built at street intersections, and sometimes in the middle of a block, if it is necessary to change the line of ditch on account of obstructions in the street. Handholes or small manholes are built as needed for furnishing service. As a rule, these cut only the top row of ducts. Manholes vary in size, but will average about six by six feet. Where there is a probability of installing junction boxes, manholes are built with square corners. If the conduit line is intended for carrying a number of through cables, the corners of the manholes are cut on a diagonal. This is a safer construction than with square corners. In training cables in a hole with square corners, they are apt to be bent too short in order to make a good-looking job, and later trouble will develop at the short bends. A conduit line is always pitched slightly so that water will not stand in the ducts. Fig. 7 shows a concrete manhole used for through 9,000-volt lines. You will notice the spreading of the ducts so as to cut off the corners. Fig. 8 illustrates the building of a manhole at Washington and Market Streets and Fig. 9 shows the same manhole later. In Fig. 10 may be noted the method of building an angle-iron roof for a manhole, the view being taken at Jackson and La Salle Streets. The laying of the Francis stone conduit is illustrated in Fig. 11, and Fig. 12 shows the method used in pulling cable.

The Chicago Edison Company has not had a great deal of trouble with electrolysis. Occasionally trouble has developed where Edison tube has been laid near the rails of a trolley line. While we are not anticipating much trouble from this source on our 9,000-volt line, we realize that there is a chance for it. We expect to break the lead sheaths by insulating joints at intervals of possibly 3,000 feet, and will also ground the lead sheath on each section in two or three places. In New York city some burn-outs on high-tension cables were traced to leakage current that followed the lead sheath for over two miles.

The organization of the underground department is separated into three divisions, the high-tension, low-tension and conduit systems. A large part of the conduit work is done by contract under the supervision of the company's engineer. The other work is done entirely by the company. The number of men employed varies from one to 200. Four or five men are required to take care of the records of the lines.

The department is frequently called upon for

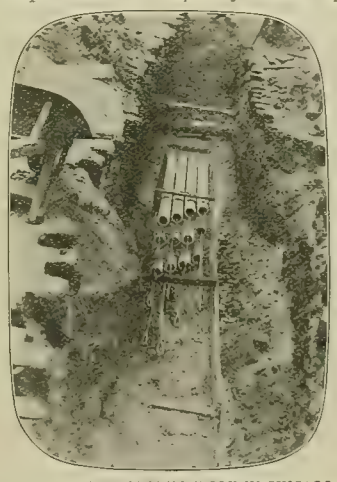


FIG. 11. UNDERGROUND WORK IN CHICAGO.—LAYING FRANCIS CONDUIT.

emergency work. One instance of this kind was at the time of the boiler explosion at the power house of the Northwestern Depot. We were asked to furnish service at about 7 p. m., and by working 40 men a good share of the night, their load was taken care of before 7 the next morning.

The subway question is one that naturally interests all companies having underground systems, and while a subway will mean a great deal of difficult and expensive work, it will be no harder than what Boston and New York have already done.

Discussion.

The discussion of the paper consisted chiefly in the asking of several questions, which were answered by Mr. Carlton. In relation to the insulating material, "Minerallac," used on the 9,000-volt cables, which has been developed by Messrs. Shildauer and Bronson of the engineering department of the Chicago Edison Company, it was stated that the compound was better in many ways than paraffin. Its burning point was 20 degrees higher than that of paraffin; it was more impervious to moisture, and not so brittle. It is a stringy substance and was used on the 9,000-volt cables in wiping joints and in sealing cable ends.

Among the other points mentioned by Mr. Carlton were the following: The capacity of the neutral throughout the whole low-tension system was 22 per cent. of the outside wires. The use of 9,000 volts came about by reason of the Edison Company's first using 2,200-volt rotary transformers. This was doubled to 4,500, and then doubled again to 9,000 volts. If such a system were started over again, the least voltage used would be 9,000 volts. The suggestion was made that, in large cities, all the companies operating there should use a standard voltage, so that they could exchange and connect their systems in case of emergency. All the switches on the high-tension system which break on load are of the automatic oil-insulated type. Not nearly so much trouble was experienced on the high-tension system as on the low-tension, in the case of short-circuits, as in the former case the line would be cut out, while a low-tension short-circuit would continue to leak and cause trouble. The loop method of testing for trouble from grounds was used on all the high-tension lines. No static discharges were employed on the 9,000-volt systems. A grounded neutral was used. Ninety per cent. of the 4,000-volt, four-wire, three-phase system was on overhead construction.

In speaking of insulation for cables, the point was brought out that a very small amount of water in the cable joints causes trouble. For this reason it was the custom of an Edison jointer, in making a wiped joint, to cut back a good distance on the cable, which was then very thoroughly heated and the compound poured in at 170 to 175 degrees Centigrade. The joint in this way was "boiled out" and allowed to cool, when another pouring was

FIG. 12. UNDERGROUND WORK IN CHICAGO.—CABLE LAYING.

made, until the joint was filled, and then the opening was sealed. It requires about two hours to make a joint.

Professor P. B. Woodworth mentioned some tests which he had made on some oils for insulating transformers. One oil was finally determined upon and recommended for use, its dielectric strength being 16, as compared with that of air. The manufacturer experienced trouble with it, and, after further experimenting, it was found that the presence of less than one-hundredth of one per cent. of water in the oil would cut down the dielectric strength remarkably and practically ruin it.

Automobile Shows.

The third annual New York automobile show, which opened at the Madison Square Garden on the evening of January 17th and continued through this week, was a great success. On the opening night an attendance of over 6,000 people showed that the exhibition had excited much popular interest. Every available space in the building, including the restaurant, basement and balconies, was utilized for exhibition purposes. The exhibition, as a whole, was very attractive, as most of the exhibits were set off by electric signs and some by festoons of lights as well.

Out of the 142 exhibitions, 77 showed complete vehicles, 68 of these being gasoline, 10 steam and eight electric. The general features of improvement noticed in the exhibition were the Edison battery, longer wheel bases to make riding easier, wooden wheels instead of wire ones, better muffling and improved ignition by magnetos or batteries, more commodious carriage bodies, wheels of equal size made to take the same size tires, improved transmission gears, more positive clutch action, a tendency to beautify the general lines of the carriage and a universal effort to make the machines as near "fool-proof" as possible.

The electric machines showed the greatest advance in the line of commercial vehicles. Trucks, delivery wagons, ambulances and other types were shown. One of the most interesting machines shown was an electric carriage which carried a gasoline engine connected to a dynamo for recharging the battery while on the road. The car is driven entirely by electric motors. It is the invention of a New York man, who has used it for the last few months, with fair success. A novelty shown was a steam delivery wagon for delivering United States mails in the Philippines. Among the electrical exhibits was one of electrical equipments and charging stations by the Westinghouse Electric and Manufacturing Company. This exhibit was in charge of W. M. Probasco and Hayden Eames.

The annual Chicago Automobile Show is to be held at the Coliseum on Wabash Avenue from February 14th to 21st, and is given under the auspices of the National Association of Automobile Manufacturers. Indications at present point to the most successful exhibition ever held in Chicago. All the space in the Coliseum has been reserved and most of that in the Annex has been taken. On February 20th, during the show, a Good Roads convention of the National Association of Automobile Manufacturers will be held at the Auditorium, and for this meeting reduced rates have been granted on the railroads. S. A. Miles, well known as manager of previous automobile exhibitions in Chicago, will manage the coming show.

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DATES AHEAD.

Kansas Independent Telephone Association, Hotel Throop, Marion, Kan., January 28th and 29th.

Independent Telephone Association of Wisconsin, Hotel Pfister, Milwaukee, Wis., February 11th and 12th.

Chicago Automobile Show, Coliseum, Chicago, February 14th to 21st.

In the set of resolutions adopted by the indignant saloon passengers who were subjected to the disgraceful delay in the recent voyage of the American liner St. Louis one paragraph is of especial interest to those who follow the development of space telegraphy. It reads as follows: "That it is a matter of keen regret that a first-class steamship, such as the St. Louis is reported to be, should not be supplied with the Marconi system, the absence of which has been seriously felt during this ever-to-be-remembered voyage." Two things are noteworthy in this resolution. One is that space telegraphy has now reached a stage where it is expected that a set of instruments should be installed on every first-class ocean-going passenger steamer. Another is the fact that the prestige of Marconi has so completely overshadowed that of all other space-telegraph inventors that a chance assembly of educated travelers refers to the new method not as the "space-telegraph" or "wireless-telegraph" system, but simply as "the Marconi system." This must be gratifying to the various Marconi companies, from a commercial point of view; but it is becoming increasingly evident that there must be some sort of an agreement in the interchange of wireless messages; the Berlin international conference has been called none too soon. Meanwhile Marconi proceeds from one triumph to another. He has now transmitted a message from the president of the United States to the king of England, the sending station being in Massachusetts and the receiving station in Cornwall, the two points being separated by an ocean expanse of about 3,000 miles. This is a splendid achievement, and whatever the future of space telegraphy may hold, Marconi has undeniably won a secure position in the estimation of mankind as one of the greatest of inventors.

A SUBSTANTIAL victory has been won by the Independent telephone interests in the decision of the United States Circuit Court of Appeals in the celebrated Berliner patent suit. This decision, handed down at Boston on January 16th, is to the effect that, while the Berliner patent is valid, the type of transmitter made by the defendants does not infringe upon it. This means that none of the telephone transmitters put out by the Independent manufacturers is to be regarded as infringing on the greatly heralded Berliner patent, long held as a potential menace to the development of telephony in opposition to the old-time monopoly. The Bell company has the empty satisfaction of seeing its patent sustained; it has won a moral victory, but one that is barren in results; for while declaring the validity of the patent, the Court of Appeals, in the same breath, construes it so that it is of no practical value to its owner.

This decision probably marks the final step in the long-drawn-out Berliner-patent litigation. The Western Electrician has taken some pains to ascertain the views of experienced patent attorneys, familiar with the telephone-patent litigation, on this subject. They all seem to agree in the opinion that the latest decision is probably the final one. It is believed that the United States Supreme Court, which has been surfeited with telephone-patent litigation, will not entertain an appeal, while there is no appeal from the decision of the Circuit Court of Appeals as a matter of right. Then, again, the decision is such that both sides, which are probably heartily sick of the protracted fight, can retire with honor. The Bell company has sustained the validity of its patent; the Independents have demonstrated their immunity from molestation under this fundamental patent. We shall be surprised if any further steps are taken in the matter.

It will be of interest to review, very briefly, the history of the Berliner case. Emile Berliner was granted Patent No. 463,569—the one in suit—on November 17, 1891, for a "Combined Telegraph and Telephone." The patent was assigned to the American Bell Telephone Company (since succeeded by the American Telephone and Telegraph Company), which asserted that Berliner had made a great invention—the microphone—and that the patent covered every form of variable-contact carbon transmitter. If these claims had been sustained, the Bell company would have secured a monopoly of all forms of telephone transmitters now in commercial use. Although the Berliner patent was granted in November, 1891, the application for it was filed in June, 1877. During this extraordinary delay of 14 years in the Patent Office the Bell company was protected by the fundamental patent issued to Alexander Graham Bell, which, however, expired in 1893. When the patent to Berliner issued in 1891 it had a life of 17 years before it, and, if sustained and interpreted to the Bell company's liking, would have prolonged the Bell telephone monopoly, virtually, until 1908. This was considered to be contrary to public policy, and the attorney-general of the United States in President Harrison's administration brought suit against the company for the purpose of annulling the Berliner patent. One court—Judge Carpenter—sustained the government's contention, but the suit was stubbornly contested, and finally the United States Supreme Court decided that no fraud was proved against the company, and the patent was allowed to stand. After the final decision of the famous "government suit," the case brought against the National Telephone Manufacturing Company of Boston for alleged infringement of the Berliner patent came on for final hearing on November 7, 1899. Eminent counsel appeared for both sides, and there was a great mass of evidence. The defense contended that the patent was invalid, and this view of the case was taken by Judge Arthur L. Brown of the United States Circuit Court at Boston, who, in his celebrated decision of February 27, 1901, declared that the patent was void from want of patentable invention and that "the defendants owe nothing to Berliner." From this sweeping decision in favor of the Independents the Bell company took an appeal to the United States Circuit Court of Appeals, with the final result noted above.

The ultimate outcome of this case—which in many respects surpasses in importance any prior patent suit—while something in the nature of a compromise, is, on the whole, satisfactory. The Bell company gets a technical victory; the Independents have demonstrated that the Berliner patent is of no practical value; the great telephone-using public connected to Independent exchanges will not be disturbed. As shown by the interviews published elsewhere, the Independents are well pleased; the Bell men, who do not care to talk for publication, no doubt are glad that Judge Brown's sweeping decision is considerably modified. All connected with the industry will be thankful that a protracted and harassing legal battle is over, while all who favor fair play in the telephone field will be relieved to find that the club so long held over the opposition turns out to be stuffed with straw.

SOME interesting comments on the hydro-electric power development along the Niagara frontier, particularly on the Canadian side, are made by Mr. H. W. Brush, United States consul at Niagara Falls, Ont., in a report to the Department of State at Washington. The consul says that it is expected that by next August the Canadian Niagara Power Company will have 50,000 horsepower available. But the demand is so great that the company will at once extend its wheel-pit to develop 110,000 horsepower instead of the 50,000 first contemplated. In addition, a second company—the Ontario Power Company—has secured rights from the Canadian government. The development of its plant commenced last April, and 50,000 horsepower will be the initial product, but this will be increased to 150,000 horsepower. Instead of being carried in an underground tunnel, the water is directed into flumes, carried to the brink of the Niagara Gorge, and then dropped into the river through penstocks, which develop the power. These two companies are backed almost exclusively by United States capital. A third company, which says that it is wholly Canadian, has applied to the government for the privilege of developing 100,000 horsepower near the two plants now under construction. The Canadian government exacts in all cases that 50 per cent. of the power developed must be provided to Canadian consumers, if called for; the balance may be exported to the United States. When the 350,000 horsepower now in process of development is placed on the market, the gross income of the power companies will be in the neighborhood of $7,000,000 a year. This is figuring the price at $20 a horsepower a year, which is somewhat lower than the present average rate. The industrial growth of the Niagara frontier in the last few years has been marvelous. It is prophesied that within 10 years 1,000,000 horsepower will be in course of development. Up to the present time, the effect on the volume of water passing over the falls is not noticeable, even with the most careful measurements, according to Mr. Brush's report. The consul's excellent summary shows that Niagara will continue to hold its position as the greatest power-producing waterfall for many years to come—perhaps indefinitely.

BERLINER PATENT HELD TO BE VALID BUT NOT INFRINGED.

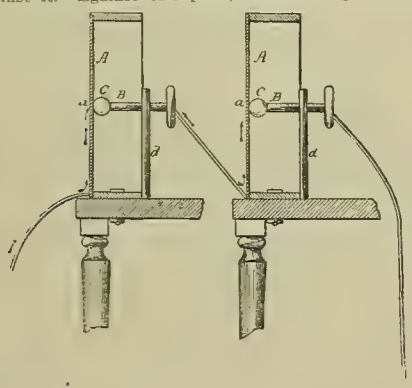
The eagerly awaited decision of the United States Circuit Court of Appeals for the First Circuit in the Berliner case (American Bell Telephone Company, complainant and appellant, against National Telephone Manufacturing Company et al., defendants, appellees) was handed down in Boston on January 16, 1903. The court consists of Judges Colt, Putnam and Aldrich, and Judge Colt wrote the opinion of the court. The opinion in full is given below. In brief, it is to the effect that Edison and Hughes solved the problem of the variable-contact transmitter, and that the discoveries of these inventors are embodied in the defendants' transmitters (which is equivalent to saying the transmitters of all Independent telephone companies, although, of course, only the defendants' instruments were within the purview of the court). Nevertheless, the two claims of the Berliner patent are sustained when limited to metallic electrodes. But, when so limited, the defendants' transmitters do not infringe, and therefore the decree of the lower court, in favor of the defendants, is affirmed. This decision is, in effect, a great victory for the Independents. Editorial comment, with a review of the case, is given on the preceding page.

This is an appeal from a decree of the Circuit Court dismissing a bill brought for infringement of Letters Patent No. 463,569, issued November 17, 1891, to the American Bell Telephone Company, as assignee of Emile Berliner. A caveat describing the invention was filed April 14, 1877, and the application for the patent June 1, 1877. The patent is for a battery telephone transmitter of the variable resistance type.

A battery transmitter is one in which a battery or strong current is utilized for the transmission of speech, as distinguished from a magneto transmitter, in which only a feeble current is generated by induction. It requires a battery current to transmit speech long distances. The variable-resistance type of transmitter utilizes a battery current for the transmission of speech by varying the electrical resistance in the circuit. Variable resistance means simply variable obstruction to the passage of the current. Variable resistance changes the strength or intensity of the current, and if these changes correspond to the changes in the density of the air caused by sound-waves, we have a current whose electrical undulations or vibrations are similar in form to sonorous vibrations or sound-waves, and which will transmit speech. In a telephone transmitter variable resistance refers to the changes in resistance which take place at the contact between the two conductors or electrodes, produced by the vibrations of the diaphragm caused by the sound-waves.

The Berliner transmitter, covered by his patent in suit, utilizes a battery current for the transmission of speech by varying the electrical resistance in the circuit. The drawing from the patent shows the Berliner telephone, in which Fig. 1 is the transmitter in controversy, and Fig. 2 the receiver.

In this drawing, as appears from the specification (A) is a metal plate which vibrates when sound is uttered against it. Against this plate, and touching it, is the



FIGS. 1 AND 2. BERLINER TELEPHONE IN SUIT.

metallic ball (C) at the end of the screw-threaded rod (B), which is supported by the bar (d). The pressure of the ball (C) against the plate (A) can be regulated by turning the rod (B). The ball and plate are included in circuit with an electric battery, so that they form electrodes, the current passing from one of them to the other. By making the plate vibrate, the pressure at the point of contact becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly. By placing another instrument capable of acting as a telephonic receiver, as shown in Fig. 2, in the same electric circuit, sound uttered against the plate of Fig. 1 will be reproduced by the plate of Fig. 2, for as the vibrations of the transmitter diaphragm caused by the sound will alternately weaken and strengthen the current as many times as vibrations occur, the diaphragm of the receiver will be caused by these electrical vibrations to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter (Fig. 1) will be reproduced at the receiver (Fig. 2). It is not essential that the plate should be of metal. It may be of any material able to vibrate, if only at the point of contact suitable arrangement is made so that the current passes through that point. It may be of any shape or size, or other suitable vibratory medium may be used, for example, a wire. Any other metallic point, surface or wire may be substituted for the ball.

From this description in the patent we find that the Berliner transmitter consists of a battery circuit with two electrodes in constant contact. One electrode is composed of a diaphragm or plate of metal or other vibratory material, and the other electrode of a metallic ball or point. Sound uttered against the diaphragm causes it to vibrate. These vibrations vary the pressure between the electrodes at the point of contact so as to strengthen and weaken the contact, and thereby vary the electrical resistance of the circuit.

The following claims are in issue:

"1. The method of producing in a circuit electrical undulations similar in form to sound-waves by causing the sound-waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

"2. An electric speaking-telephone transmitter operated by sound-waves and consisting of a plate sensitive to said sound-waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate."

These claims must be read in connection with the disclaimer of the patent, which declares that the patentee does not claim to be "the first inventor of the art of transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the sound-waves accompanying said sounds," nor to be "the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing."

In view of this disclaimer, the first claim covers only the particular method described for varying the resistance in the circuit to produce electrical undulations similar in form to sound-waves; and the second claim covers only the instrument or transmitter which embodies this method.

The complainant mainly relies on the first, or method claim. It is contended that the invention covered by this claim was first disclosed by Berliner in his caveat of April 14, 1877. This invention was the method of varying resistance in the circuit by varying the pressure at the point of contact between solid electrodes in constant contact. This way of varying the resistance, it is said, is the same as that disclosed by Professor Hughes a year later, on May 9, 1878, in a paper read before the Royal Society of London. Hughes called his instrument the microphone. The complainant rests its case upon the identity of the Berliner and the Hughes methods of varying the resistance, and upon the priority of invention by Berliner. In the language of complainant's brief, "It cannot be seriously denied, and none of the witnesses deny, that the Hughes article and the caveat describe the same invention." "The complainant stakes its case upon the proposition, firmly established by the testimony, that Emile Berliner was the original and first inventor of the microphone." This position of the complainant is necessary in order to make out infringement. The defendant's transmitters use carbon electrodes; and, unless Berliner first discovered and disclosed the microphonic method of varying resistance, his patent must be limited to the metallic electrodes described in the specification, and the defendants do not infringe. The issue here raised can be more intelligently considered if we briefly review the state of the art at the time Berliner made his invention.

The speech-transmitting telephone presents the problem of the reproduction, by means of an electric current, of a succession of vibrations on the receiving diaphragm which shall exactly correspond to the vibrations of the transmitting diaphragm caused by the air vibrations, or sound-waves, produced by the voice in speaking. The problem was rendered more difficult for the reason that the air vibrations caused by the vocal organs in articulate speech are very complex in form.

On March 7, 1876, a little more than a year before the Berliner caveat appeared, Bell's basic patent was issued, diclosing his art of transmitting speech by creating changes of intensity in a continuous current of electricity exactly corresponding to changes of density in the air caused by the vibrations which accompany vocal sounds. This is known as Bell's undulatory current, which simply means an electric current whose undulations are similar in form to sound-waves.

The prior current in the Reis telephone would only reproduce musical tones. It would not reproduce the finer and more complex sonorous vibrations upon which depends the quality of sound which characterizes the human voice. This was because the current was intermittent. Bell discovered that the current must be continuous in order to impress upon it changes which correspond to the form of sound-waves.

The Bell patent also disclosed several ways of utilizing his undulatory current. One way is known as the magneto method, in which the current is induced or generated from the magnetic field surrounding an electromagnet by the movements of the diaphragm caused by sound-waves. These movements, by altering the condition of the magnetic field, produce a current which corresponds in form to the sound-waves. An undulatory current of this kind, generated by the transmitter itself by means of the slight movements of the diaphragm, is necessarily feeble, and can only transmit speech short distances. Nevertheless, this instrument was the first practical speech transmitter, and the only commercial transmitter in use until it was supplanted by the carbon variable-resistance transmitter. The instrument is illustrated in the accompanying figure (Fig. 3) taken from the Bell patent.

In this drawing a soft-iron armature (c) is caused to vibrate in front of the pole of an electro-magnet (b) by means of a membrane diaphragm (a), moved by the sound-waves, to which diaphragm the armature is attached. This induces or generates an undulatory current in the coil of the electro-magnet, which current passes through another electro-magnet (f) in the same circuit, and causes its armature (h) to perform like movements to those of the armature of the transmitter, whereupon the diaphragm (i) attached to the second armature, reproduces the same sounds as are uttered into the transmitter.

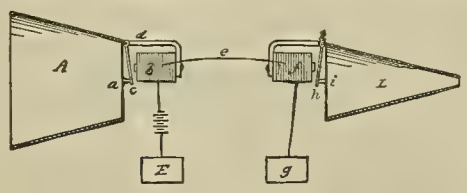


FIG. 3. ORIGINAL BELL INSTRUMENT.

Bell subsequently took out a patent for an improved form of this transmitter, in which the diaphragm itself was of metal, instead of being a membrane with an armature attached to it.

Another way of utilizing Bell's undulatory current, disclosed in his 1876 patent, was by varying the resistance in a battery circuit. This is made the subject of Claim 4, which is for "the method of producing undulations in a continuous voltaic current by gradually increasing and diminishing the resistance of the circuit." The specification refers to this method and apparatus as follows:

"The external resistance may also be varied. For instance, let mercury or some other liquid form part of a voltaic circuit, then the more deeply the conducting-wire is immersed in the mercury or other liquid, the less resistance does the liquid offer to the passage of the current. Hence, the vibration of the conducting-wire in mercury or other liquid included in the circuit occasions undulations in the current."

The art, as it was left by Bell's primary patent, may be thus summarized: There existed the undulatory current, the only known current which will transmit speech. There existed one form of its application, known as the magneto transmitter or magneto telephone, which went into extensive use for several years, but which would transmit speech only a short distance, owing to the feebleness of the current. There existed also another way of utilizing the undulatory current by varying the resistance in a battery circuit at the contact between electrodes in constant contact, those electrodes being a solid and a liquid. The instrument embodying this method is known as the mercury transmitter.

After these disclosures in the Bell patent, the problem which remained was the invention of a practical transmitter which would utilize the undulatory current by varying the resistance in a battery circuit, and so transmit speech long distances. Bell had supplied the current, and had shown that it could be utilized by varying the resistance in a battery circuit; and what remained was to devise a better way of varying the resistance than was pointed out by Bell. This problem was solved by two discoveries which are now embodied in every commercial transmitter. The first was the discovery of the peculiar properties of carbon in varying electrical resistance, and the second was the discovery of the remarkable effects of sound-waves in varying resistance at a loose contact between solid electrodes. Edison made the first discovery, and the fundamental question for our determination in the case at bar is whether Berliner or Hughes first made the second discovery. The instrument which utilizes both these discoveries is called a microphone transmitter. Every microphone transmitter, as commonly understood in the telephonic art, is an instrument having carbon electrodes in loose or feeble contact. But a transmitter may still be a microphone without having carbon electrodes, provided the electrodes are of solid material, and so capable of embodying microphonic action. It is not pretended that Berliner discovered the carbon electrode, but it is maintained that he was the first to discover microphonic action, and to embody that principle in an operative speech-transmitter. If this be true, the complainant may well insist that the claims of the Berliner patent are not limited to metallic electrodes, but cover the microphonic process or art for the reproduction of sound by varying the electrical resistance in a circuit at a loose contact between solid electrodes in constant contact.

Before the consideration of the microphonic method, and Berliner's priority of invention over Hughes, it may help to throw some light on the subject if, at this stage of our inquiry, we briefly trace the development of the variable-resistance transmitter.

After Bell's great contribution to the telephonic art in 1876, the thoughts and efforts of inventors were largely turned in the direction of material and structure, rather than to the discovery of new methods. The only two transmitters then known which used a battery current were the Reis transmitter and the Bell mercury transmitter; and inventors naturally looked for the solution of the variable-resistance transmitter problem along the lines of these instruments. A brief reference to these instruments and those which followed, until we reach

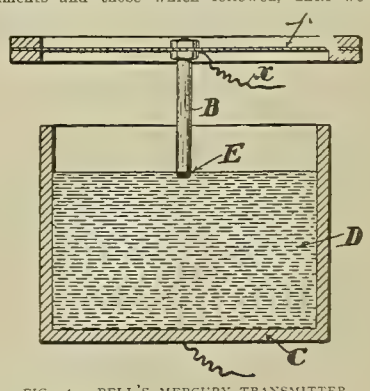


FIG. 4. BELL'S MERCURY TRANSMITTER.

the commercial carbon transmitter, will prove instructive.

The Reis transmitter employed a battery current. There was a diaphragm set in motion by sound-waves, and there were two metallic electrodes in loose inconstant contact in the circuit. This instrument would transmit musical sounds, but not articulate speech, because at every full vibration of the diaphragm the electrodes separated, thereby interrupting the current. In structure this instrument is substantially like the Berliner transmitter. Reis failed because he had not discovered that a continuous current, which requires a constant contact between the electrodes, was essential to transmit speech. In spite of this failure, it has been truly said that the telephonic art owes much to Reis.

The next battery instrument was Bell's mercury transmitter, described in his 1876 patent, in connection with his undulatory current. This instrument was operative, but not practical. A sketch, in an exaggerated form, is here given (Fig. 4).

In this drawing (A) is the diaphragm, (B) the wire attached thereto, (D) the mercury or other liquid, and (X) and (Y) the circuit connections. As the diaphragm vibrates, the point (E) moves down and up in the mercury, thereby causing electrical undulations similar in form to sound-waves. Here we have a diaphragm set in motion by sound-waves, and a metallic electrode and a liquid electrode in constant contact. As the vibrations of the diaphragm cause the metal point to be immersed in the liquid, the less resistance there is to the passage of the current. The way or method of varying the resistance in this transmitter is by varying the area of contact between the two electrodes.

In February, 1877, 11 months after Bell's patent disclosed his mercury transmitter, Edison invented what is known as the plumbago-film transmitter. This instrument utilized Bell's undulatory current in a battery circuit by varying the resistance between solid electrodes in constant contact. It was an operative instrument, but not practical. A sketch of the instrument is here reproduced (Fig. 5).

This drawing represents a disk of hard rubber coated with plumbago, which presses against the tinfoil sheet on the diaphragm. One of the line wires is connected to the disk at its upper edge, and the other to the tinfoil sheet on the diaphragm. This sketch was the original from which was made the application for patent No. 474,230. In this instrument we have a diaphragm set in motion by sound-waves, and two solid electrodes in constant contact. The vibrations of the diaphragm due to the sound-waves caused it to come into greater or less contact with the disk, and so varied the resistance in the circuit. The thin film of plumbago on the disk being a poorer conductor than the metal diaphragm, the movements of the diaphragm cut in and out the resistance

of the circuit. The way or method of varying the resistance in this transmitter would seem to be by varying the extent or area of contact surface between the electrodes caused by the vibrations of the diaphragm, although the patent also speaks of the vibrations as causing an increase and decrease of electric energy according "to the intimacy of contact between the vibrating diaphragm and the surface of the adjacent disk."

We come next to Edison's plumbago cylinder transmitter, which bears the date of April 1, 1877, and which is described in his final form in patent No. 474,231. This instrument also utilized Bell's undulatory current in a

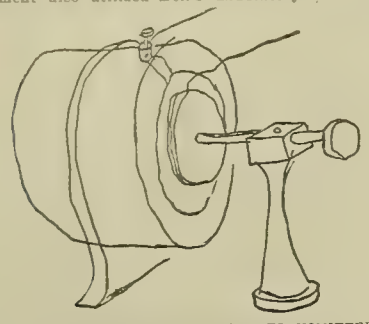


FIG. 5. EDISON PLUMBAGO FILM TRANSMITTER.

battery circuit by varying the resistance between solid electrodes in constant contact. It was an operative speech-transmitter, but not practical. A sketch of this instrument is here given (Fig. 6).

This apparatus comprised a diaphragm in contact with a series of plumbago cylinders mounted on stiff springs which held them in a state of contact. The diaphragm was in constant contact with the plumbago at one end of the series, and by its vibrations varied the resistance in the circuit. In this instrument we have a diaphragm set in motion by sound-waves, and solid electrodes in constant contact. The vibrations of the diaphragm compressed the mass of plumbago, which caused variations of resistance in the circuit. The way or method of varying the resistance in this transmitter is by varying the compression of the mass of plumbago caused by the vibrations of the diaphragm. There would seem to be little doubt that microphonic action would be present in this transmitter, provided the adjustment between the diaphragm and the plumbago cylinders were such as to make a loose initial contact between them.

Next in the order of time is the Berliner transmitter in suit, described in his caveat of April 14, 1877. This instrument, as we have seen, also utilizes Bell's undulatory current in a battery circuit by varying the resistance between solid electrodes in constant contact. It was an operative speech transmitter. It never went into

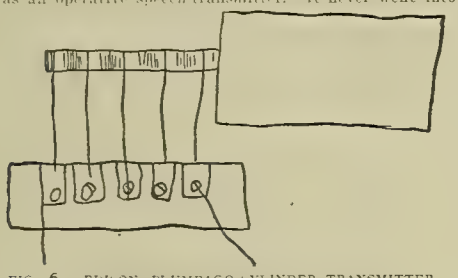


FIG. 6. EDISON PLUMBAGO CYLINDER TRANSMITTER.

use, however, as it was not a practical instrument. For the sake of clearness, the drawing of the transmitter (Fig. 1) is again referred to.

In this instrument we have a diaphragm set in motion by sound-waves, and two metallic electrodes in constant contact. The vibrations of the diaphragm vary the pressure at the point of contact, and thereby vary the resistance in the circuit. The way or method of varying the resistance in this transmitter is by varying the pressure at the point of contact, and so varying the intimacy of contact between the electrodes. When the electrodes in this instrument are so adjusted as to be in loose contact we have present microphonic action, and the instrument becomes a microphone transmitter. It may here be observed, however, that our inqurly is not whether the Berliner instrument became a microphone when properly adjusted, but whether Berliner first discovered the microphonic way of varying resistance, and made it known to the world in his caveat.

This brings us to Edison's carbon transmitter, which was invented in the fall of 1877, and is found in patent No. 203,016, dated April 30, 1878. The instrument utilizes Bell's undulatory current in a battery circuit by varying the resistance between two solid electrodes, one of which is carbon. The accompanying figure (Fig. 7) shows the commercial instrument.

In this figure (D) is the metal diaphragm resting by

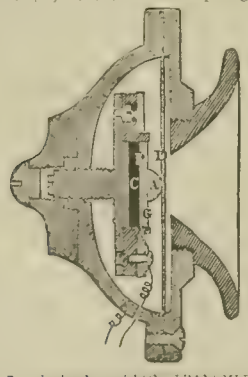


FIG. 7. EDISON CARBON TRANSMITTER.

means of the small brass tube (A) upon a disk of hard rubber (C), beneath which is a thin plate of platinum foil (F), connected with the battery. Beneath this platinum foil is a button of carbon (G), made of highly compressed lampblack, and beneath this is another thin plate of platinum foil, which is connected to the line through the frame of the instrument. The carbon button, with its enclosing plates, was so mounted as to be capable of adjustment by means of a screw. In this instrument we have a diaphragm set in motion by sound-waves, and two solid electrodes in constant contact, one of the electrodes being composed of carbon. "The vibrations of the diaphragm," in the words of the patent, "subject the carbon to different pressures, according to the amplitude of motion resulting from the sound-waves, and this difference of pressure varies the resistance offered by the carbon to the passage of the current, and produces a rise and fall of electric tension." The way or method of varying the resistance in this transmitter is by varying the pressure at the contact and so varying the intimacy of contact between two solid electrodes. In this instrument Edison disclosed to the world his discovery of the special proporties of carbon in varying resistance in a telephone transmitter. When the electrodes in this instrument are adjusted in feeble contact it becomes a microphone.

The Edison carbon transmitter was the first practical long-distance speech-transmitter which utilized Bell's undulatory current in a battery circuit by varying the resistance in the circuit. The commercial art passes at once from Bell's magneto transmitter to Edison's carbon transmitter. In December, 1879, there were 34,000 magneto transmitters in use, and 18,000 variable-resistance carbon transmitters. Subsequently, the use of the magneto transmitters declined, and they were supplanted by the carbon transmitter. All variable-resistance transmitters commercially used have carbon electrodes in loose contact. The alleged infringing transmitters in the case at bar are mere improvements in the structure, form or adjustment of the Edison carbon transmitter, invented by him in the fall of 1877.

We now pass to the crucial point upon which the complainant rests its case. The complainant's position on this point may be stated as follows:

Berliner first discovered the microphonic method of varying resistance, and first disclosed this method, and an operative instrument embodying it, in his caveat of April 14, 1877. In other words, Berliner first invented the microphone. Bell's mercury transmitter and Edison's plumbago film and plumbago cylinder transmitters are not anticipations, because they do not operate by the microphonic method. They are not microphones. On the other hand, Edison's carbon transmitter and the two carbon transmitters made or used by the defendants infringe the Berliner patent, because they employ the microphonic method, and are microphones. The microphonic method is not limited to the use of the carbon electrode, but only to the use of solid electrodes, or hard and unyielding electrodes, and therefore the carbon electrode, when there is microphonic action, is within the microphonic method, and infringes the Berliner patent. The microphonic method was disclosed to the scientific world by Professor Hughes in May, 1878, and was regarded as a wonderful discovery. Hughes called his instrument a microphone, from analogy to the microscope, since he believed it would magnify small sounds. The microphonic method of varying resistance, disclosed by Hughes in 1878, was the same as the microphonic method of varying resistance disclosed by the Berliner caveat in 1877. To be sure, the Hughes instrument, which he was the first to term a microphone, was constructed of carbon electrodes, but this is immaterial, because he states that the best material for the electrodes has not yet been discovered, and because his discovery resides in the method of varying the resistance, and not in the materials composing the electrodes. The disclosure by Berliner of the Hughes method of varying resistance is found by the complainant in the following passages from Berliner's patent, which also appear in substantially like form in his caveat:

"It is a fact that if at a point of contact between two conductors forming part of an electric circuit and carrying an electric current the pressure between both sides of the contact becomes weakened the current passing becomes less intense—as, for instance, if an operator on a Morse instrument does not press down the key with a certain firmness the sounder at the receiving instrument works much weaker than if the full pressure of the hand had been used. Based on this fact I have constructed a simple apparatus for transmitting sound along a line of an electric current in the following manner:

"In Figures 1 and 2 of the drawings (A) is a metal plate well fastened to the wooden box or frame, but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the plate and touching it is the metal ball (C), terminating the screw-threaded rod (B), which is supported by the bar or stand (d).

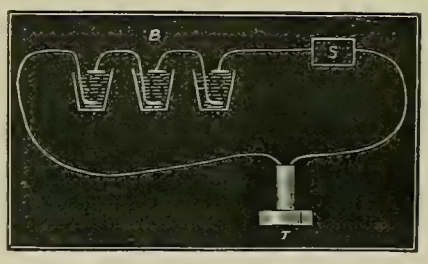


FIG. 8. HUGHES' SOUND DETECTOR.

The pressure of the ball (C) against the plate (A) can be regulated by turning the rod (B). * * * By making the plate vibrate the pressure at the point of contact (a) becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly, as already described."

The Berliner invention above described consists in the method of varying the resistance by variation of pressure at the point or points of contact between solid electrodes in constant contact.

To determine whether this invention is the same as the Hughes method of varying resistance, it is necessary to have a clear understanding of the nature of the discovery which he revealed to the world on May 9, 1878.

Such portions of the Hughes article as seem material may be summarized as follows:

The introduction of the telephone led Professor Hughes to investigate the effect of sonorous vibrations upon the electrical behavior of matter. Sir William Thomson and others had shown that resistance to the passage of currents afforded by wires is affected by their being placed under strain, and inasmuch as the conveyance of sonorous vibrations induced rapid variations in the strain at different points of a wire, Professor Hughes believed that the wire would vary in its resistance when it was used to convey sound. To investigate this he made a rough telephone receiver or "sound detector," which he connected in line with a battery current in a closed circuit. The apparatus or materials experimented upon were used in the same way as the transmitter of the speaking telephone of Bell. The following is a sketch of his apparatus (Fig. 8).

In this drawing (B) is the battery, (S) the source of sound or material examined, and (T) the telephone. He then proceeds:

"I introduced into the circuit at (S) a strained conductor—a stretched wire—listening attentively with the telephone to detect any change that might occur when the wire was spoken to, or set into transverse vibrations by being plucked aside. Gradually, till the wire broke, the strain was varied, but no effect whatever was remarked except at the moment when the wire broke. The effect was but momentary, but invariably, at the moment of breaking, a peculiar 'rush' or sound was heard. I then sought to imitate the condition of the wire at the moment of rupture, by replacing the broken ends, and pressing them together with a constant and varying force by the application of weights. It was found that if the broken ends rested upon one another with a slight pressure, of not more than one ounce to the square inch on the joints, sounds were distinctly reproduced, although the effects were very imperfect."

Professor Hughes had now discovered microphonic action, or the mode of operation of the instrument which he calls the microphone, and all that follows in his paper is only the further development of this principle. He sought to investigate the effect of sonorous vibrations or sound-waves upon the electrical behavior of matter, and he began his investigation with the belief that such vibrations would vary the electrical resistance of wire under strain. He found no marked effect until the moment when the wire broke or parted contact, when he detected a peculiar "rush" or sound. He then imitated the condition of the wire at the moment of rupture by replacing the broken ends in the apparatus, and pressing them together with a constant and varying force by the application of weights. He discovered that, if the broken ends rested together with a slight pressure of not more than one ounce to the square inch on the joints, sounds were distinctly reproduced. Thus Professor Hughes, by a process of deduction and experiment, and advancing step by step, made his great discovery of the effects of sonorous vibrations in varying electrical resistance at a feeble or loose contact between two electrodes. When Professor Hughes placed the two ends of the ruptured wire in contact, he had not discovered microphonic action. When the ends were pressed together with considerable pressure, he had not discovered microphonic action. When the ends were in a very loose contact he had not discovered microphonic action. But when, after repeated experiments with different degrees of pressure, the broken ends rested upon one another with a slight or feeble contact, his hopes were realized. Hughes did not, like Bell, discover a new current, but he did make known the close affinity between sound-waves and an electric current at what electricians were accustomed to term a "bad joint" in an electric circuit. He discovered the sensitiveness, the adaptability, of the current at a loose or light contact to vary its resistance in conformity with the vibrations of the air produced by sound-waves. He discovered a new way of varying resistance which has proved of great utility in the telephonic art. Unless anticipated by Berliner, he was the first to disclose this new way, although previously it may have been present in telephone transmitters without the knowledge of the inventors. Professor Hughes' discovery lay in loose initial contact between the electrodes. This is the essence of the microphone. With loose initial contact there is microphonic action; without loose initial contact there is no efficient microphonic action. When the contact between the electrodes is greater or less than a feeble contact, such action is either greatly impaired, or ceases altogether. Microphonic action, or the microphonic method, or the microphonic process or art, discovered by Professor Hughes, is simply the effects of sonorous vibrations in varying resistance at a feeble or loose contact between solid electrodes in constant contact, whereby sound is reproduced at the receiver. Microphonic action is dependent upon three simple conditions, atmospheric vibrations produced by sound-waves, two solid electrodes in feeble contact in a line circuit, and a sound-receiving instrument in the circuit. What produces these effects is unknown. Professor Hughes believed the effects were "due to a difference of pressure at the different points of contact," and that they were "dependent for the perfection of action upon the number of these points of contact." Professor Bell doubted this, and attributed the effects to "a variation in the amount of contact" supplemented by the heat produced at the point of contact. But what causes these effects is immaterial. What we know is that the phenomenon exists, and was disclosed by Professor Hughes in this article.

It may here be observed that the discovery of Profesor Hughes relates to the direct effect of the sonorous vibrations upon a loose contact, and that it is not essential to use a diaphragm. The introduction of a diaphragm merely signifies that the sonorous vibrations produce corresponding vibrations in the diaphragm which affect the resistance at the loose contact exactly the same as the direct impact of the sound-waves.

We will now resume the consideration of the article from the point where Professor Hughes discovered microphonic action.

He found it was not necessary to join two wires endwise together to reproduce sound, but that any portion of an electric conductor would do so even when fastened to a board or to a table, and no matter how complicated the structure upon this board, or the materials used as a conductor, "provided one or more portions of the electrical conductor were separated, and only brought into contact by a slight but constant pressure." If the ends of the wire, terminating in two common French nails laid side by side and separated from each other by a slight space, were electrically connected by laying a similar nail between them, sound could be reproduced. "Up to this point," he continues, "the sound or grosser vibrations were alone produced; the finer inflections were missing, or in other words the timbre of the voice was wanting; but in the following experiments the timbre became more and more perfect, until it reached a perfection leaving nothing to be desired. I found that a metallic powder, such as the white powder—a mixture of zinc and tin—sold in commerce as 'white bronze,' and fine metallic filings, introduced at the point of contact, greatly added to the perfection of the result. At this point, articulate speech became clearly and distinctly reproduced, together with its timbre; and I found that all that now remained was to discover the best material and form, to give to this arrangement its maximum effect." The paper then proceeds with a description of his experiments with the best material and form to give the maximum effect. He found carbon an excellent material, but he obtained the best results from mercury in a finely divided state. He refers to the fact that, in his experiments the diaphragms of Reis, Edison, and Bell have been "altogether discarded," and that "the variations in the strengths of the currents flowing are produced simply and solely by the direct effect of the sonorous vibrations."

After describing the instrument which he calls a microphone, he says: "The best form and material for this instrument, however, have not yet been fully experimented on. Still, in its present shape, it is capable of detecting very faint sounds made in its presence. If a pin, for instance, be laid upon or taken off a table, a distinct sound is emitted, or if a fly be confined under a table-glass, we can hear the fly walking, with a peculiar tramp of its own. The beating of a pulse, the tick of a watch, the tramp of a fly, can thus be heard at least a hundred miles distant from the source of sound."

He further says: "It is quite evident that these effects are due to a difference of pressure at the different points of contact, and that they are dependent for the perfection of action upon the number of these points of contact. Moreover, they are not dependent upon any apparent difference in the bodies in contact, but the same body, in a state of minute subdivision, is equally effective."

The instrument he devised is described as follows:

"The microphone, in its present form, consists simply of a lozenge-shaped piece of gas carbon, one inch long,

quarter inch wide at its center, and one-eighth of an inch in thickness. The lower pointed end rests as a pivot upon a small block of similar carbon; the upper end, being made round, plays free in a hole in a small carbon block, similar to that at the lower end. The lozenge stands vertically upon its lower support. The whole of the gas carbon is tempered in mercury, in the way previously described, though this is not absolutely necessary. The form of the lozenge-shaped carbon is not of importance, provided the weight of this upright contact piece is only just sufficient to make a feeble contact by its own weight. Carbon is used in preference to any other material, as its surface does not oxidize. A platinum surface in a finely divided state is equal, if not superior, to the mercurized carbon, but more difficult and costly to construct. I have also made very sensitive ones entirely of iron."

A Hughes microphone is shown in the sketch (Fig. 9).

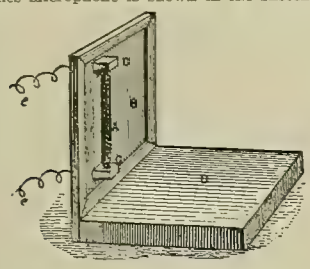


FIG. 9. HUGHES MICROPHONE.

In this figure (B) and (D) are two pieces of wood fastened together, with their planes at right angles to each other. Attached to (B) are two small blocks of carbon (C) (C). Between these a light rod (A) of carbon is supported on small cups in (C) (C). If this microphone is joined in circuit with a telephone and a small battery, the vibrations produced by a fly walking on the base (D) can be distinctly heard in the telephone.

Another sketch of a Hughes microphone is also reproduced (Fig. 10).

In this drawing, the pointed piece of carbon (C) sets loosely in the notches of two pieces of carbon (A) (B). If we place our ear at the telephone (T) we shall hear distinctly not only the ticking of the watch but the friction of the wheels.

Professor Hughes' article was regarded by the scientific world as disclosing a remarkable discovery. The Journal of the Franklin Institute of June 19, 1878, said: "Professor Hughes * * * discovered that when two or more electrical conductors rested lightly upon each other the variation in the force of contact, caused by exceedingly feeble, sonorous vibrations, would so vary the electrical resistance as to take up and transmit these vibrations to the distant telephone with great force and distinctness."

The Russian Messenger, in describing Hughes' discovery, said: "It occurred to Hughes to investigate whether the transmission of sound-waves by a wire had any influence on its ability to conduct a galvanic current. If so, then the change of strength of current ought to act on the telephone, and the latter ought to transmit to us the sound. For a long time Hughes' experiments with a tightly drawn wire were without success, but fortunately, because of its great tension, the wire broke. Not wishing to stop his experiment Hughes temporarily tied the ruptured ends, and to his astonishment he noticed

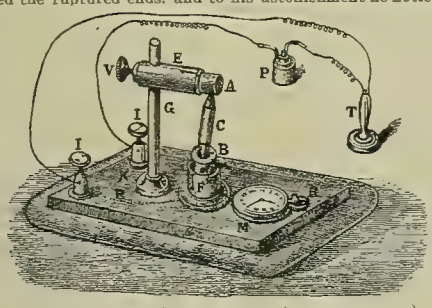


FIG. 10. HUGHES' MICROPHONE (ANOTHER FORM).

that after the rupture of the wire, the telephone began to transmit sounds much better. Minutely investigating this phenomenon he soon convinced himself that the transmission of sounds by telephone is best accomplished when the ends of the wire touch each other lightly, or better still when they are at certain distance from each other, and between them, in light contact with them, there is another body of good electric conductibility, for example, an iron or brass plate, or a piece of carbon. The slightest sound or noise produced near that piece of carbon naturally causes the latter to vibrate. In consequence of these vibrations there is a greater or lesser contact of the conductors of the current, and therefore the latter meets in the circuit a varying resistance, and consequently its strength also varies."

It will be impossible, in our opinion, to find in the Berliner caveat or patent any conception of Hughes' discovery. It would seemingly appear that Berliner had not advanced so far in his conception of microphonic action as Hughes at the moment he heard a "rush" or sound when the ends of the wire parted contact. It will certainly be made plain that Berliner's conception extended no further than the time when Hughes placed the broken ends of the wire in contact, and began his experiments on the effect of sonorous vibrations at different degrees of constant pressure, which finally led to his discovery of microphonic action.

Always keeping in mind that microphonic action involves the conception of sonorous vibrations and loose contact between electrodes, let us turn to Berliner's conception and invention.

Berliner, as appears from his testimony, having already become familiar with Bell's 1876 patent, commenced in January, 1877, "making experiments" in "the speaking telephone." "Some time," he says, "during that month one of the operators in the fire-alarm office in Washington, in showing me about the use of the Morse key, explained the importance of pressing the key down firmly upon its rest or base in order to insure the operation of the sounder promptly. He explained that if the key was not firmly pressed down the sounder might fail to respond promptly, and that was a reason why female operators were often objected to because they did not have sufficient strength to give a good contact between the key and its rest. It immediately occurred to me that if a variation of contact pressure between the circuit-closing key and its rest could produce a variation in the current then a varying pressure between the points of contact could be obtained by the vibration of one or both of them imparted to them by sounds or sound-waves in the air in their neighborhood."

Manifestly, the conception here given is not Hughes' conception, because the essence of microphonic action, which resides in loose contact, is entirely wanting. When the operator told Berliner that the more firmly the fire-alarm key was pressed down the more promptly the sounder operated, he was merely stating a scientific fact, then well known, that the closer the contact ends of a wire in an electric circuit are pressed together, the less the resistance and consequently the greater the strength of the current. Acting upon this information, Berliner says it occurred to him that if a variation of contact pressure between the circuit-closing key and its rest could produce a variation in the current, then a varying pressure between the points of contact could be obtained by the vibration of one or both of these electrodes, imparted by sound-waves in their neighborhood. Berliner's conception of a telephone transmitter was this: Starting with the electrodes in contact, he conceived that a varying pressure between the points of contact, and a consequent varying of the strength of the current, could be obtained by the vibration of one or both of the electrodes caused by sound waves. This conception does not reach to the character of the initial contact, and therefore does not even approach microphonic action.

Suppose Professor Hughes had stopped his experiments when he had placed the ends of the severed wire in contact, he would not have discovered microphonic action. Or suppose, after the wire broke, he had said: "I then placed the two ends of the wire in contact, and found that the sonorous vibrations would vary the pressure at the points of contact, and so vary the strength of the current, whereby sound was reproduced," he would have made no discovery of microphonic action. If, however, Hughes had embodied this conception in a telephone transmitter, he would have made an invention, in that he had discovered that the minute atmospheric vibrations due to sound-waves would sometimes so vary the pressure between the points of contact of metallic electrodes as to strengthen and weaken the current, and so reproduce sound. And this is exactly the scope of the Berliner conception, and of his invention. His conception, by reason of the absence of any comprehension of microphonic action, when embodied in a transmitter, produces an instrument which is sometimes operative and sometimes not. If, by accident, the electrodes are adjusted in loose initial contact, or microphonic contact, the instrument may be operative, while, if not so adjusted, it is inoperative.

But while Professor Hughes, under such circumstances, would have made an invention, he could not have seriously asserted that he had discovered microphonic action, because we know that when he placed the ends of the wire in contact, he had not made his discovery, and that it was only after repeated experiments with all degrees of contact pressure he found the ends must be placed in loose contact to insure the reproduction of sound.

Contact, or points of contact, are meaningless as a conception of microphonic action. So, likewise, is the conception of varying pressure at the contact or points of contact. A contact, or points of contact, affected by varying pressure, may be a firm contact, in which case there is no microphonic action, or a very loose contact, in which case there is no microphonic action, or any other degree of contact where microphonic action is not present. Microphonic action resides in the conception of a loose initial contact between the electrodes, and it is immaterial to this conception how the sound waves affect such a contact, whether by varying pressure or not. This shows that it is only the clear comprehension of loose contact which can be held to be a conception of microphonic action. A conception of microphonic action which omits loose contact leaves out the very essence of the thing to be conceived.

Berliner testified to this conception of his invention on April 12, 1879, in some interference proceedings. This was two years after the filing of his caveat, and one year after the publication of the Hughes article. So far as this description of his invention may differ from that found in his caveat, we must, of course, be guided by the latter. It is the invention disclosed in the caveat upon which the complainant must, and does in fact, rely.

Berliner begins his caveat by the statement of the fact which the operator had previously told him, though

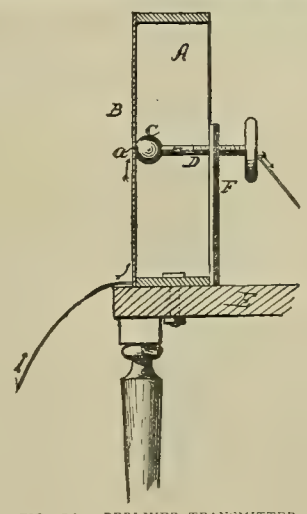


FIG. 11. BERLINER TRANSMITTER.

he now speaks of the pressure at "a point of contact," instead of the pressure between "the points of contact."

"It is also a fact that if at a point of contact between two ends of a galvanic current the pressure between both sides of the contact becomes weakened, the current passing becomes less intense, as, for instance, if an operator on a Morse instrument does not press down the key with a certain firmness, the sounder at the receiving instrument does work much weaker than if the full pressure of the hand would have been used. Based on these two facts I have constructed a simple apparatus for transmitting sound along a line of a galvanic current in the following manner."

The drawing of the transmitter is here reproduced (Fig. 11).

"In the drawing accompanying this caveat (B) is a metal plate well fastened to the wooden box or frame (A), but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the plate and touching it is the metal ball (C), which rests on the bar or stand (F) and presses against the plate which pressure, however, can be regulated by the thumb screw (D) attached to the ball. By making the plate vibrate the pressure at the point of contact (a) becomes weaker or stronger as often as vibrations occur and according to it from which side of the plate the sound comes."

It is impossible to find in this language any description of microphonic action.

Referring to the figure, Berliner says:

"Against the plate and touching it, is the metal ball (C), which * * * presses against the plate, which pressure, however, can be regulated by the thumb-screw (D) attached to the ball."

This is simply saying that the electrodes are in constant contact, and that the degree of contact may be regulated by the thumb-screw. But in what manner it is to be regulated, or what is to be the degree of pressure caused by such regulation, the caveat is silent. Presumably, by experiment with different degrees of adjustment, the pressure between the electrodes is to be so regulated that the instrument will operate to transmit speech. But how can this be said to be a disclosure of microphonic action? The operator gets no knowledge from this description of the degree of initial contact pressure which is necessary. If he presses the ball and plate too closely together the instrument becomes inoperative. If the contact is too loose, a like result follows. But if, after frequent attempts, he happens to make such an adjustment as gives a feeble contact between the ball and the plate, the instrument may become operative. Can it for a moment be maintained that this is the discovery revealed by Professor Hughes?

The caveat continues:

"By making the plate vibrate [by sound-waves] the pressure at the point of contact (a) becomes weaker or stronger as often as vibrations occur."

This may all be true, and this feature may have involved invention, but it has no bearing on the disclosure of microphonic action. These words are merely descriptive of what takes place after some kind of an adjustment between the ball and plate has been made. The discovery of microphonic action resides in the particular kind of adjustment, and not in the fact that after such an adjustment the vibrations of the diaphragm caused by sound-waves vary the pressure at the point of contact.

To make still more clear the distance which separated Berliner from any conception of microphonic action, we may turn to another passage from his caveat, which says:

"Same instrument to be used as a transmitter of sound-waves, by uttering sound against or in the neighborhood of the said plate, or its mechanical equivalent, thus vibrating the plate and diminishing the amount of electricity passing as many times and as much as the vibrations will loosen the pressure of contact, as described."

Berliner's mind was still full of what the operator had told him about the fire alarm. He believed, as this passage shows, that the electrodes must be first firmly pressed together, in which case the current would flow freely, and that the vibrations of the plate due to sound waves would lessen the pressure of contact and so diminish the amount of current flowing as often as the vibrations occur. He consequently started with a firm initial contact between the electrodes, and his theory was that the vibrations of the diaphragm would lessen the contact. This is the reverse of microphonic action, which starts with a loose initial contact, and, consequently, a greatly diminished flow of current.

On April 30, 1877, 16 days after the filing of the caveat in suit, Berliner filed another caveat, which describes an ingenious arrangement for "producing sound by the noise of sparks." On May 9, 1877, nine days afterwards, Berliner filed a third caveat for what is known as his double-pin instrument. This was for an improvement on the ordinary make-and-break transmitter, by the use of a double contact. Then follows, on June 4, 1877, the application for the patent in suit, covering, with the receiver, single-pin transmitters and double-pin transmitters, continuous currents and intermittent currents, in such a confused way that an intelligent and satisfactory interpretation of this document bids defiance to the human understanding. The obscurity of the paper may be in part accounted for by the blunders of the solicitor's clerk, but not wholly; for it is quite manifest that Berliner's ideas at this time as to the best form of transmitter, and the principle of its operation, were unsettled and needed clarification. This course of action on the part of Berliner may not be conclusive of anything. It is sometimes unsafe to infer too much from a subsequent line of conduct. In this particular case, however, we think this much may be said with truth:

Assuming that Berliner, on April 14, 1877, had already made Hughes' discovery of microphonic action, his caveat of May 9th and his application of June 4th become incomprehensible.

In this connection it may be noticed that, in his two patents for microphones, No. 222,652 and No. 224,573, applied for more than two years after his caveat, and more than a year after the publication of the Hughes article, Berliner describes the necessity of loose initial contact between the electrodes. In the first instance, one of the electrodes, which is preferably of carbon, is described as "just in contact by its own weight with said plate," and in the claim as "the said non-elastic pin resting solely by its own weight upon the diaphragm." The second patent is for maintaining the carbon pin constantly in light contact with the diaphragm "by the action of gravity," or, in the words of Claim 1, "an opposite electrode maintained in contact with the vibrating surface by the action of gravity." Here is the loose initial contact of Hughes, and the maintenance of such a contact during the operation of the instrument.

Berliner's attempts to make his transmitter reproduce speech were hardly satisfactory; but, as the evidence stands, he succeeded in reproducing some words, and indistinct sentences, so that it may be said there was the transmission of the quality of sound which characterizes the human voice in speaking. In his experiments with the instrument he says nothing about loose contact between the electrodes, or the necessity of such contact. That his efforts were not more successful he believes was owing to the crudeness of the apparatus and the difficulty of adjusting it. His apparatus, however, was not more crude than the apparatus which Hughes used in his experiments. The unsatisfactory character of Berliner's efforts cannot be wholly ascribed to this cause, nor to the fact that he used metallic electrodes, which, for several reasons, are difficult properly to adjust, nor to both of these causes combined, but must have been due, at least to some extent, to his ignorance of microphonic action. Had he known of Hughes' discovery, the results, in all probability, would have been much more satisfactory. Subsequent experiments, however, have shown that the Berliner instrument can be so adjusted as to become an operative speech transmitter. But the experts who made these experiments years afterwards had been long familiar with Hughes' disclosure of microphonic action, and they knew the absolute necessity of loose initial contact between the electrodes in order to make the instrument an operative speech transmitter. They certainly possessed this advantage over Berliner, and the success of their efforts may be attributed in part to this cause.

The complainant's contention that Hughes' discovery of microphonic action is disclosed in the Berliner caveat rests upon general definitions of the microphone and of Berliner's invention rather than upon a critical analysis

of the actual discovery revealed by Hughes in his article, or a critical examination of the Berliner caveat.

The definition of the Berliner invention is founded on what the complainant conceives to be the "true definition of a microphone" which is as follows:

"The essence of the microphone consists therefore in varying the resistance at the 'joint' or point of contact between two electrodes by varying the pressure between them."

But this is not descriptive of the microphone, or of microphonic action as disclosed by Hughes. "A joint" may be either tight or loose, and a "point of contact" may be either firm or feeble, and the difference between a joint and a loose joint, and a point of contact and a feeble point of contact, is the difference between what is a microphone and what is not a microphone. This is confirmed by the testimony of complainant's experts.

Professor Cross says, defining microphonic action:

"It is a fact that when a current passes from one electrode to another kept loosely in contact with it, there is a certain resistance of passage or 'transition resistance,' as it may be called, at the surface of contact between the two electrodes."

And Professor Wright says:

"When transmitting speech, the electrodes of a microphonic transmitter are brought together with a pressure which is very light, and which has been determined by experiments to vary within a comparatively narrow range."

This error is present in every definition of the microphone and of the Berliner invention in complainant's brief, and it permeates and undermines the fundamental position on which it rests the case.

Again, the Berliner invention is defined as "varying the pressure at a point of contact between electrodes," or "varying the pressure between two electrodes in contact and thereby varying the resistance in the circuit so as to produce undulatory sound waves." More fully stated, the definition may be expressed as follows: The method of varying resistance by variation of pressure at the point of contact between solid electrodes in constant contact. These definitions are not descriptive of the microphone or of microphonic action, because they omit any reference to loose contact between the electrodes.

The complainant then proceeds to define what it calls Professor Hughes' "brilliant and radically novel discovery" in substantially the same terms, as follows:

"It was recognized that the essence of this discovery lay in the variation of pressure at a point of contact between two electrodes in a galvanic circuit, thereby varying the resistance which such 'joint' offers to the passage of the current."

Again:

"The method of varying resistance by varying the pressure at a point of contact between electrodes, which was set forth in Berliner's caveat and subsequently in Professor Hughes' article, was instantly recognized as solving the problem of the 'battery-speaking telephone.'"

Again:

"Hughes says that he may use one contact (like two ends of wire) or a larger number of points of contact, and that he may use either metal or carbon contacts, the one essential thing being the 'difference of pressure at the different points of contact.' Berliner's caveat describes the invention as resting on variation of pressure at a point of contact between the electrodes, and says that the plate which forms one of the electrodes may be of any material, and that there may be more than one point of contact."

From these comparisons follows this conclusion:

"It cannot be seriously denied, and none of the witnesses deny, that the Hughes article and the caveat describe the same invention."

In this comparison of the Berliner and Hughes inventions, it will also be observed that no mention is made of loose contact, or feeble contact, or light contact, and that, consequently, all of these descriptions are wanting in any reference to the essence of microphonic action. What Hughes disclosed to the world, as we have seen, was not varying the pressure at the point of contact; nor did the essential thing which he discovered lie in the difference of pressure at different points of contact. His discovery resided in loose contact, or rather in the remarkable effects of sonorous vibrations in varying resistance at a loose contact. He also made loose contact between the electrodes the indispensable feature of his microphone. In describing that instrument in his article, he says: "The form of the lozenge-shaped carbon is not of importance, provided the weight of this upright contact piece is only just sufficient to make a feeble contact by its own weight." He believed that these effects were due to pressure at the points of contact. This, however, was simply his theory of what took place, his theory of microphonic action. Except in alluding to this theory near the close, the word "pressure," throughout the article, has reference to initial contact pressure. "Variation of pressure at a point of contact" may be descriptive of Berliner's invention, but, to say the least, it is a mistaken and misleading description of microphonic action and of Professor Hughes' discovery.

Again, the first and most important claim of the Berliner patent fails to define the microphonic method of Hughes. The claim is for "the method of producing in a circuit electrical undulations, similar in form to sound-waves, by causing the sound-waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit." It will be observed that the claim is silent as to the character of the initial contact between the electrodes. The claim must be read as if written April 14, 1877, a year before the Hughes discovery. With such knowledge of the telephonic art as existed at that time, no one would have known from this description of the Berliner method that the electrodes must be adjusted in a loose initial contact. In omitting any reference to loose contact, the claim fails to disclose the essence of the Hughes microphonic method.

The complainant has rested its case on the prior discovery by Berliner of microphonic action as disclosed by Professor Hughes in his article of May 9, 1878. We are of the opinion that Berliner had no conception of this discovery, that he does not disclose such discovery in his caveat or patent, and that, if his transmitter operated as a microphone, it did so without any knowledge on his part of the microphonic principle. The world was left in the same ignorance of microphonic action after the appearance of his caveat as before. If Professor Hughes had had lying on his table a Berliner transmitter and the Berliner caveat, they would have revealed nothing to him, nor have been of any assistance in the experiments which resulted in his discovery of the remarkable effects of sound-waves in varying electrical resistance at a loose or feeble contact. If he had taken the diaphragm and metal ball of the Berliner instrument in place of the ends of his wire, he must have gone on experimenting with the effect of sonorous vibrations at different degrees of initial pressure between the plate and ball, until he had discovered that only with a slight pressure, or feeble contact, is there microphonic action. Professor Hughes' discovery cannot be read into the Berliner caveat or the claims of the Berliner patent.

In connection with the invention set forth in the Berliner caveat, the complainant's experts dwell on "transition resistance," and the fact that such resistance varies enormously with pressure. "Transition resistance" is only another name for loose-contact resistance, or microphonic resistance, and it was Hughes, not Berliner, who discovered transition resistance in the telephonic art, and the effects of sound waves in varying such resistance.

It was in its rebuttal testimony that the complainant fully brought out its contention that Berliner was the prior inventor of the microphone. In the opening testimony the complainant seemed to rely more upon the variable-pressure theory of the Berliner invention. Professor Cross, adopting Professor Barker's language in the government case, defines the invention of the Berliner patent as "a transmitter whose operation was based upon the variation of electrical resistance by variation of contact pressure." Again Professor Cross says:

"It is what is known as a variable-pressure contact transmitter. It operates, not as did the magneto transmitter to generate the undulatory current produced by the small amount of energy which the voice can communicate to the transmitter, but simply to impress upon the electrical current furnished from another source—practically a battery—variations in strength which correspond to the motions impressed by the voice upon the transmitter. The current from the battery, in flowing through the two electrodes (as they are called) of the transmitter, when these are set into vibration by the voice, is molded by their variations of pressure into a shape similar to that of the air-vibrations of the air-particles themselves; that it, it is molded into Mr. Bell's undulatory current."

"Pressure" and "variation of pressure" in the telephonic art usually refer to the effects of the movements of the diaphragm caused by sound waves at the contact between the electrodes. In every variable-resistance transmitter the sound-waves vibrate the diaphragm, and the movements of the diaphragm cause variations of pressure at the surface contact between the electrodes, which vary the resistance and thereby reproduce speech.

"Variable pressure," however, in connection with the Berliner invention, is used by the complainant in a special sense. It signifies variations of pressure which vary the intimacy of contact between solid electrodes, and so vary the resistance, as distinguished from variations of pressure which vary the area of contact between a solid electrode and a liquid electrode, or the area of contact between two solid electrodes, or vary the compression of the mass between solid electrodes.

These distinctions may be further illustrated: If we cut the wire in an electric circuit, and place the severed ends in contact, it will be found that, by varying the pressure at the contact the resistance will be varied, and consequently the strength of the current. This was a well-known fact in electrical science long before 1876. Here the variation of pressure may be said to vary the resistance by varying the intimacy of contact at the surface ends of the wire, although it is manifest that the varying pressure must also cause, in some slight degree, a varying area of contact. If, instead of two ends of a wire, we have one end of a wire and a liquid in constant contact, it is apparent that by pressing the wire down more or less, or by varying the pressure on the wire, the resistance will be varied, and consequently the strength of the current. Here variation of pressure may be said to vary the resistance by varying the area of contact, although the intimacy of contact also will be varied in some degree. Again, if in place of the two ends of a wire, or the ends of a wire and a liquid, we have the end of a wire and some compressible solid material, like plumbago, in constant contact, it is equally clear that by varying the pressure on the wire the resistance will be varied, and consequently the strength of the current. Here variation of pressure may be said to vary the resistance by varying the compression of the mass of material rather than by varying the intimacy of contact, or area of contact.

Turning now to the telephone-transmitter art, we find that none of these ways of varying resistance by varying pressure has advanced the art, or made any impression upon it. These ways of varying resistance, and the difference between them, have been brought out and emphasized by the learned and skilled experts in the case at bar. These ways are simply the different modes of operation of the materials which compose the electrodes. They certainly cannot form the basis for any method-patent covering all materials whose mode of operation is the same, because there is nothing in the so-called area-varying method, or density-varying method, or intimacy-of-contact-varying method, considered by themselves and apart from the discovery of microphonic action, or the special properties of some material like carbon, which has ever contributed anything to the progress of the telephonic art.

The terms "pressure" and "variation of pressure," considered by themselves, are mere abstractions, and cannot involve invention. There may be instances, however, where an invention may be said to reside in the discovery of "pressure," or "variation of pressure," and their utilization in the telephonic art. For instance, Edison may have discovered that carbon or plumbago varied its resistance greatly under pressure; and, if this discovery were embodied in a telephone transmitter, the invention might be said to reside in his discovery of "pressure," or "variation of pressure," in a particular material. Again, some one might have discovered that the resistance varies enormously with pressure at a loose contact between electrodes; and, if this discovery were embodied in a telephone transmitter, the invention might be said to reside in the discovery of pressure, or variation of pressure at a loose contact. It cannot be said, however, that Berliner made any discovery of pressure or variation of pressure, which has proved of any utility in the art. His discovery, as we have seen, of the variation of pressure at a point of contact between metallic electrodes in a telephone transmitter possessed little utility and was practically worthless. It may have been an invention, in that he discovered that the minute vibrations of the diaphragm due to sound waves, by varying the pressure at the contact between metallic electrodes, as distinguished from other kinds of electrodes, vary the resistance and reproduce sound; but this is the limit of his invention, in the absence of any discovery of microphonic action springing from loose contact between the electrodes.

To summarize our conclusions respecting the variable-resistance transmitter:

We find that Bell, in March, 1876, discovered that the minute atmospheric vibrations due to sound waves would cause the diaphragm to vibrate, which vibrations, by varying the pressure between a solid electrode and a liquid electrode in constant contact, produced variations of electrical resistance, whereby speech may be transmitted.

We find that Edison, in February, 1877, discovered that the minute atmospheric vibrations due to sound waves would cause the diaphragm to vibrate, which vibrations, by varying the pressure between two solid electrodes of different conductivity in constant contact, one metallic and the other hard rubber covered with a plumbago film, produced variations of electrical resistance, whereby speech may be transmitted.

We find that Edison, on April 1, 1877, discovered that the minute atmospheric vibrations due to sound waves would cause the diaphragm to vibrate, which vibrations, by varying the pressure between two solid electrodes in constant contact, one metalic and the other compressible plumbago, produced variations of electrical resistance, whereby speech may be transmitted.

We find that Berliner, on April 14, 1877, discovered that the minute atmospheric vibrations due to sound waves would cause the diaphragm to vibrate, which vibrations, by varying the pressure at the point of contact between metallic electrodes in constant contact, produced variations of electrical resistance, whereby speech may be transmitted.

All of these discoveries, when embodies in transmitters, were inventions, but none of them was a commercial instrument, or solved the problem of a practical long-distance speech transmitter.

We find that, in the fall of 1877, Edison discovered the carbon electrode; that this discovery represents the first marked advance in the transmitter art since the 1876 Bell patent; and that the carbon electrode is found in every commercial battery transmitter.

We find that in May, 1878, Professor Hughes discovered microphonic action, or the fact that sound waves produce remarkable variations of resistance at a loose or feeble contact between solid electrodes in constant contact, whereby speech may be transmitted; that the principle he then made known is utilized in every practical battery transmitter; and that he embodied his discovery in an instrument, which he was the first to term a microphone.

We also find that Edison's discovery of the carbon electrode and Hughes' discovery of microphonic action solved the problem of a variable-resistance transmitter, whereby speech may be transmitted long distances; and that both these discoveries are embodied in the defendants' transmitters.

We also find that the two claims of the Berliner patent in suit, although upon their face open to the objection of excessive breadth, may be sustained when read in connection with the specification, provided they are limited to metallic electrodes, and that, when so limited, the defendants' transmitters do not infringe.

Our conclusion is that the decree of the Circuit Court must be affirmed on the ground of non-infringement.

The decree of the Circuit Court is affirmed, with costs for the appellees.

What Is Thought of the Decision.

To representatives of the Western Electrician prominent Chicago telephone men gave the following interviews on the effect of the Berliner decision on the telephone industry.

P. C. Burns: "The decision, as I understand it, is what I anticipated. When I started in the telephone manufacturing business in 1893 I sold goods to customers with the guarantee that they would never be interfered with. The decision has justified my confidence. The interference of the Bell company has kept millions of dollars out of the telephone business, and new and increased activities in that line may now be expected. Having suffered defeat in this last stronghold, the Bell company may resort to something else, of course, but whatever such efforts may be they cannot prevent the aggressive advance of the Independent telephone interests. It is doubtful if the Bell company will take an appeal, supposing it can do so. And even if it does, I cannot see how that could change the situation. The litigation has been a costly one all through, but the decision will relieve us all from future trouble on account of the Berliner patent. I think we have heard the last of it."

L. D. Kellogg: "The facts disclosed after the government suit for cancellation of the Berliner patent was begun under the direction of President Harrison's administration led manufacturers to believe that they and their customers were entitled to use the device in question. Two courts have now justified this belief. While activity in Independent telephone construction has never waited upon the decision of this case, the influence of the decision will doubtless be felt in financial quarters, and certain conservative financial institutions will look upon Independent telephone securities with added favor. We understand the decision was a broad one in favor of the Independents. It was a great victory."

I. J. Kusel: "Again the Independent companies have been successful—this time in the decision just handed down by the Court of Appeals in the Berliner patent. The outcome is only the prediction of knowing ones made some years back. The broad contention made by the Bell company, in its efforts to have this patent great in notoriety only, to have it cover broadly any microphone carbon transmitter, seems to have been its undoing. It is a common occurrence to open one of the electrical journals and read weekly that this company owns Letters Patent No., etc., etc., covering all forms of carbon transmitters; and now see the final outcome! It is certainly a condition that Independents can be gratified with. It is well at this time for the Independents that the patent issued to Thomas A. Edison was voided by the Supreme Court's decision in 1896, wherein that body ruled that an American patent expires by limitation at the same time as the expiration of the foreign patent (this decision was before the change which now exists in that law), for were it not for the voiding of that patent the second claim of that voided patent would certainly have a very valuable standing in the interest of the Bell company at this time; but, to the good fortune of the Independents, in view of that decision and the final outcome of the Berliner hearing, the field is now clear, so far as any patent questions are concerned on the microphone transmitter employing carbon, excepting upon specific construction. We believe the result of this decision will only tend to forge another link in the already strong chain of the Independent companies."

J. J. Nate said that by this decision the Independent telephone people had been relieved of a weight which had been hanging over their heads for a number of years. "It has strengthened the position of the Independent companies, and we all can now, with added security, go right along manufacturing transmitters employing carbon electrodes, as we have been doing, despite the efforts of the Bell company to stop us through the courts and

otherwise. I have always had faith that the ultimate decision would be in our favor, and this decision of the Court of Appeals will relieve us from all future anxiety."

E. B. Overshiner said that in his opinion the policy of the Bell company in hanging on to the Berliner proposition was to intimidate capital as much as possible. "It always looked to me," he added, "as if the court would not support a patent obtained as the Berliner was. It would also appear that the fact of the Bell company having used transmitters for a longer period than 17 years would knock out the very broad claim of this Berliner patent covering all forms of carbon transmitters. The Independent companies have nothing now, in my opinion, to fear from the Berliner case."

Henry Shafer: "The decision, as I understand it, from the brief mention I have seen, settles the last telephone patent issue to which any great importance need be attached. It will leave the field free for the Independent companies, as far as patents with broad claims are concerned. This decision of the Court of Appeals will have a tendency to bring a large amount of capital into the operating field which has heretofore been slow and hesitating to engage in the business. It places telephone investments now on the soundest possible basis."

Defense of the Berliner Suit.

From New York, under date of January 19th, Judge James M. Thomas, president of the Independent Telephone Association of the United States, writes to the Western Electrician as follows:

"After the decision in the government case, in which the Supreme Court sustained the decision of the Court of Appeals, refusing to cancel the Berliner patent on the grounds of fraud and other claims contained in the bill of the government, nothing remained to be done but for those interested outside of the American Bell Telephone Company and licensees, who had invested their money, to bend their efforts toward the defeat of the Berliner patent, so far as it related to what is known as the carbon microphone. Immediately after the organization of the Independent Telephone Association of the United States of America at Detroit, in 1897, a committee was appointed, consisting of Hon. H. D. Critchfield of Chicago, formerly of Ohio, Judge Savage of Pennsylvania, and myself, who undertook to assist the defense in three cases brought by the American Bell Telephone Company in the city of Boston. The National Telephone Manufacturing Company, which has been the prominent party in all this litigation, had previous to this time retained Mr. Edward P. Payson of Boston as its counsel, and arrangements were effected whereby the three cases (on account of involving the same issues) were to be considered as one, and that Judge R. S. Taylor of Fort Wayne, Ind., should be accepted as a representative of an outside interest to assist in trying this case.

"Only those who have been through similar experiences can appreciate the amount of work that was expended in preparation of the defense and in financing a plan whereby this great victory has been brought to the Independent telephone interests of the United States.

"Mr. Edward P. Payson has devoted years of study to the troublesome legal and technical questions involved in this case. He has worked faithfully and deserves the everlasting esteem of all the nivestors of the $200,000,000 which was jeopardized in this case. This is the amount that is now invested in Independent telephony.

"Judge R. S. Taylor, having been on the government case, and being more or less familiar with the questions involved, immediately took up the work and has proved a master in the handling of legal and technical questions involved therein.

"No case ever had more devoted lawyers, and the courts have had no case involving greater and more universal interests than this famous Berliner case.

"The litigation committee of the association, consisting of Hon. Hugh Dougherty, Bluffton, Ind.; Hon. H. D. Critchfield, Chicago; Hon. S. P. Sheerin, Indianapolis; E. B. Fisher of Grand Rapids, Mich., and myself, have worked and contributed in every way possible to the support of those who had undertaken the defeat of this patent."

Drainage-canal Power Plants to Be Built.

The trustees of the Sanitary District of Chicago have authorized Engineer Isham Randolph to advertise for bids to build works at Lockport and Joliet for the transmission of electricity for commercial uses. It is estimated the plants will cost $4,000,000. If the Sanitary District cannot arrange for the money, it is said it will be furnished by Chicago citizens, who have inspected the waterpower with a view of estimating whether or not its utilization would be practicable. "There is no doubt the investment would be profitable," said Mr. Randolph. "The slope of the canal varies from five to seven feet below the level of the lake. At Lockport there is a fall of 32 feet, which would furnish, when the flow is at its minimum energy, 18,176 horsepower. With proper construction at Joliet a fall of 20 feet would be gained, giving 11,360 horsepower during the minimum flow and 22,720 horsepower when it is increased."

Edison's Automobile Battery Exhibited in New York.

One of the most important features of the automobile show held at Madison Square Garden, New York city, this week, was the Edison storage battery for automobiles, which was invented by Thomas A. Edison about two years ago, and now, after months of experiment, is said to be ready to be placed on the market. Mr. Edison announces that the manufacture of the batteries is now under way, that business vehicles equipped with them will be in operation in New York city in a few weeks and that the batteries will be put upon the market in time for the coming season, probably in April.

The exhibit consisted of 38 complete cells, several sets of parts mounted on boards so as to show both the construction and the internal arrangement, diagrams showing the curve of discharge, etc. The device is remarkably simple, as it consists essentially of but three parts—a square outer case of thin sheet steel and two sets of thin steel plates, which contain in small, flat pockets, the metallic oxides composing the two elements of the battery.

The complete cells are 3½ by 5½ inches square and 14 inches high and weigh about 18 pounds each. They have a capacity of 200 watt-hours, it is said. The outer case or covering is of polished steel with horizontal corrugations extending about two-thirds of the way down each side in order to combine lightness with strength. From the top project the two electrodes, with binding screws attached, the capped opening through which the solution is introduced into the cell, and a specially devised valve, which Mr. Edison declares will absolutely prevent the escape of any fumes. An automobile containing a battery of these cells has been upset and remained overturned for a space of five minutes with a loss of only about a pint of solution.

The cells are composed of alternate layers of oxides of iron and of nickel, which are contained in small rectangular pockets of the thin perforated steel plates. There are about a dozen of each kind of these plates, which are about a foot long and about five inches wide. The plates of each kind are connected, and the two series fit together so as to alternate the plates. In their construction the powdered oxide is placed in the little shallow pockets, a perforated steel cover is put on, and the plates are then subjected to hydraulic pressure in a press which not only compresses the oxide, but crimps the edges of the pockets so as to secure the covers upon them. The entire construction is of an exceedingly thin steel plate, which is only 0.0025 of an inch in thickness. The solution is distilled water and potash.

Mr. Edison is credited with the following remarks about his battery by the New York daily press: "The experimenting with the new batteries has all been done, and they have been abundantly tested as well, and the only thing that remains is to adapt them to the use of the public. These batteries are for public use, and not for experts, and before they are put on the market I intend that they shall be adapted to the use of the most ignorant and most careless person.

"Regarding the matter of charging, they can be charged as quickly as anybody desires; in fact, they will meet every condition required. A most valuable feature of the new cells will be their rapid rate of discharge, which will give a very large amount of power in any emergency where it will be needed; this will be a particularly great advantage to hill climbing, in bad weather, or on a poor road. The cost of charging, of course, is a small matter.

"In our experiments with pleasure automobiles, we have used an electric runabout of a well-known type, made in Cleveland, Ohio, and have found that 25 cells, weighing 460 pounds, will run the vehicle over fairly level macadamized roads, such as are found in this part of New Jersey, with a load of one person, 100 miles to a standstill. Of course, on asphalt, it would do much better; so that these figures might be taken for ordinary city use as well. We have run 3,000 miles over the Belgium blocks between the car tracks with one set of batteries, and at the rate of 12 miles an hour, and after that test the batteries have seemed better than at the start. No deterioration could be observed, even under a microscope."

When asked regarding the cost of the new battery as compared with the ordinary type, Mr. Edison said: "They are far cheaper, even now, on account of being practically indestructible. At present they will cost about 33 per cent. more than the ordinary type, but this cost will be largely reduced. It is due almost entirely to the high cost of the material, as the expense for labor is very slight. For example, there are 22 operations in the making of the cover alone, and yet the cost is only 1.8 cents. The steel which we use comes from Germany, and we not only have to pay two prices for it there, but a duty of 40 per cent. on it in addition. The ore from which the nickel oxides is obtained comes from New Caledonia, in the South Seas, but the oxide is made in this country by the nickel trust. The iron oxide, too, is made in this country. Every item of cost will be reduced when we get to turning them out in quantities."

Indiana Engineering Society.

The twenty-third annual convention of the Indiana Engineering Society was held at the Commercial Club rooms, Indianapolis, on January 15th, 16th and 17th. An interesting programme was carried out, including a trolley excursion over the Shelbyville Traction Company's line. The Indiana Engineering Society was recently incorporated, and this was the first meeting as an incorporated society. The membership amounts to nearly 100, and is made up of practicing engineers. W. D. Pence, of Purdue University, president of the society, presided. Secretary Charles C. Brown of Indianapolis read his report, which showed the society to be in excellent condition. President Pence delivered his annual address, taking for his subject "Engineering Education." "We naturally judge of the value of a commodity by the demand for it," said the president. "Considering engineering in this light, and noting the very striking increase in attendance of students within the last five years, we must conclude that there is a growing appreciation of technical education. Statistics show that during the year 1901-2 there were 15,000 or more engineering students in attendance at the 114 institutions in the United States which have courses in engineering. A still more startling and equally gratifying illustration of the popular movement toward self-improvement in the electrical and other courses is to be seen in the enormous growth of correspondence-school patronage. One of the best of these institutions, having its origin a few years ago in the 'answers to correspondents' column of a technical journal, soon had an enrollment of 1,000 students, and is now said to have the almost incredible enrollment of 500,000 students for the one institution. Admitting that such instruction is not of the best, nevertheless we must conclude that this movement among the masses, who, as a rule, cannot afford the more desirable and formal courses, is bound to have a far-reaching influence. The correspondence-school idea is but one phase of the general movement, and there are many young men in attendance at the better engineering schools who are there because their ambitions were aroused by first taking the correspondence training. It is well to state in plain terms that the engineering schools are not pretending to turn out graduates who are engineers. It would be absurd to attempt such a feat in the four short years given to the engineering courses. This training is but little more than the cornerstone laying, after which the professional superstructure is to be built by the man himself."

J. B. Nelson, city engineer for Indianapolis, read a descriptive paper on the Richmond (Ind.) municipal electric-lighting plant. This plant has attracted considerable attention, because of its completeness and because of municipal control. Mr. Nelson, who was consulting engineer during the building of the plant, said the high prices charged for service by the private company in control was the principal cause of the sentiment in favor of municipal plant. Mr. Nelson said the plant had been in operation five months, the gross receipts for December being $2,711. The plant furnished power for 82 street arc lamps, 274 commercial arc lamps and 9,000 incandescents. After July next the plant will have the whole of the street lighting. The mistake made, Mr. Nelson thinks, was in putting the rates too low and discriminating too much between the small and the large consumer. This rate ranges from six to nine cents. A rebate of 20 per cent. for the payment of bills before the 10th of the month is also too much, said he.

Other interesting papers were read on sanitary, sewerage, pavement, municipal and bridge engineering, all of which were vigorously discussed. The convention was a great success, and there are indications that the enrollment will be doubled during the year. R. L. Sackett of Richmond was elected president, and Charles C. Brown of Indianapolis, secretary.

Western Union-Pennsylvania Litigation.

In the United States Circuit Court at Trenton, N. J., a decision was filed on the 14th inst., in favor of the Western Union Telegraph Company, restraining the Pennsylvania Railroad Company from interfering with the telegraph company's lines along its road. The injunction was made permanent. At Pittsburg, Pa., on the same date, a new phase of the legal battle between the companies developed, when the Pennsylvania company filed a cross-bill in the United States Circuit Court against the Western Union. The bill asked the court to declare that all contracts between the plaintiff and defendant terminated as of June, 1902, and that the Western Union has no right or authority to occupy any portion of the property of the plaintiff.

Since the above was written Judge Joseph Buffington, sitting in the United States Circuit Court at Pittsburg, has decided two cases against the telegraph company. One was a petition to condemn a right-of-way for the Western Union lines along the Pennsylvania railroad, the other an application for an injunction to prevent dispossessing the Western Union pending the final outcome of the petition to condemn. The decision of the court was to grant condemnation proceedings and dismissal of the motion for an injunction. This decision offsets that of the court sitting at Newark.

NORTHWESTERN ELECTRICAL ASSOCIATION.

The eleventh annual convention of the Northwestern Electrical Association was held in Milwaukee at the Hotel Pfister on Wednesday, Thursday and Friday of this week, and in many particulars was one of the most successful meetings held by this prosperous organization of central-station men. The attendance was between 150 and 200, and of this number a somewhat larger proportion than usual were men actively engaged in the operation of electric-lighting plants or other electrical utilities. Several good papers on a variety of subjects were read and the discussions were valuable. Of nearly equal importance were the reports of some of the committees and their consideration and disposal at the hands of the association. Mr. Irving P. Lord, the retiring president, executed the duties of his position with efficiency and dispatch. The usual careful attendance and supervision of details which Secretary Mercein gives to the convention of the association were also characteristic of this meeting.

On the Chicago Train.

Many of the delegation from Chicago and vicinity went to the convention in a special car that was attached to the regular Chicago, Milwaukee and St. Paul train leaving Chicago on Wednesday morning and arriving in Milwaukee just previous to the opening of the convention. The party consisted of the following-named gentlemen:

Harold Almert, manager Cicero Light, Heat and Power Company, Oak Park, Ill.; A. M. Barron, South Bend, Ind.; George Cutter, George Cutter Company, Chicago; Locke Etheridge, electrical engineer Pullman Car Works, Pullman, Ill.; Arnold H. Friend, M. E. Austin & Co., Chicago; Walter S. Goll, Fort Wayne Electric Works, Chicago; Thomas G. Grier, American Circular Loom Company, Chicago; J. H. Harding, treasurer and superintendent Laporte Electric Company, Laporte, Ind.; I. S. Jackson, Fort Wayne Electric Works, Fort Wayne, Ind.; George C. Keech, general manager Bryan-Marsh Company, Chicago; H. B. Kirkland, American Circular Loom Company, Chicago; L. F. Mahler, district manager Curtiss-Crippen Engineering Company, Chicago; J. S. Mauer, Hart & Co., Chicago; Ed. P. Maxwell, superintendent Dixon Power and Lighting Company, Dixon, Ill.; A. L. Millard, Westinghouse Electric and Manufacturing Company, Chicago; Frank L. Perry, Western Electrician, Chicago; Charles E. Phillips, Rothschilds Company, Chicago; W. R. Pinckard, Westinghouse Electric and Manufacturing Company, Chicago; J. S. Pomeroy, Adams-Bagnall Electric Company, Chicago; Francis Raymond, General Incandescent Arc Light Company, Chicago; J. H. Raymond, Fort Wayne Electric Works, Chicago; A. H. Sabin, Edward Smith & Co., New York city; Leroy P. Sawyer, Bryan-Marsh Company, Chicago; F. F. Skeel, Crouse-Hinds Electric Company, Chicago; William M. Smith, secretary-treasurer Chicago Insulated Wire Company, Chicago; R. H. Strang, Armour Institute, Chicago; William J. Trott, manager W. E. Donley Electric Light and Power Company, Big Rapids, Mich.; R. H. Watson, Gregory Electric Company, Chicago; C. W. Whitney, Western Electrician, Chicago; J. Wolff, New York Insulated Wire Company, Chicago.

Opening Session.

President Irving P. Lord called the opening session of the convention to order shortly after 11:30 a. m. on Wednesday, there being a fair attendance in the convention hall. After some preliminary business, Mr. Lord then read his presidential address, which was as follows:

President Lord's Address.

It is with pleasure that I greet you at this the tenth annual meeting of the Northwestern Electrical Association. I am pleased to see you all, individually and collectively.

I am going to take up but a few minutes of your time with an address, as there are quite a large number of papers prepared, that will be read during the convention, and, as usual, our discussion will be of great benefit to those of us present.

The summer meeting, which was held at Waupaca last June, was one of unusual interest to those members present, and especially so to myself. There were 123 people in attendance, including 20 ladies. The weather was not what we should like to have had, but, like all determined men, we made the best of the situation, and I think that the general opinion was that we had an enjoyable as well as profitable time.

The year just closed has been one of unusual prosperity with all industries, and I do not think that the electrical business has been any exception. I can speak somewhat intelligently as to the prosperity of the central-station men, as I have talked with a good many of them, and all seem to report a successful year. We find that we have been obliged to pay rather more for our new electrical machinery and supplies than we paid three or four years ago, but even with this pleasant little jolt, our increased incomes have been such that our net profits at the close of the year have been somewhat in excess of previous years. Our labor account has also been larger, as it has cost our employes more to live, and necessarily they were entitled to an increase of wages. The merchants and inhabitants generally are finding that electricity produces the best light on the market, and while it costs more than other kinds, it is worth more. I think that the people are being surely educated to the use of electric lights, and that even in the small cities, plants which have in times past had a hard struggle, will eventually be placed upon a paying basis, and will return at least a fair rate of interest on the investment.

One thing that I wish especially to call the attention of central-station men to is the tendency of state legislatures to place exorbitant taxes upon electric-lighting plants. I do not think that this is really the intention of the members of the Legislature, but there seems to be a large demand from the people in general for increased taxation along certain lines, and especially upon corporate interests. It is probably unfortunate that most electric-lighting plants are owned by corporations, for I really think that were these properties owned by individuals, they would not be placed in the same classification with railway companies, express companies, street-railway companies, and the like, against which there now exists a manufactured prejudice. I do not think that there is a man interested in the electric-lighting business but what is willing that his property should bear an equal and just proportion of the taxes paid by the owners of other property, but the trouble seems to be in determining just what this equitable fair proportion is. An electric-lighting plant can hardly be likened to money in hand, secured notes or mortgages, or even a brick business block, or farm, but occupies a field almost by itself. I am in hopes that the legislative committees from the various electrical associations throughout the country may be able to talk this matter of taxation over with the proper committees of the different legislatures, and that it will result in fair and equitable legislation in reference to the taxation of lighting plants. There are already hundreds of thousands of dollars invested in electric-lighting plants in the state of Wisconsin, and every year witnesses the installation of new ones and the betterment of old ones. Unless the owners can receive a fair rate of interest upon their investment, progress in this line will be slow. In case taxation becomes exorbitant, it will be necessary for the companies to charge the consumers higher prices for current, and this would be a hardship to many, and absolutely prevent some from using it at all.

I wish to say one thing at this time to central-station men, regarding the use of meters, and I am speaking from a personal experience. The Waupaca Electric Light and Railway Company, with which I am connected, until the beginning of 1902, sold current by monthly contract, and the result was that consumers wasted more than they of necessity used. Our machines were being crowded beyond their capacity, and we were confronted with the necessity of installing more machines, or declining proffered business. To obviate this, we began installing meters, and I am pleased to say that the result has proven very satisfactory. Since we put in the meters our load, especially after 11 p. m., has been reduced fully 60 per cent., and during the earlier part of the evening from 30 to 40 per cent., while the gross income of the company has been increased about 12½ per cent. Were we running entirely by steam, this would make a very desirable showing as a business proposition. I cannot too urgently recommend to central-station men the benefits that will accrue by the installation of meters, and the doing away of the old contract method of selling electric current so prevalent in smaller cities. It will increase the capacity of your plant, it will increase your income, and it will decrease the amount of your operating expenses.

Of course, there are other things which can also be used to great advantage, but I do think that the principle of selling electric current by meter is the only correct and proper method.

Officers' Reports.

Mr. Lord's address was heartily applauded and Thomas R. Mercein then read a brief report as secretary and treasurer of the association. The finances were shown to be in a very satisfactory condition. In April Mr. Mercein went to Europe on a combined business and pleasure trip and during his absence James A. Wolff of Chicago had acted efficiently in his place as secretary and treasurer. The summer convention was held at Waupaca, Wis., in June, and while the attendance was not fully up to expectations, the convention was a successful one, especially from a social standpoint. The printing of the convention papers in advance having met with approval, the same plan was continued this year.

After duly adopting the report, President Lord requested that the meetings convene promptly at the hour to which adjournment was taken. Mr. Mercein announced a slight change in the programme, and the session adjourned to afternoon.

Wednesday Afternoon Session.

Shortly after two o'clock on Wednesday President Lord called the convention to order and announced as members of the nominating committee J. H. Harding of Laporte, Ind., E. P. Maxwell of Dixon, Ill., and H. F. Pearce of Negaunee, Mich. A membership committee, consisting of H. J. Gille of Minneapolis, Minn., O. B. Williams of Whitewater, Wis., and P. H. Korst of Janesville, Wis., was then appointed, and soon afterward on its recommendation, the following-named were elected to membership in the association: Osborn-Morgan Company, Cleveland, Ohio; Roger U. Kimball, Kenosha Gas and Electric Company, Kenosha, Wis., and A. W. Grabe, electrical engineer Plankinton estate, Milwaukee, Wis.

Legislative Committee Report.

The following report upon legislative matters in the several states covered by the association submitted by S. B. Livermore of Winona, Minn., chairman of the legislative committee, was then read by Secretary Mercein in Mr. Livermore's absence:

"I have written to the chairman of the sub-committee of each state, but up to date, have received replies from only Michigan and Indiana. It is evident that the committees of the other states, either have no interest in the mater of furnishing information for the report, or that no legislation affecting our interests had been introduced in their several states.

"The report from Michigan states that the governor has recommended to the Legislature that the tax commissioners have their powers enlarged, and be made the final ones to equalize in the state. Most of the other bills relate to electric railways, which are not within the strict scope of this report.

"The report from Indiana is that there are no bills before the state Legislature affecting the electrical business.

"In Minnesota a special session of the Legislature was held during the months of January and February, 1902. The principal bill introduced at this session was one regarding taxation. It was proposed to levy a tax upon the stock and bonds, and then find the value of the franchise by adding together the face value of the stock and bonds, and from this sum the cash value of the entire personal property is subtracted, the remainder to be assumed to represent the value of the franchise. In other words, they propose to tax the total issue of stock and bonds of all electric companies at their face value. It is needless to say that a great fight was put up against this preposterous proposition by the electric interests of the state, and after a hard fight we succeeded in defeating the bill. At the present session of the Legislature a bill has been introduced authorizing the tax of public-service franchises either on the basis of property or gross earnings, the tax to be apportioned among the state, the counties and municipalities where the franchise is exercised, and in the same manner that real-estate taxes are apportioned. There seems to be in our state little objection to a gross-earnings' tax, which a careful study of the matter has convinced me is the fairest method of taxing public-service corporations.

"This report is very brief, on account of not having received any information from Wisconsin, Iowa and Illinois."

Uniform Advertising.

The committee appointed at the last January meeting of the association to report on "uniform advertising" then submitted its report. H. J. Selle, the chairman of the committee, read the report, which was as follows:

"The primary object of advertising is to bring and keep a class of goods before the buying public. The question is, Does the present method accomplish this result? that is, is the advertising matter in such form that it can be utilized for reference by the purchaser, and does the advertiser obtain the best results? There are large sums of money spent annually in advertising matter in journals, through circulars, catalogues, personal canvass, etc., a large portion of which we believe does not bring adequate returns. The reason for this is that it is not distributed in such form that it can be properly filed for reference. In order to keep goods or a concern making or selling them before the buying public, it is necessary to have advertising matter in such form that it can be conveniently and accurately filed, and it must be borne in mind that advertising matter is filed by the purchaser, not only on account of advertising a certain brand of goods, but for the information it contains regarding that brand. It would, therefore, seem that the most effective advertising is literature which contains the most information and in such form that it can be utilized for the purpose intended.

"The question of uniform advertising is, therefore, a very important matter. If, for illustration, a manufacturer who spends large sums of money annually for the purpose of familiarizing the trade with his goods, could feel that his advertising matter, which gives full information covering his goods, was carefully filed away and will be referred to whenever a prospective customer is in the market for that particular class of goods, he would feel that he is getting value received, and would place his customer in a position where he would at all times have complete information covering the product. Such a system of advertising, therefore, would be very valuable to both parties concerned.

"This question is not new by any means. It has been considered and discussed by other associations in years gone by. For an illustration, in 1894, the

Master Car Builders' Association went so far as to adopt standard sizes for pamphlets, catalogues, specifications, etc., which were as follows: For postal-card circulars, 3½ by 5½ inches; for pamphlets and catalogues, 3½ by six, six by nine inches and nine by 12 inches; for specifications and letter paper, 9¼ by 10¾ inches.

"In connection with these standards, it was decided that a standard practice should be, to have the proper standard dimensions and the word 'standard' printed on the upper left-hand corner of title paper or cover, whenever practicable. These standards, I understand, are still adhered to, and are certainly a step in the right direction. However, we believe that it could be carried considerably further to good advantage.

"We also believe that some of the sizes should be changed to conform to the standard card-index system, which is used very extensively at this time, and which was not used so extensively when the Master Car Builders' Association adopted its standards.

"We do not know of any electrical society or association that has adopted or has made an attempt to standardize advertising matter, and feel that this association is in a position to adopt standards which we feel will meet with the hearty approval and co-operation of manufacturers and jobbers in the electrical business. We, therefore, recommend that this association adopt standards, and suggest the following: For postal-card circulars, quotations, etc., three by five inches; catalogues, four by six, and six by nine inches; letter paper, specifications, bulletins, circulars, etc., 6½ by 11 inches. All descriptive circulars are to be printed on paper similar in size and thickness to letter paper, and issued in bulletin form, numbered, dated and punched, so that they can be bound in a binder. At least two holes to be punched on the left-hand side, three inches from the top and bottom, making the holes five inches between centers.

"For an index to these bulletins we suggest the card index system with which can also be combined prices on material described in the bulletins. On these cards or paper (if cards are used they should be very thin) the index or title subject, to be printed on the top of the broad side with date on the right hand; bulletin number in which description of material can be found, on the left. On the next line to be the manufacturer or jobber's name and address; then following with prices similar to a form presented herewith. These cards to be 3 by 5 inches. This size could also be used by punching holes on one side to bind in a cover, to be carried in a pocket.

"We would also recommend that business cards be of this same size, gotten up in a similar way for filing purposes; for the reason that very often a representative of a company will present his card, and if the customer contemplates purchasing any particular article, prices can be put on the card and conveniently filed. This matter has been suggested to several manufacturing and jobbing companies in Chicago and has already been introduced with very good results.

"Your committee has taken this question of uniform advertising up with quite a number of manufacturers and jobbers and is assured by them that they will welcome any suggestion or standard adopted by this association for the reason that it will give them some assurance that the money they are spending for advertising matter is increased in value and is appreciated by their customers, and is in such form that it can be utilized at their convenience.

"We think it is not necessary to enter into the question of the form in which advertising matter is circulated at the present time. It is almost impossible to devise a system without considerable labor, that can be utilized at all. The result is that we venture to say that a large amount of advertising matter finds its way to the waste basket; whereas, if there was a system of uniformity it would be a comparatively easy matter to keep it in some form where it is easily accessible. If the system suggested is adopted, each manufacturer and jobber would have at all times, a complete up-to-date catalogue of their product or goods in the hands of the customers without going to the great expense of issuing catalogues."

The report evoked considerable discussion. H. Almert of Oak Park, Ill., thought the work of the committee ought to continue and some system be adopted. He had battled with the problem for some time and was of the opinion that some standard system was badly needed by the central station men. George Cutter of Chicago, said he would like to know that his advertising literature would be filed away by the prospective purchaser in a way that he will easily find it when he wants it, and he only needed a suggestion from the purchasers indicative of what they would like him to print, and in what sizes, for him to carry out their wishes. The report was not quite complete enough for him. He wanted to know how the scheme could be put into operation. T. F. Grover of Fond du Lac, Wis., had experienced only the night before a great deal of trouble in going through his catalogue and circulars in search of some advertising matter. He thought the report of the committee timely, and believed it should be followed out.

Mr. Cutter then moved that the committee be retained to work upon the question, and when satisfied, that it has adopted the right sizes, that it communicate with the advertiser to the effect that their sizes and their standard have been adopted by the association. F. W. Bowen of Kenosha, Wis., one of the committee, in discussing the motion, referred to a system which he had in use for some time, gave credit to the chairman of the committee for his efficient work in investigating the matter, and mentioned the great desirability to have advertising material in such shape that it can be kept on file and can be indexed and cross indexed. A. M. Barron of Elkhart, Ind., as the third member of the committee, thought there was no necessity for sidetracking the report. He would venture to say that if the secretary would notify every one of the supply men who are members of the association that the association had adopted this standard, it would not be long before they would be sending out cards, bulletins and other literature conforming to those sizes.

President Lord stated that the committee had been appointed with great care and he thought that it had done its work well. After some further discussion by Mr. Graves and Mr. Gille, the matter was put over till the following day for consideration, without adopting any motion.

MISCELLANEOUS.

Under the head of miscellaneous business, Secretary Mercein stated that he had had some correspondence with the secretary of the American Institute of Electrical Engineers, in regard to the adoption of regulation of high-tension wiring in connection with the National Electrical code of the Underwriters' National Electric Association. Copies of a report of a joint committee of the Institute and the Underwriters were distributed, and a committee consisting of Mr. Button of Red Wing, Minn., R. W. Kimball of Kenosha, Wis., and P. H. Korst of Jonesville, Wis., was appointed to report on the following day on the matter.

Secretary Mercein then read a letter from Henry L. Doherty of Denver, Colo., in which he expressed regret that he would be unable to attend the convention. He hoped the association would take some action tending to support the Louisiana Purchase Exposition, to be held at St. Louis in 1904.

After a brief discussion, a motion was carried that the association hold its summer meeting in 1904 in St. Louis, in conjunction with the committee of the National Electric Light Association.

Secretary Mercein then read an interesting paper on "Association History," which elicited a hearty reception. A vote of thanks was given Mr. Mercein for his paper and a committee consisting of himself, P. H. Korst and E. L. Debell was appointed to report on the plan suggested in the paper, i. e., a combination of interests of the various electric associations into one corporate body.

This was followed by an instinctive and valuable paper on "Metal Preservation," by Prof. A. H. Sabin of New York city. Professor Sabin made his address particularly interesting by clear and explicit explanations of the different points treated, and by showing samples of linseed oil, resin, varnished pipes, etc. He was given a vote of thanks and Thomas A. Grier of Chicago announced that his company possessed a large baking oven, such as Professor Sabin described, and would be pleased to treat any samples that members of the association would like to send him. After a short discussion of Professor Sabin's paper, the convention adjourned for the day.

Thursday's Proceedings.

[By telegraph to the Western Electrician.]

Milwaukee, January 22.—At the opening of the session on Thursday morning, under "Questions and Answers," H. F. Pearce of Negaunee, Mich., brought up the subject of taxation of electric-lighting plants, saying that the taxes on his property had increased 200 per cent during the last 10 years. Mr. Bowen thought there should be a reasonable tax on the profits on the business. President Lord believed the tax should be on the gross receipts, and Mr. Barron was of the opinion that the valuation of property for taxation should be properly made on the physical value rather than on the gross or net receipts, which view was also that of Mr. Pearce. Mr. Gille preferred a gross-earnings tax.

The committee appointed to consider the joint report of the American Institute of Electrical Engineers and the National Underwriters' Association, on amendments to the National Electric Code, reported, recommending that the association adopt the joint report. The committee's report was adopted.

The matter of uniformity in advertising literature postponed from the previous day was then taken up. Harold Almert thought the subject should be taken up with the various national electrical associations. "Get their approval," he said, "and let the supply men get up their literature in accordance with the standards adopted." The committee should be continued and submit further sizes. Mr. Gille thought the report should be adopted and committee continued. After some further discussion the committee's report, with standard sizes recommended, was adopted and the committee instructed to continue its work.

Later the association elected these officers:

President—F. W. Bowen, Kenosha, Wis.

First Vice-President—H. J. Gille, St. Paul, Minn.

Second Vice-President—A. M. Barron, South Bend, Ind.

Secretary and Treasurer—Thomas R. Mercein, Milwaukee.

Board of Directors—S. B. Livermore, Winona, Minn.; T. F. Grover, Fond du Lac, Wis., and J. H. Harding, La Porte, Ind.

A paper on "Rates and Methods of Charging" was read by J. W. Shuster of Madison, Wis., and briefly discussed by Messrs. Gille, Lord, Almert, Shuster and Allen. Professor George D. Shepardson of the University of Minnesota then read a paper on "The Economic Value of Testing," and the association adjourned to afternoon.

At the afternoon session H. C. West of Schenectady, N. Y., read a paper on "Automatic Voltage Regulation," and this was followed by a very interesting lecture, illustrated by lantern slides on colored charts, on "Light and Modern Illumination."

On Wednesday a theater party attended a vaudeville performance at the Alhambra Theater, and on Thursday evening was held the annual banquet at the Hotel Pfister. W.

Convention Notes.

The O. C. Little Pulley Coating Company was an exhibitor.

Arnold H. Friend saw that M. B. Austin & Co., Chicago, were not forgotten.

Electrical Engineer Locke Etheridge of the Pullman Car Works, was one of the most welcome visitors.

A. M. Barron, consulting engineer, South Bend, Ind., was one of the most welcome ones of the delegates.

George Cutter, "the electrical sage," hobnobbed with the more experienced scientific men of the fraternity.

Jandus fans were well looked after by Keelyn & Smith, who also exhibited a rack of very handsome arc lamps.

Julius Andrae & Sons Company had an exhibit in charge of J. C. Schmidtbauer, H. P. Andrae and A. Cummer.

The Holophane Glass Company's interests were taken care of, as usual, by the V. R. Lansingh Company of Chicago.

The Monarch Electric and Wire Company of Chicago exhibited wires and supplies in one of the parlors, under the care of C. H. Kuhlman.

The Westinghouse Electric and Manufacturing Company made no exhibit, but its interests were well looked after by W. R. Pinckard, A. L. Millard and W. D. McDonald.

Of course, American Circular Loom was in evidence, and, as usual, was kept well in the field of vision by popular H. B. Kirkland and none the less welcome Thomas G. Grier.

Manager James B. Coale of the Columbia Incandescent Lamp Company's Minneapolis office joined President Garrison at the Pfister on Thursday, having run in from Fargo, N. D.

Mr. McGill, now of the Crescent Electric Company, Chicago, and formerly of McGill, Porter & Berg, arrived on Wednesday afternoon. Mr. McGill is pushing Crescent specialties with fine success.

The ever-popular J. G. Pomeroy, so well known through his energetic allegiance of his western sales of the Adams-Bagnall Electric Company, came up from Chicago with the delegation. There could be no convention without Pomeroy, and, as someone put it, "his lamp always burns brightly."

Western Sales Agent Francis Raymond of the General Incandescent Arc Light Company came up from Chicago with the delegation that arrived on Wednesday morning. Mr. Raymond is one of the most popular electrical representatives in the West, and his work for the G. I. company has been most excellent.

The only "Kirkpatrick," of the McRoy Clay Works, put in an appearance at the Pfister on Wednesday. Mr. Kirkpatrick was recently made an honorary member of the Bunbery Club, one of Boston's most exclusive social organizations. Mr. Kirkpatrick's popularity redounds greatly to the credit of the institution.

Fostoria lamps were looked after by J. S. Maurer. The Fostoria Company made no attempt at an exhibit; but its two energetic principals, J. R. Crouse of Cleveland and Manager of Sales H. H. Geary of Fostoria should have lent their personality to the occasion. Mr. Maurer, however, did the honors nobly in their stead.

Secretary Thomas R. Mercein, the indefatigable, courteous and invaluable friend of all Northwestern convention delegates, read a paper which was in effect a condensed history of the Northwestern Electrical Association at the Wednesday afternoon meeting of the association. As the writer of such a sketch his own work was of necessity kept in the background, but it is safe to say that in some future day, another history of the Northwestern Electrical Association will be written, in which references

will be made to one that has been literally its "cornerstone"—Mercein, himself.

Secretary and Treasurer William M. Smith of the Chicago Insulated Wire Company was decidedly in evidence, as is his usual custom with all conventions wherein are gathered users of high-class insulated wire. Mr. Smith made no exposition of his factory's product, but it is safe to say that no one was more warmly welcomed.

District Manager L. F. Mahler of the Curtiss-Crippen Engineering Company, Monadnock Block, Chicago, made his first trip to a Northwestern convention starting with the Chicago delegation on Wednesday morning. Mr. Mahler is energetically pushing the New York Headlight and Train Lighting Company's De Laval system.

The "tallest" man at the convention in more senses than one was President J. W. Peterson of the Electrical Equipment Company, Chicago. Mr. Peterson was accompanied by his wife. Electrical Engineer W. W. Kittleman, late of the editorial staff of the Western Electrician, has joined the engineering staff of this company. He should prove a valuable acquisition.

Western Agent Charles L. Hibbard, of the Varley Duplex Magnet Company, appeared early Wednesday at the Northwestern Convention. Mr. Hibbard is always indefatigable in looking after the interests of the Varley Duplex winding, and rumor has it that during his Milwaukee stay, he closed a large order that ran up into quite a considerable amount of money.

Manager R. H. Watson of the sales department of the Gregory Electric Company, Chicago, did the honors for Mr. A. L. Kuehmsted, who had expected to be present. Incidentally, it may be stated that Mr. Kuehmsted has recently forsaken the ranks of his bachelor friends and as a newly elected benedict found time this year too precious to be wasted at conventions.

Manager A. L. Severance was literally a "host in himself." For years Mr. Severance has held the unanimous friendship of the Northwestern convention, and this time, as has been his steady custom, he again merited it. The delegates were shown every attention, both in the matter of exhibition facilities and comfortable living quarters. The banquet, under Manager Severance's care, likewise was pronounced a great success.

The ubiquitous and trustworthy principal of the John A. Stewart Electric Company of Cincinnati, Ohio, made his initial bow at a Northwestern convention on Wednesday morning. As is well known, the Stewart company buys or sells machinery that has "seen some usage," and while Mr. Stewart has heretofore worked largely in the territory with Cincinnati as a center, he has recently done business practically all over the United States. Mr. Stewart is well liked.

Western Manager James Wolff of the New York Insulated Wire Company came early and stayed late. Mr. Wolff may be classed among those electrical representatives that are given the warmest welcome at every electric convention. With a popularity earned through a constancy of allegiance to old friends and the faculty of making and keeping new ones, it is not to be wondered that the western business of the New York Insulated Wire Company shows a constant increase from year to year.

Manager Walter S. Goll of the Chicago branch of the Fort Wayne Electric Works, did the honors for his company. Mr. Goll was accompanied by J. S. Jackson and J. S. Raymond. While the Fort Wayne company made a comprehensive exhibit, and its indefatigable representatives were constantly on the alert, looking out to see that the Fort Wayne specialties were well exploited. In the company's parlor arc lamps were shown, revolving fan motors, wattmeters and a most complete line of Fort Wayne switchboard instruments.

The Electric Appliance Company, as is its usual custom at all Northwestern conventions, made a most interesting exhibit of supplies. President W. W. Low officiated, assisted by the following-named representatives of the company: W. P. Upham, I. A. Bennett, J. B. McMullen, L. Chadwick of the New York and Ohio Company and A. C. Nevins of the Whitney Electrical Instrument Company. As is now becoming a regular custom, Mr. Bennett distinguished himself at this convention by a number of unique and brainy advertising schemes.

Mr. W. D'A. Ryan's lecture on "Light and Modern Illumination," was one of the most interesting features of the Northwestern Convention. Mr. Ryan is commercial engineer of the General Electric Company's Lynn Works. His treatment of his subject was physiological, psychological and practical, with special reference to the semi-concealed method of interior illumination by means of the Ryan concentric diffuser. The General Electric Company's exhibit consisted practically entirely of Mr. Ryan's special apparatus, which he had designed for measurement and the practical handling of light. The Ryan diffuser excited much comment and was used at the Northwestern Convention in the meeting hall and in Mr. Ryan's exhibition room. Manager F. N. Boyer, of the supply department of the western office of the General Electric Company, was in charge of the western office contingent. Among those who assisted Mr. Boyer were Messrs. Scribner, Tom Ferris, Dibble, Ryan, Stickney, Beardsley and H. C. Wirth.

It is safe to say there never was a convention that might be classed under the head of electric-light, heat or power, to say nothing of the telephonic industry that did not have the words "Chloride accumulators" blazoned in full sight of every delegate. The Electric Storage Battery Company, however, this time made no exhibition of storage batteries. Manager Godfrey Atkin of the company's Chicago office, assisted by Engineer Otto E. Osthoff, was in attendance. The company requested visitors to visit the power station of the Milwaukee Electric Railway and Light Company to see one of the largest storage batteries in the world, of 608 cells of Chloride accumulators.

President W. O. Garrison of the Columbia Incandescent Lamp Company of St. Louis, Mo., was one of those who dropped in on Thursday. Mr. Garrison's company made no attempt at an exhibit of its product. It is interesting to know, however, that the Columbia company has installed itself in a most commodious and specially equipped incandescent-lamp factory on Locust Street, about three blocks from the old Columbia factory on Olive Street. The new factory was specially built to carry on the Columbia company's high-class and scientific methods of lamp manufacture, and it is needless to say that the large plant as it now stands is looked upon as one of the monuments among St. Louis factories.

John W. Brooks, sales agent for Pass & Seymour, came up from Chicago on Tuesday, installing himself in one of the handsomest parlors at the Pfister to present his various electric specialties. Mr. Brooks presented a full line of Pass & Seymour's porcelain specialties, exhibiting in particular the new Pass & Seymour brass shell socket. It is said that this socket is the only double-pole appliance of its kind on the market. It is made for use on 250-volt circuits, in view of the modern tendency toward the use of that voltage. The circuit is broken on both poles, thus lessening the possibility of the formation and maintenance of an arc. Mr. Brooks has made a great success in building up the western business of Pass & Seymour. He will send a new descriptive pamphlet on "Electrical Specialties" on application.

Manager F. F. Skeel of the Chicago branch of the Crouse-Hinds Electric Company of Syracuse, N. Y., put in an early appearance. Mr. Skeel was this time full of a "new thing." The Crouse-Hinds company has recently put on the market a novel and valuable line of porcelain specialties of decided interest to wiremen. Mr. Skeel made an exhibit of these specialties. Generally speaking, they may be classed as porcelain goods of the enclosed-contact order. To be fully appreciated, however, the new Crouse-Hinds specialties must be seen and handled. The Chicago office of the company, however, at 133 South Clinton Street, stands ready to furnish descriptive pamphlets, that fully describe a line of goods that have excited such favorable comment on the part of those interested in the avoidance of the slightest fire risk.

General Manager George C. Keech of the Bryan-Marsh Company, Chicago, accompanied by Assistant General Manager Leroy P. Sawyer, reached the Pfister Wednesday morning, there to be joined by Minneapolis Representative J. L. Barnard. As it is now pretty generally known, Mr. Keech was made general manager of the Bryan-Marsh Company several months ago, and his most excellent work since that time as executive has already shown itself in an increase of business that indicates that even greater things may be looked for in the future. The Bryan-Marsh Company deserves no little credit for the scientific manner in which it prosecutes the introduction of its product into service with the thinking lamp man, and Mr. Keech's technical and business education fits him eminently for the trying position of executive of so technical a business. The Bryan-Marsh Company this time made no exhibit.

The Christensen Engineering Company of Milwaukee, manufacturing as it does so many of the larger types of electrical machines, made no attempt at a special exhibit beyond a presentation at the Pfister of a direct-current, 15-horsepower motor. This machine was used as an illustration from which the representatives of the company could explain the special features of the type "Ceco" machines. The Christensen company, as it is now very generally known, has gone most extensively into the manufacture of electrical machinery and possesses at the present day the services of some of the most skillful designers in the world. The electrical sales department has recently been organized by F. L. Hutchinson. Incidentally, it may be stated that Charles G. Burton has been appointed manager of the Christensen company's Chicago agency, with offices at 1105 Merchants' Loan and Trust Building. At the Pfister convention the interests of the company were looked after by President Watkins, Mr. Hutchinson, Charles D. Knight, who is the direct-current designer, and Messrs. Burton and Waters, the last-named gentlemen being the company's alternating-current designer. A souvenir tape measure was presented as a remembrance of the occasion.

Marconi Sends Message from Massachusetts to England.

Another success was scored by Marconi during the night of January 18th, when he transmitted from his station at Wellfleet, Mass., a complete message by space telegraphy to his station at Poldhu, Cornwall, England. The message which was transmitted had been sent to Marconi by President Roosevelt and read as follows:

His Majesty Edward VII., London, England: In taking advantage of the wonderful triumph of scientific research and ingenuity which has been achieved in perfecting a system of wireless telegraphy, I extend on behalf of the American people most cordial greetings and good wishes to you and to all the people of the British empire. THEODORE ROOSEVELT.

Marconi reported to Washington that the message had been sent, and a short time afterward this message was received at the White House:

Sandringham, Jan. 19, 1903.—The President, White House, Washington, America: I thank you most sincerely for the kind message which I have just received from you through Marconi's transatlantic wireless telegraphy. I sincerely reciprocate in the name of the people of the British empire the cordial greetings and friendly sentiment expressed by you on behalf of the American nation, and I heartily wish you and your country every possible prosperity. EDWARD, R. and I.

The remarkable feature about the sending of the message was that no previous attempt had been made to communicate between the United States and England, even by signals. Marconi had been busy all day preparing the apparatus at Wellfleet, and had received the prearranged signal "S" from Poldhu. Then, instead of replying with similar signals as had been arranged, Marconi, as an experiment, practiced sending the president's message, without calling either of his other two stations. Then, having the dispatch at hand and thinking that he might not be able to get the English station for a day or two, he decided to send it by way of the Table Head station. Calling up the latter station, he sent the message, directing the operator at that place to forward it to England. Greatly to his astonishment, he immediately received a reply from Cape Breton to the effect that the operator had been informed by the station at Poldhu that the message had been received direct from Wellfleet. Mr. Marconi was roundly congratulated for his success by his assistants. It is said that there was not the slightest hitch in the process of sending and that it took about four minutes to get the entire message off. The distance is about 3,000 miles, or 600 miles farther than that between Table Head and Poldhu, and is the longest distance over which space-telegraphic messages have ever been transmitted.

Marconi has announced that the tape system of receiving messages has been discarded and that the messages are now received by sound from the pulsations made on the drum of a telephone receiver. Improvements have been made at Table Bay which permit of a rate of sending something in excess of the receiving capacity of the instrument at Poldhu. Thirty-five words a minute, it is stated, can be accomplished with the Table Head apparatus, and when some improvements have been made at the Poldhu station 35 words a minute will be the average speed for regular business.

Making Steel by Electricity.

At the works of the Cowles Electric Smelting Company in West Lockport, N. Y., on January 15th, Marcus Ruthenberg of Philadelphia, Pa., made an important demonstration of his new process for manufacturing steel. Mr. Ruthenberg was permitted to erect one of his new electric furnaces in the plant, and he had invited to be present several gentlemen representing the independent steel operators of the United States. In the group that watched the tests were John Fritz of Bethlehem, Pa., and others. The claim is made that by the use of the Ruthenberg electric furnace the intermediate processes of making pig iron, oxidization, etc., are eliminated or practically combined in the one operation, and that from the raw material fine steel is turned out ready for the market. In speaking of the process, Mr. Ruthenberg said it was not improbable that the independent operators might use it as a weapon to fight the great steel trust. "The test or demonstration," said he, "of the new electric-furnace process of making steel seemed satisfactory to the steel men who witnessed it. We apply electricity to the smelting of iron ore, at about half the cost of the reduction of ore through the blast furnace and steel hearth. The furnace tested to-day is unique in that it used only about one-tenth the power formerly used in reducing iron electrically, thus putting it upon a very favorable basis of comparison with the ordinary methods of the blast furnace and steel hearth. The critics who watched the process employed in my electric furnace to-day were much elated. The raw ore is first cleaned to the highest degree of purity, reducing material in the form of charcoal or coke dust is incorporated with the ore, and then it is fed to the electric furnace, producing a reduced fritted mass, which goes to the open-hearth furnace as steel-melting stock, saving the ore from going through the blast furnace. This economizes 33 per cent. of the fuel and all of the limestone, and at the same time produces a better and purer quality of steel."

Westinghouse Multiple Train-control System.

The increasing use on electric-railway lines, especially on elevated systems, of trains made up of two or more cars each, has been a strong incentive for the development and perfection of multiple train-control systems by which a train may be controlled from a single point. In an ideal system of train operation the weight of the train and the capacity of the motors would increase or decrease in direct proportion to the paying load. The Westinghouse multiple train-control system, which has been developed by George Westinghouse, provides a means by which these ideal conditions can be closely approached, and is well adapted for the operation of trains under everyday railway conditions. The Westinghouse system involves the use of compressed air for moving the current-controlling apparatus, electromagnetic valves governing the admission of air to the controlling cylinders and low voltage electric circuits running from car to car for controlling the action of the magnet valves. The connections for the low-voltage circuits are the only ones which have to be established between the cars of the train, no air connections being required outside of the ordinary brake hose. A complete equipment for each motor car consists of one controller with operating head, two or four electric motors, two motormen's multiple controlling switches, one railway-type circuit-breaker, one set of seven-point connectors and one cell of storage battery. The car controller is similar in design to the ordinary form of hand controller which has been successfully used on electric street cars for many years. It consists essentially of two drums which revolve in bearings, and stationary-contact fingers, which make contact with points upon the revolving drums. The large or main drum opens the main circuit and makes the motor and resistance combinations; the small drum reverses the motors.

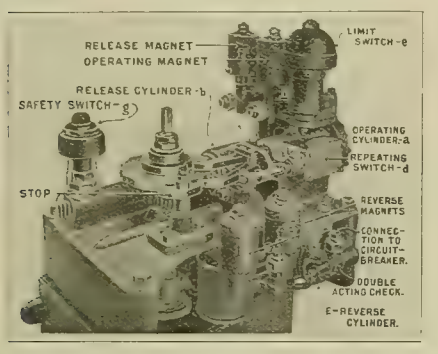


FIG. 1. WESTINGHOUSE MULTIPLE TRAIN CONTROL SYSTEM.—OPERATING HEAD.

The operating head, shown in Fig. 1, consists essentially of an operating cylinder (a), a release cylinder (b), two reverse cylinders (EE), a repeating switch (d), a limit switch (e), four magnetic valves (f^1)(f^2)(f^3)(f^4), and two safety switches (g) (h).

The circuit-breaker is provided with a special front upon which are mounted the pneumatic operating devices. These pneumatic devices provide a means by which the motorman may open or close the circuit-breaker, but at the same time they do not interfere with its automatic action.

The two multiple-control switches are placed one at each end of the car, and by means of the one on the front of the leading car the motorman directs the action of the controllers on all of the motor cars in the train. The switch consists essentially of a skeleton brass drum mounted upon a shaft and insulated therefrom, and stationary contact fingers, making contact with points upon the drum. The switch controls only the low-voltage battery circuits which operate the magnet valves.

Fig. 2 shows diagrammatically the operating head, circuit-breaker, multiple-control switches, batteries and complete wiring connections for one car as generally installed. In following out this diagram the various cycles of operation it will be found a great help to remember that all of the contacts on the drum of the multiple-control switch, the development of which is shown, are electrically one, and that the function of this switch is merely to connect the low-voltage magnet circuits to the positive of the battery. All of the magnets, with the exception of the limit-switch magnet, have one terminal connected to the common return (B)—which is in turn connected to the negative terminal of the battery.

When the multiple-control switch is moved to the right so that the point marked (1) on the drum development corresponds with the stationary contacts, (6) is connected to B +; this completes the battery circuit through the circuit-breaker magnet (f^5), which immediately opens the air valve, admitting air to the cylinder (A). The air, acting upon a piston in this cylinder, compresses a spring, the function of which is to open the circuit-breaker.

When the multiple-control switch drum is moved to position (2), (6), (1), and (5) are connected to B +, thus completing the battery circuit through magnets (f^6), (f^1) and (f^5).

Magnet (f^1) opens the valve admitting air to one of the reverse cylinders, turning the reverse drum to the "ahead" position, air then passes from the reverse cylinder through the pipe connection (K) to the cylinder (D), where, acting upon a piston, it throws in the circuit-breaker. Air is prevented from passing from one reverse cylinder to the other by means of a double-acting check, located at the end (E'). Magnet (f^5) closes the air supply to the release cylinder and opens an exhaust passage from the same to the atmosphere.

Upon moving the switch drum to position (3) the battery circuit through magnet (f^3) is completed through the repeating switch (d) and the safety switch (h); (S) and (M) are connected together and to the battery circuit, and at the same time the circuits through magnets (f^6) and (f^5) are kept closed, but the one through (f^1) is opened.

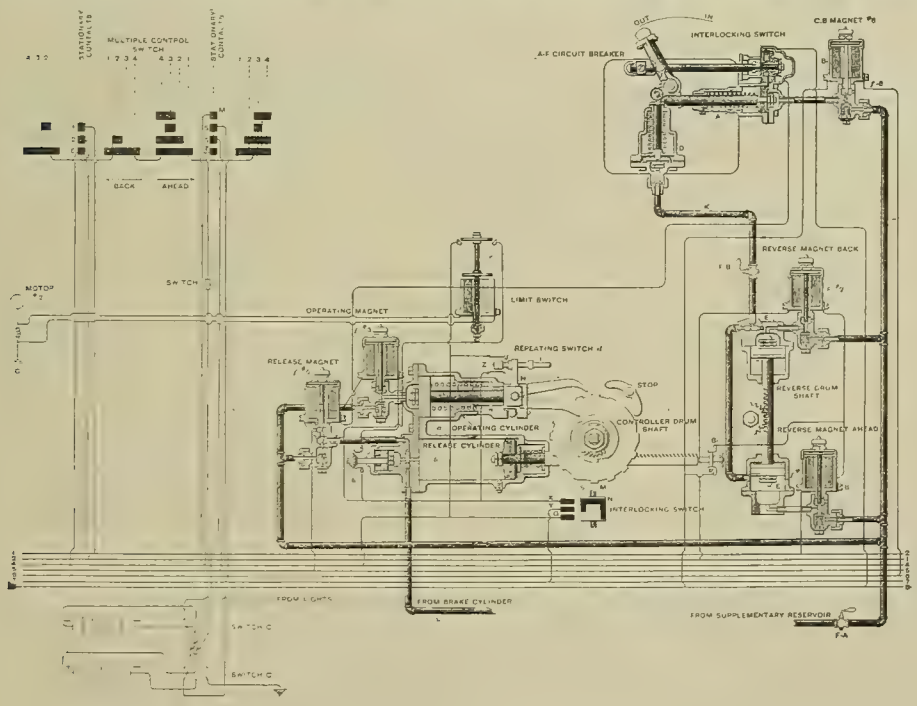


FIG. 2. WESTINGHOUSE MULTIPLE TRAIN CONTROL SYSTEM.—DIAGRAM OF CONNECTIONS.

The completing of the circuit through magnet (f^3) opens the air valve, admitting air to the operating cylinder (a). The operating piston immediately moves forward, throwing the controller on one notch.

As soon as the operating piston reaches the end of its stroke the arm (H) strikes the shoulder (I') and opens the repeating switch, which breaks the battery circuit through the operating magnet (f^3), cutting off the air from the operating cylinder and opening the air exhaust from the same to the atmosphere.

The operating piston is now returned to its original position by means of a spiral spring, located in the front end of the cylinder. As the piston reaches the end of the return stroke the arm (H) strikes the shoulder (J'), closing the repeating switch, completing the battery circuit again through magnet (f^3), and admitting air once more to the operating cylinder, which now advances the controller to the second notch.

This cycle is automatically repeated until the controller reaches full series; at this point the fingers (X) and (Y), which are connected to the terminals of the repeating switch, are short-circuited by the contact piece (N'), stopping further automatic action.

Upon moving the multiple-control switch handle to position (f^4), the connection between the wire (S) and (M) is broken, which opens the circuit between the finger (Y) and the repeating-switch terminal (Z), allowing the automatic notching of the controller to proceed. When full multiple is reached the fingers (X) and (G) are short-circuited, which again stops the automatic action.

To throw off the controller the multiple-control switch handle is brought to position (1). This opens the circuit through magnets (f^3) and (f^5), thus shutting off the air from the operating cylinder and allowing air to pass into the release cylinder, which, acting through the rack and pinions, throws off the controller.

Two sets of batteries are used, so that one set may be charged while the other is discharging. The batteries are charged by throwing one set at a time in series with the light circuit.

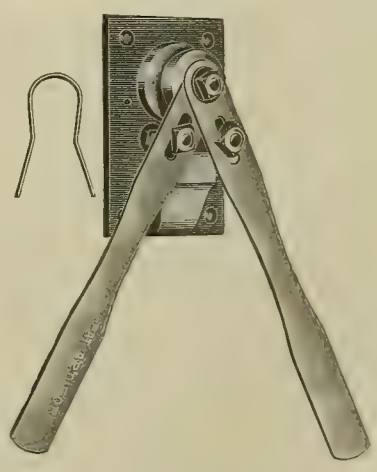
By the use of this system it is possible to operate cars individually as on ordinary trolley roads, or to make them up into trains of any length. Also, any proportion of motor cars may be used, making it possible to obtain any desired amount of power for starting the trains quickly, which is necessary in any service involving many stops. The Brooklyn Rapid Transit Company has given an order to the Westinghouse Electric and Manufacturing Company for 210 of these multiple train-control equipments, which will be used for the operation of trains on its lines in Brooklyn, N. Y.

Chicago Electrical Association.

The regular meeting of the Chicago Electrical Association was held at the association rooms in Chicago on the evening of January 16th. The paper of the evening was delivered by W. G. Carlton, assistant to the chief operating engineer of the Chicago Edison Company, and his subject was "The Underground Work of the Chicago Edison and Commonwealth Electric Companies." The paper was well illustrated by stereopticon views showing maps, drawings and street scenes of the underground work. In the discussion several additional points were touched upon. Mr. Carlton's paper in full and an abstract of the discussion are given elsewhere in this issue of the Western Electrician. The meeting was attended by about 90 members and visitors, and in many respects was the most successful meeting of the winter. H. M. Brinckerhoff's paper on "Third-rail Systems for Electrical Railways," originally scheduled for the meeting of last week, will be presented at a future meeting of the association.

The "Only" Tie-wire Former.

The "Only" tie-wire former, which is being marketed by the Only Manufacturing Company of Moravia, Iowa, is a device for making tie wires, such as are used by the telegraph, telephone and electric-railway companies. There is said to be nothing similar on the market. The tool is adapted for Nos. 12, 10, 9 and 8 galvanized-iron wire, and is said to be so simple and strong that it cannot get out of order. It is handy to use, and in the hands of a boy will do what formerly required six men, using up all one's scrap wire. The device is made in two sizes, pony and standard. The manufacturer reports very good sales and says that arrangements have been made with several concerns in Chicago and St. Louis to handle the article.



THE "ONLY" TIE-WIRE FORMER.

DEVELOPMENT OF THE TELEPHONE FIELD.

Indiana Telephone Items.

A number of new telephone companies were incorporated last week. The Bedford Home Telephone Company was one. It has a capital stock of $75,000. This company is headed by Charles Lanz, and will absorb the present local company operating in Bedford. The People's Telephone Association of Indiana (capital, $10,000), with headquarters and principal exchange at Aurora, will construct and operate telephone lines in Dearborn, Ohio, Franklin and Switzerland Counties. Bayard L. Kilgore heads the board of directors. The Sugar Creek and Warrington Telephone Company has been incorporated to build and operate a rural system in Hancock County. The exchange will be in the residence of B. F. Reeves, east of Greenfield.

The Home Telephone Company of Wabash will issue $20,000 of bonds, of which $10,000 will be sold at once to provide money to pay up the current debt incurred through the destruction of its plant by fire and to make advisable extensions.

The new telephone exchange at Lebanon was damaged by fire during the week. Though the rooms were filled with blinding smoke, the brave young women operators remained at their posts and continued to answer calls.

The telephone companies operating in Indiana are considerably agitated over two bills that have been introduced in the Legislature, and they have organized a lobby to oppose their passage. The first bill provides that where there is more than one telephone exchange in a town or city, the exchanges shall maintain a trunk line, by which a subscriber of one exchange may talk to a subscriber on another exchange. A rate of one cent a minute is provided for in the bill, three cents being the minimum charge. The second bill is designed to regulate the charges for service. Under the bill no company can charge more than $1 a month for a residence telephone or $1.50 a month for business telephones. Representatives Luhring, Rock, Fear, Talcott, Smith, Cantwell, Green, Lopp and Poer constitute the telephone committee. F.

Southern Telephone Developments.

After six months' delay a 52-year franchise has been granted the Cumberland Telephone Company in Natchez, Miss., on condition that several long-distance connections shall be built and that present rates shall not be increased.

According to a recent report, it is probable that the Asheville (N. C.) Telephone Company holds the world's record for the percentage of subscribers as compared with the population, there being one subscriber to every 13 inhabitants.

Negotiations are on foot for a consolidation of the Southside Telephone Company of Manchester and Chesterfield, Va., with the Southern Bell company.

The stockholders of the Reidsville (N. C.) Telephone Company have elected G. D. Williams president. A 10 per cent. dividend was declared.

The Bell company at Greenville, S. C., has ordered material for consolidating with the recently purchased Independent telephone company, a sufficient number of people having signed the agreement circulated by the Bell company.

An important bill has been introduced in the state Legislature, Richmond, Va., to require telephone companies to connect with other telephone lines and to transmit messages originating on other lines at the same rates charged their own subscribers. The bill, if enacted, will give small Independent lines connection with the Bell company's lines and will enforce telephone co-operation. It will be strongly opposed.

R. A. Moore, manager of the Southern Bell Telephone Company at Huntsville, Ala., reports that since 1896 the company has increased from 36 to 355 subscribers.

A. Daus of Macon, Ga., and others have bought the interest of J. E. Smith in the Macon and Dublin Telephone Company. A charter has been applied for, the company to have $6,000 capital. The company owns lines from Dublin to Macon and to Sandersville. L.

Telephone News from the Northwest.

Patrons of the Iron Range Telephone Company at Ada, Minn., are petitioning the company to reduce its rates 50 cents a month. They are now $2.50 for business connections and $1.50 for residences.

The Chippewa Valley Electric Railway Company has just installed telephones on its electric cars. Each motorman is supplied with a jointed rod, from which two wires are suspended, and connection can be made and conversation carried on with the power station. In cases of accident, relief can be sent without delay.

The Independent telephone companies of Iowa which connect with the Mutual Telephone Company of Des Moines will issue a guide containing a list of all the farm service and local exchanges available. The list will give the name, number and location of each subscriber available.

Salix, Iowa, has voted a franchise for a local exchange to J. H. Quick of Sioux City and R. H. Countermine of Salix.

The local exchange at Peterson, Iowa, has been sold to Robert Sitz, Sr., and hos nephews, Robert and Louis Sitz. They will continue as the Peterson Telephone Company.

Montezuma, Iowa, has voted a franchise for the Keokuk, Mahaska and Poweshiek Mutual Telephone Company—a rural line.

Hampton, Iowa, complains of too many telephone lines. The Iowa Telephone Company, the Central and the Cedar Valley are all after rural and local business there.

The Black Hawk County Farmers' Mutual Telephone Association of Hudson, Iowa, has grown so rapidly that it will incorporate and go actively after still more business. R.

Utah and Idaho.

President George Y. Wallace of the Bell Telephone Company states, in relation to the raise recently granted to Butte operators of $15 monthly, that the company was obliged to accede to their demand, owing to the peculiar labor conditions in Butte. The girls recently organized a union, and asked for an immediate raise of the above amount, which was granted. The company is talking of raising the rates in that city.

S. F. Fenton, for the new Home Telephone Company, has won the fight against the Bell people in Logan, Utah, the council of that city having granted the new company a franchise. The fight between the two companies is becoming very bitter.

Much dissatisfaction has been caused in Pocatello, Idaho, through the increase in the rates of the Bell people, and the people of that place may ask an Independent company to install an exchange. G.

Telephone-rate Question in Ohio.

The suit of Charles H. Mucklin against the Findlay Home Telephone Company of Findlay, Ohio, in the Circuit Court of the Tenth District, in which it was sought to prevent the company from charging more than $12 a year for residence telephones, has been decided in favor of the company. The case was appealed from the lower courts, in which a decision to the same effect was rendered.

It seems that the franchise which the Town Council of Findlay granted the company provided that $12 a year should be the limit for residence telephones, and business telephones also were to be supplied at a price fixed by the council. The company, finding it could not operate so large a plant as Findlay requires at that rate, proceeded to charge more. The court, in its decision, says the council has no more right to set a price on telephone service than it has to fix the price of groceries, or dry goods which shall be sold to citizens of the municipality. In effect, the court then holds that a city or town council has only the right to grant a company the privilege of operating a plant and making an agreement as to where and how the poles and wires shall be placed.

The case will, no doubt, be carried to the Supreme Court for final decision, and other companies which find themselves in the same position will await the action of that tribunal. There are a number of companies in the state which cannot extend their service or make necessary improvements unless they are allowed to charge more for their service, having ascertained by experience that each additional telephone only adds so much to the loss they are now sustaining. The largest company so situated is the Cuyahoga Telephone Company of Cleveland. The Federal Telephone Company is interested in a number of plants which are in the same position.

EXTENSIONS AND IMPROVEMENTS.

The Northwestern Toll Line Company of Defiance, Ohio, has filed notice with the secretary of state of an increase of capital stock from $20,000 to $50,000. James E. Brailey is president of the company.

The Peninsular Telephone Company has just opened a new exchange at Tampa, Fla. This company has, within the last two years, built a number of other plants in that state and has about 200 miles of toll line, in addition. The company will build a number of other plants.

Work of installing its first exchange in Chicago is now under way by the Illinois Telephone and Telegraph Company. The exchange building is located at 181 Fifth Avenue. On January 1st 5,000 automatic switches had been mounted, and an additional 5,000 is now going in.

A contract for 5,000 automatic telephones and switches has been awarded the Automatic Electric Company of Chicago by the Citizens' Telephone Company of Grand Rapids, Mich., for the equipment of the Independent exchange in that city. Delivery is to be made during the spring, as soon as the Grand Rapids company is ready with its new building, work upon which is rapidly proceeding. The ultimate capacity of the exchange will be 19,000 stations.

Suggested Methods for Improving Long-distance Telephony.[1]

By Charles E. Hull.

Improvement is the slogan of this age. Especially is this true of telephony. The time was when almost any kind of an instrument or line would suit the otherwise progressive citizen. Any sort of communication by spoken words was progress, and the poorest and often-interrupted service was readily forgiven. Rapid strides are being made in improvement of instruments and the public is fully aware of it. We can but expect that they demand better, if not perfect, service. There are many reasons why Independent telephone service, ever improving, has not reached the highest standard of excellence. Nine-tenths in point of number of the Independent telephone exchanges have been built with the primary object of supplying local service and without any thought on the part of the promoters of any necessity arising whereby they would be called upon to extend their lines or procure for their subscribers and customers any communication beyond that afforded by their limited faculties.

At the beginning of this enterprise the community served and the company furnishing the service were agreed and a unit as to the objects and uses of a local telephone exchange. But soon the people of a neighboring town or perhaps county seat, in their casual business with their fellows, perceived the advantages gained by their friends or perhaps rivals, across the prairie and forthwith, over night, plans were laid for the construction and operation of the Blankville Independent Telephone Exchange. Soon it was discovered that, although striving to outdo each the other, both commercially and socially, these adjacent communities must have opportunity to reach each other quickly. According to the advertisements in some public places that we may read while we impatiently wait for the answer to our call, "the mail is quick, the telegraph is quicker, but the telephone is quickest." For this reason a connecting telephone line is proposed. It is hurriedly built. I say hurriedly, for the reason that additional facilities for communication between existing plants invariably bring a host of clamoring people who want their telephones installed instantly. Once the telephone habit has taken hold of a community, there is no way to check it except by bad equipment, poor service and gross inattention to the wants of the people.

Emulating the example of the prosperous farmer in his endeavor to buy all the land that joins him, managers and patrons join in the effort to reach surrounding communities. The undertaking is laudable and popular. Lines are built that answer for the time, and the interested communities are happy and contented. The work goes merrily on. The circle ever widens, and all goes well until its outward boundaries touch and overlap a similar telephone system.

The two systems are joined at perhaps some out-of-the-way place, without any thought of the consequences, and an announcement is made that each system is ready for "through" business with the other. Satisfied subscribers vanish. There seems to be no call for the service now asked for prior to this time. But now that it is within reach it must be furnished. Any up-to-date manager can read the handwriting on the wall. He must not be weighed in the scales and found wanting. It is useless for him to explain that the fault is at the other end of the line. Whatever it is, it must be remedied. It matters not if the remedy involves the expenditure of more than his plant can comfortably afford; it must be done. The high-sounding title and the far-reaching import of the subject under such a title are calculated to mislead.

The manifest inadequacy of sufficient suitable means of telephonic communication between Independent exchanges within our association prompts the subject. The primary object of the suggestions offered will be looking more to the ways and means of securing the needed better "local" long-distance communication rather than purely "long-distance" telephony. There is but one solution to the latter problem. One company or a system of connecting companies, must furnish such service to the Independent field. Until the Independent movement obtains sufficient foothold in the larger commercial centers, provision must be made, more or less local in its nature, for carrying for "local" long-distance messages, and especially such cases as I mentioned at the outset. For instance, in my own state of Illinois, there is hardly a link out of the chain of Independent exchanges from Egypt to the Wisconsin line, or from the banks of the Wabash to the Mississippi. We can each of us hold communication with our neighbors on either hand, and perhaps with our neighbor's neighbors, but beyond that, we must resort to the unsatisfactory practice of repeating the message. What shall be done? My many letters of inquiry, directed to many exchange managers, brought no satisfactory solution or answer. Strong companies are occupying the larger inland cities of the states. How are the smaller inland cities and towns to reach them satisfactorily? The composite

1. Paper presented to the Interstate Independent Telephone Association at Chicago, on December 11, 1902. Mr. Hull is president of the Salem Telephone Company of Salem, Ill.

ideas to my inquiries seem to be embraced in the following three propositions, namely:

First—That the present system of lines connecting individual exchanges be continued and improved.

Second—That companies be formed along a given route to build metallic standard construction lines, to operate in conjunction with the already-established exchanges. The stock in the company to be subscribed by connecting systems.

Third—That encouragement be given to the formation of entirely Independent long-distance companies who will connect on favorable terms with individual exchanges.

The general sentiment seems to be that whichever of these ideas seems to be best, or a combination of the three, will be readily adopted by all concerned—other than building standard construction. The most practical suggestion for improving present conditions is that new lines be run under present conditions on the same poles as now, with no telephones on, and that these lines terminate in open jacks on the respective switchboards of the different companies or stations. All calling should be done over present lines. When a so-called through message is to pass several switchboards, operators are to be notified to connect the new line by means of these open jacks. This would be at best a makeshift, but certainly would be a vast improvement on present conditions.

The second plan presents some complications which will be hard to overcome. The theory is a good one. It seems to me that practice will demonstrate that it will be a difficult matter to adjust the different ideas and conditions which will be brought into such an organization. It would seem strange if any two stockholders in such a company would come under similar circumstances. It is not my province to discuss these matters.

The practical system for the advancement of the Independent telephone movement, it seems to me, would be a combination of the three ideas above suggested. There is a great deal of purely local telephoning that is offered subscribers so cheaply that no long-distance company could undertake it. Under this head comes free county service. Lines of the long-distance company could be run to the main office of such a company, with the understanding that all incoming lines from other stations be of standard construction. Better still, the long-distance lines should touch each exchange. Through business should be given the long-distance company, and direct and local business should remain with the home company.

Conflicting interests are so diversified and individual wants so varied that the best thought of the best men among us will be necessary to bring order out of chaos. The betterment of existing facilities for the transmissions of messages will not accomplish all of the results desired. We must adopt some definite plan of action and have better facilities for the settlement of our accounts, and (I am sorry to relate) our differences, together with a board whose business it is to adjust all these things. These last-mentioned matters, of course, do not concern the general public, but they are of vital interest to us. We should be the people who are endeavoring to lead the movement into a sound business policy. By so doing, we will gain the confidence of the financial world, and thereby be enabled to make all the necessary improvements to our plants, so that we can give to the public the best service known in the science of telephony.

TELEPHONE MEN.

E. H. Bouton has resigned as president of the Maryland Telephone and Telegraph Company and is expected to resign as president of the Pittsburg and Allegheny Telephone Company, which is controlled by the Maryland company. George R. Webb succeeds Mr. Bouton in both positions.

W. A. Vail, special representative of the American Telephone and Telegraph Company, with headquarters in Indianapolis, has been made general manager of the Northwestern Telephone Exchange Company, covering Minnesota and the two Dakotas. Mr. Vail has removed to Minneapolis, where his headquarters will be.

MANUFACTURERS AND DEALERS.

The Disco (Ill.) Telephone Company and the Easton (Ill.) and Greenview (Ill.) Telephone Companies have purchased their equipment from the Stromberg-Carlson Telephone Manufacturing Company of Chicago.

The Chicago Pay Station Company of Chicago has designed a unique consecutive counter for the purpose of keeping an accurate check on the number of calls handled by each individual operator during any hour or fraction of an hour of the day. Among the advantages that this device is said to have over previous ones is that it can be easily set back to zero, thus enabling the chief operator or manager to determine readily the number of calls handled in any given time. Another good feature is that it stands upright before the operator, and in a very convenient position for immediate use, without mutilating the switchboard. The use of this device will enable the telephone manager to place the operators in such manner as to handle the greatest number of calls in the minimum time, thus increasing the efficiency of the service and decreasing the operating expense.

Independent Telephone Securities as an Investment from a Small Investor's Standpoint.[1]

By John W. Layne.

In the brief period of the last six years' history of our country, we have reason to be filled with exultant pride for the brilliant achievements won by the marvelous growth of the Independent telephone systems; also its expansion abroad throughout the civilized world aaginst the most relentless monopoly—the American Bell Telephone Company. We also rejoice with the nation that, within this brief period of our magnificent progress in expansion and increase of trade, of our commercial and other industrial enterprises, our enormous exports and balance of trade in our favor has greatly aided and revolutionized our financial conditions, existing at this time. We also should feel exultant over having gained supremacy over the old world, in forging our commercial and industrial enterprises to the front ranks of all nations. It has also been conceded we have attained supremacy in the rapid accumulation of wealth, and we now feel we are masters of the situation for the solution and control of such financial conditions in maintaining our supremacy for all future time. The financiers and rulers of the old world look on our marvelous growth of trade and the accumulation of wealth with manifest jealousy and alarm. The recent aggressive inroads by our Morgan and Yerkes in capturing with American capital some of their most profitable industries on their own soil, is but characteristic of our young financiers laudable ambition.

Such indomitable energy as manifested by these financial giants, will in due time conquer the slothful Goliahs of the old world. The genius of inventions, and the applied methods of the adaptability of their various uses, for the purposes to be accomplished, is the true secret of our success. Within a period less than half the time we have here mentioned for a retrospective view of our great progress made in telephone and other industrial enterprises, we have come to realize we are no longer compelled, as in former years, to seek investors for sale of bonds and stock of our varied enterprises in European countries. Conditions have so changed that local or home capital can now be found and obtained almost everywhere on our own continent, in amounts sufficient for all legitimate uses.

Also, never before in the history of the speaker has the circulating medium of our money been so generally distributed. Now, in portions of our own country money sufficient is available for all local demands. For many years prior to the last three years, money was concentrated and hoarded in our eastern cities, and not available for the many local enterprises of the middle and western states, except negotiations were made through eastern capitalists. This is a most fortunate condition, to have the money more equally distributed, whereby the local investor, having a better knowledge of the real merits of the investment seeking capital, can meet local demands.

It has also been long known by many that the capitalists of the more remote cities of the East have not only been timid of Independent telephone securities, by reason of being unable to comprehend the rapid growth and development of the telephone system of our middle and western states. Our progress has been much retarded for want of more capital for the betterment, and to meet the increased demand for telephone service; hence the importance of better knowledge of telephone securities, and where to place them. Rate of interest was never so low, and all industrial securities in shape of bonds and stocks are sought after, with the single exception of the Independent telephone securities.

Why this discrimination by the inventors, in the face of our present financial prosperity as shown in the preliminary facts, is now the paramount question for our consideration at this time. I will venture the assertion that fully three-fourths of all the Independent telephone companies would like a solution of this question, whereby they might receive just and equitable consideration for their securities, as other industrial enterprises receive for theirs.

We have by their untiring energy won one of the essential points to be desired by the capitalists, that of stability and permanency of maintaining our holdings, both in patronage and manifest loyalty of the public, wherever we establish our exchanges. No other industry, coming into existence for so short a period, can show so large a percentage of increase or a larger dividend or profit for the capital invested as that which can be shown from the books of the Independent telephone companies. Even after due allowance has been made for deterioration, still but few other enterprises will show better results. Again, no other industry has greater prospective growth of expansion, by reason of the fact that it is universally acknowledged that a telephone is an indispensable necessity in every business as well as the household.

No longer the threatened "crushing out of the Independent telephone companies" by the old monopoly, which so long held the field, menaces the safety of our systems, so long as good service is maintained.

The Independent telephone companies, by their indomitable energy and courage, sprang into the competitive field in such numbers that the "monster crusher," from sheer exhaustion of the long-continued fight (using the common parlance of modern slang), "has gone away back and sat down."

Also, the Independent telephone companies and others holding their securities, entertain now no doubt or fear of being "crushed out" or of their ability to maintain our holdings, and the loyal support of the people.

From my own experience, as well as information derived from other sources, the easiest way of floating telephone securities, is to enlist the aid of the local capitalists, using the same energy you have displayed in building up your business. Formulate your prospectus, both present and prospective financial conditions, and you will be surprised at the favorable results.

My first attempt in floating telephone securities was a little more than three years ago. My prospectus was carefully prepared, showing 18 per cent. income on the capital invested, and from this showing I felt no trouble would be encountered to float the bonds. When presented to a large banking and trust company by a representative agent, the head of the firm in one of our large cities seemed incensed at the audacity of an Indepedent telephone company for asking such, and proceeded to lecture him thus: "I own stock in the American Bell Telephone Company, and it will not be three years until all your Independent telephone companies will be crushed out by the Bell Telephone Company, and there will be nothing left of you."

After getting this message I looked up the quotation of the Bell Telephone Company's stock, as then rated in the stock market, and now remember it was quoted at $354, more than three times its face value. But a short time ago I saw the same quoted at $152 (less than one-half depreciation in a period of about three years), while my company's stock was absolutely worth $300 for each $100 of the stock for which Mr. Banker refused to invest, and instead of his prophecy of being wiped out by the Bell Telephone Company, I have lived to see my company expand from 220 subscribers to 2,250, in less than 3½ years under the one system and management, as an Independent company.

In conclusion, I would say to the capitalists seeking investment, no surer or larger paying dividends of any industrials, can be more than that in Independent telephone securities, and especially small plants which pay from 15 to 30 per cent. on the cost of construction.

My advice to those seeking aid or capital is to build up your Independent exchanges; local capital is much easier secured than seeking to float bonds or stock in distant cities, unacquainted with the environments favorable for the upbuilding of an exchange and its marvelous growth.

The time has come when we should justly demand of the capitalists and financiers a favorable recognition of our securities. This claim of recognition is justly due, by reason of the fact that we can show the greatest growth of increase in development of any other one industrial enterprise within the same time. Again, we justly claim in our magnificent achievement that of bringing within the reach of the masses, by greatly reducing the cost—that which all now concede to be an indispensable necessity.

For this one achievement we are entitled to the gratitude of not only our nation, but by our demonstration of this fact, the gratitude of the whole world.

1. Paper read before the Interstate Independent Telephone Association at Chicago, on December 11, 1902. Mr. Layne is a telephone operator at Carthage, Mo.

Ohio Telephone Elections

The directors of the Home Telephone Company of Ravenna have elected the following-named officers: President, E. R. Taylor; treasurer, W. S. Drake; secretary, H. L. Beatty. The board of directors, in addition to the gentlemen named, consists of C. C. Byers, C. H. Pitkin, J. F. Babcock and W. W. Stevens. It was decided to enlarge the plant in order to accommodate the growing business.

The annual meeting of the directors of the Weston Home Telephone Company, Weston, Ohio, was held a few days ago and the following-named officers were chosen: President, D. E. Lashley; treasurer, G. B. Spencer.

The new board of directors of the Belmont Telephone Company, Martins Ferry, elected a few days ago, consists of the following-named persons: J. C. Dent, J. B. Driggs, J. C. Heinlein, H. J. Heinlein, Henry Schmulbach, R. B. Mitchell, C. L. Weems, J. W. Doudna and E. G. Smith.

The directors of the Flatrock Telephone Company, Bellevue, have chosen the following-named officers: President, C. C. Pfund; vice-president, E. F. Leinhard; treasurer, W. H. Gardner; general manager, S. D. Huff.

The Muskingum Valley Telephone Company of Swift, Ohio, has chosen the following-named officers: President, E. B. Vincent; vice-president, Arius Lawrence; secretary and general manager, W. W. Mason; treasurer, A. Nickerson. The company was only recently incorporated and will build a line from Swift Station to Marietta.

The Steubenville (Ohio) Traction and Light Company's power plant at Steubenville was destroyed by fire recently, and it is believed that all the machinery is ruined. The Steubenville, Mingo and Brillient and the Pleasant Heights trolley lines secured their power from this station, and the city of Steubenville was supplied with light from it.

St. Louis and Other Meetings of the Institute.

The members of the American Institute of Electrical Engineers residing in St. Louis met on January 15th in the rooms of the St. Louis Engineers' Club, and organized a local chapter of the Institute. Eleven members were present, and several others who were unable to attend sent word that they were heartily in sympathy with the movement. The meeting was very enthusiastic, and, after an informal discussion of the project, Professor Goldsborough was elected to the chair, and Gerard Swope elected secretary. It was decided to hold the first meeting on January 23d, at which time the paper to be presented at the New York meeting will be read and discussed. The St. Louis chapter will undoubtedly come into prominence during the World's Fair, and every effort will be made to augment the membership and stir up a lively interest and participation in the meetings. Those present were W. E. Goldsborough, Henry H. Humphrey, Dr. George Hessenbruch, Professor A. S. Lansdorf, Henry Rustin, R. F. Moore, Ferdinand Schewdtmann, Percival Fansler, R. H. Klauder, Frank Welz and Gerard Swope.

In addition to the chapter in St. Louis and those in Chicago, Pittsburg, Cincinnati, Champaign and Minneapolis, which have already been mentioned in the columns of the Western Electrician, Secretary R. W. Pope reports in the January announcement of the Institute the formation of various other local chapters of the organization. The Denver chapter was inaugurated on December 8th, with Henry L. Doherty as chairman, and E. Y. Sayer as secretary. A second meeting was held on December 20th. The meeting place is the assembly hall of the Denver Gas and Electric Company, and the next meeting will be held on January 28th. In addition to reading and discussing Mr. Lockwood's paper, there will be a discussion on "Intermountain Telegraphy and Telephony."

The chapter at Ithaca, N. Y., has been successfully started and maintained under the direction of Professors Harris J. Ryan, chairman, Henry H. Norris and George S. Macomber, secretary. Once a week, in lieu of the regular formal lecture, at Sibley College, Cornell University, Professor Ryan meets all students and members of the Institute who are interested, for reading and discussing the current papers that have appeared before the Institute. An extra meeting is held once a month for the purpose of going over the discussion of the papers that occurred at the New York meeting of the Institute.

A meeting for the organization of the Boston chapter will be held at the "Tech. Union" on February 13th. Professor Elihu Thomson has been asked to preside, and Thomas D. Lockwood will read his paper on "The Evolution of the Telephone Switchboard."

At the close of last term a Columbus (Ohio) chapter was inaugurated at the Ohio State University by Professor F. C. Caldwell. This chapter started with 32 Institute members and students. Two meetings a month have been arranged for.

Professor D. C. Jackson of the University of Wisconsin has been utilizing the past papers of the Institute for the foundation of the work in one of his engineering seminaries since the beginning of the present college year.

At the University of Missouri, Columbia, Mo., a chapter has been started under the direction of Professor H. B. Shaw. Regular monthly meetings for the reading and discussion of Institute papers are being held at Lehigh University, Bethlehem, Pa., under the direction of Professors W. S. Franklin and William Esty. The Electrical Society of the Pennsylvania State College, of which Professor John Price Jackson is secretary, discusses the papers at its weekly meetings. A chapter is about to be formed at the Electrical Engineering School of Purdue University, under the direction of Professor W. E. Goldsborough and Dr. Charles P. Matthews. At Allegheny, Pa., provision has been made in the regular schedule of the engineering school of the Western University of Pennsylvania, under the direction of Professor S. M. Kintner, for one hour a week to be devoted to a consideration of Institute papers and other electrical topics.

New Electric Truck.

Electric trucks are not now uncommon in New York, and one of them used by a machinery firm in that city is described as follows: The body of truck is 16½ feet long by 5½ feet wide. It is of steel-frame construction, with what is known as "Pedestal" running gear. The axles are placed into the jaws of this pedestal and are free to move vertically, but not laterally. The battery is made in sectional trays which slide out at either side. The power is furnished by two motors of General Electric make, operating independently on rear wheels. The tires are six-inch solid rubber; the forward springs are full elliptic, the rear one half elliptic. A double brake operates on the inside of the gear wheels, being worked by foot pressure. The controller has four speeds ahead and two reverse, the maximum speed of the truck being 5½ miles an hour. An electric windlass, which is placed forward under the seat, is operated by an independent motor and controller, the power being obtained from the storage battery.

Chicago Street-railway Situation.

As the time approaches for the expiration of the franchises of the local street-railway companies in Chicago, great interest is taken in the settlement of the traction problem and of the factors that necessarily enter into it. Now that Mr. Arnold's report is available, the matter rests with the City Council or its committee on local transportation, on the one hand, and the officials of the traction companies on the other, to come to an understanding. Some unofficial conferences have been held, and it is announced that the Chicago City Railway Company has its plans defined and will present them at an early date. It is rumored that the company will agree to pay the city a compensation of 10 per cent. of its gross receipts, will put in the underground trolley as far south as Twelfth Street, adopt double-truck cars, use grooved rails where practicable, give transfers on all its lines and will not contest the matter of municipal ownership.

The Chicago Union Traction Company, it is understood, is not quite ready yet to submit a proposal, but a committee of stockholders has been appointed to draw up a plan for the complete regeneration of the traction systems. Rumors have been current that J. P. Morgan was coming to Chicago to supervise a merging of all the traction interests in the city, and it is also reported that New York and Chicago capitalists have joined forces to construct an underground railroad, combined with a new elevated line on the South Side, at a cost of over $50,000,000.

As a step toward providing for the future municipal ownership of the street railways, the City Council of Chicago at its meeting on January 19th agreed upon a bill to be presented to the state Legislature with the request that it be passed. The bill, offered by Alderman Jackson, and superseding the Finn bill, gives to every city the right to own and operate street railways and to acquire by purchase or condemnation any existing lines. In any ordinance for street railways given to any person or company a clause must be inserted reserving the right to the city to purchase the plant. The City Council is given the power to license its own cars or lease its tracks to any company for a maximum period of 20 years. The city has the right, under the terms of the bill, to issue bonds or certificates of indebtedness payable solely out of the revenue of the street railways. These bonds or certificates are to be secured by a trust deed. If the bonds are defaulted, the purchaser has the right, under foreclosure, to operate the lines for 20 years. The bonds are not to be a lien on the city's general fund. The bill provides that the city shall have the right to make all rules and regulations for municipal operation, to fix rates of fare and to provide a sinking fund for the retirement of the bonds. All surplus, after paying expenses and providing for bonds, can be devoted to corporate purposes. The city is not to take over or purchase any street railway until an ordinance specifying the sum proposed to be invested or employed in the purchase is submitted to the voters at a general or municipal election and shall have received the affirmative votes of 60 per cent. of those voting for such proposition. For the operation of municipal lines a 60 per cent. vote of the entire numbers of voters voting at an election is required.

Long-distance Electric Railroading in the East.

The Boston News Bureau, which publishes bulletins for the guidance of investors, recently published an item on "Interurban Trolley Lines," which says, in part: "The Boston and Worcester Street railway represents the first stage in some ambitious interurban trolley plans, some of which have already proved too large for realization. The Worcester road is the first link in a chain which at first was to stretch down the coast to Washington, but now will terminate at New York. The original scheme provided for an alliance with the late Albert Johnson, whose plans contemplated a high-speed line between Philadelphia and New York, but were disrupted by legislative difficulties and by his subsequent death. Present plans look to completing, in about three years, a service to New York within 10 hours' time from Boston. The route to Providence is pretty well mapped out. In connection with this plan, the organization of two minor interurban lines is being prepared between Worcester and Providence and Worcester and Hartford, the latter to be part of the New York project. The steam-railroad connections are decidedly roundabout and it is possible for trolley lines to make nearly if not quite as good time, with many more trips and at less than half the steam fares. Rights-of-way have been secured for the lines from Worcester to Hartford and Providence and charters will be sought from the Connecticut and Rhode Island Legislatures this winter. The cars employed will be of the largest and fastest interurban type and will probably include, in time, dining and sleeping cars."

An underground-trolley railway, to supplant the old horse lines, is in course of construction in Brussels, Belgium, under the direction and control of Americans. The machinery for the road is being put in by the General Electric Company of the United States.

CORRESPONDENCE.

London Letter.

London, January 10.—Fatal accidents due to electric shock are happily very scarce nowadays. Employes in the electrical industry rarely meet with such mishaps, and the general public still more infrequently. When the general public do suffer an outcry is so general that the electrical press feels bound to deal with such instances in some detail. Such an instance has just happened at a public bath, where two bathers met with fatal shocks, owing to a leak in the electric-light system, whereby the metal framing of the partitions became charged. This unfortunate catastrophe has once again proved the care with which such public buildings should be wired, and also the great necessity for putting everything out of reach. Had the lamps been hung from the ceilings instead of being suspended from the partitions between the baths, these two lives would never have been sacrificed in this manner. The chief characteristics of this accident are that the specification was faulty, inasmuch as wooden fuse boxes were used in a complete metallic system (the wires being run in tubes) and the fact that the specification was not strictly adhered to by the wiring contractors, viz., a complete earthed system. The cost of thoroughly earthing the system was put at one shilling by a consulting engineer, by no means a consolation to the relatives, when it was pointed out that if earthing had been efficiently carried out the accident could not have occurred.

Continuing my note on the electric-power schemes a short time ago, another of these undertakings is now making good progress, viz., the Derbyshire and Nottinghamshire Electric Power Company, which has now three stations in course of erection. Among the new undertakings seeking parliamentary powers this session are two affecting Fifeshire, in Scotland, and another taking in Shropshire, in Wales. The former proposes to supply over the whole of the county of Fife, and will have a capital of some $3,000,000, while the latter includes an equally large area over which it is intended to distribute electrical energy from three stations.

The electrification of the Inner Circle is being steadily pushed forward. The design of the carriages has been completed. Corridor trains will be put into service, each consisting of seven coaches, the two end ones and the middle one being the motor cars. Doors will be put in at either ends of the cars and also one in the middle. As hinted by Mr. Yerkes before the parliamentary committees last year, a non-inflammable wood has been introduced, while the seats will be made of rattan and not upholstered. The seating accommodation of these seven-coach trains will be 330. Some portions of the lines in the hands of Mr. Yerkes will probably be running before the end of this year. In fact, some of the above-mentioned trains are expected to be completed in about six weeks' time.

The directors of the Central London Railway Company are still experimenting with a system of ventilation for their tube railway. This has now been going on for some time, but a satisfactory method has not yet been found. In this respect Mr. Yerkes' electrified Inner Circle will, when running, prove highly successful, as it is much nearer the surface and has large ventilators connected with the streets already fitted. But in view of the large amount of tube construction anticipated in the near future, the question of ventilation is assuming great importance, and the final results of the experiments on the Central London Railway will be awaited with interest.

The members of the Institution of Electrical Engineers have, during the past few years, paid highly successful foreign visits to Switzerland, Germany and France. This year a trip is to be made into Italy, where there will be much to interest. In 1904 it is intended to visit the St. Louis exhibition, an invitation having been received both from the McGill University, Montreal, and the American Institute of Electrical Engineers. Visits will be made both to New York and Montreal on that occasion.

For several months now an arbitration has been in progress as to the price to be paid by the St. Marylebone (London) Borough Council for the portion of the undertaking of the Metropolitan Electric Supply Company's undertaking, which comes within the Marylebone area. This is the first time such a purchase has taken place in London, and the figure involved is said to run to something like $5,000,000. However, the arbitrators' award has not yet been issued, but the proceedings are now completed, after continuing for something like eight months. W.

New York Notes.

New York, January 19.—Mayor Low recently made a trip through a portion of the rapid-transit subway and expressed his delight at the character of the work done, saying that it was everything that could be demanded, and when completed would be entirely adequate for the service it is expected to give. He was surprised to see how light the stations were. The work is rapidly approaching a state where the laying of rails will be possible throughout, and experiments are now being made with different sorts of lights for use along the tracks. New York, Mayor Low asserts, will certainly be proud of this addition to its public works.

The stockholders of the Manhattan Elevated Rail-

way Company have ratified the proposition to lease the lines of that road to the Interborough Rapid Transit Company, over 90 per cent. of stockholders approving of the step. The stockholders also approved of the increase of the capital stock from $48,000,000 to $60,000,000, of which $7,200,000 is to be issued at once, and the remainder not before January 1, 1906, the proceeds to be used for improvements. The voting trustees of the Interborough company also held a meeting, at which the lease was formally accepted, and Alfred Skitt, vice-president of the Manhattan company, has secured from the State Board of Railroad Commissioners the approval of that body to the lease by the Manhattan company to the Interborough Rapid Transit Company.

The Union Terminal Company is a new underground rapid-transit project which has been incorporated under the laws of the state with a capital of $40,000,000. Its powers, as defined by its charter, empower it to maintain and operate an underground tunnel to be operated by electricity. The purpose of this tunnel railway, as set forth by the prospectus of the company, is to give access to the city of New York to those railways from the west and south now having their terminals at or near Jersey City. It is the intention to establish at Union Square a great central station communicating with the city's rapid-transit system, where all this enormous western and suburban passenger traffic will be discharged.

The comprehensive scheme contemplates a tunnel 9½ miles long from the Jersey Meadows under the North and East Rivers, to Brooklyn, with spurs for freight and passengers under New York city.

An electric-light bulb was the cause of a curious accident in Hupfil's brewery in this city. Two of the employes were in one of the brewery vats coating its interior with shellac, which they thinned with alcohol as needed. An incandescent lamp had been lowered down to them to enable them to see what they were doing. The bulb exploded, and a moment later the alcohol followed suit. Both men were badly burned before they were rescued. One of them, Mathias Kainz, died later.

Tentative plans are under consideration for a comprehensive coal merger and the formation of a great securities-holding company which shall include the Chesapeake and Ohio, the Norfolk and Western and the Baltimore and Ohio, as soft-coal carriers, and the Reading, Jersey Central, Lehigh Valley, Delaware, Lackawanna and Western and the Erie as anthracite coalers. O.

New England News.

Boston, January 16.—The Boston Transit Commission has awarded the contracts for the construction of a part of the East Boston tunnel at the head of State Street and for alterations in the old State House, so that it will be suitable for a station. There were nine bidders. Woodbury & Leighton, contractors and builders, received the contract, their figures ($39,102) being the lowest of any of the bidders. The highest bidder wanted $103,000. The tunnel is now open the entire distance under the harbor, from the East Boston side.

The Watertown (Mass.) Gas Light Company is preparing to build a new electrical plant to be finished in the spring.

The Salem (Mass.) Electric Lighting Company has obtained possession of West Wharf in that city, which adjoins its plant, and it will now enlarge the latter. The wharf affords excellent dockage.

The Commonwealth Avenue Street Railway Company has ordered 44 closed and 56 open cars of the same size as the cars used by the Boston Elevated Railway Company, to be used on the trips which are to run into the Boston subway, in accordance with the through-car arrangement made by the two companies.

In his inaugural address Governor Chamberlain of Connecticut recommended that the General Assembly should carefully scrutinize applications for electric-railway charters, "and refuse all applications which are made for speculative purposes or to prevent desirable competition by rival companies." There is a growing sentiment in favor of an annual-franchise tax on electric railways in that state.

The Connecticut Railway and Lighting Company has practically completed the electric railway between Cheshire and Mount Carmel, Conn., and probably it will be in operation by January 20th. The company will soon extend the Cheshire line to Southington, where it will connect with the line to Meriden, and complete a through electric line between New Haven and Hartford.

The stockholders of the Massachusetts Gas Companies have voted to increase the companies' stock to the amount of $20,000,000, making the total $50,000,000, the proceeds of the increase to be used in acquiring the stocks of corporations engaged in making and supplying gas or electricity in the city of Boston. Interested persons are trying to obtain an injunction against the proposed increase. A representative of the companies stated that the increased stock is to be used in purchasing the remaining gas and electric companies in Boston and vicinity.

The Eddy Electric Corporation has filed a certificate of organization with the Connecticut secretary of state. Its headquarters are at Windsor, Conn., and it is a reorganization of the Eddy Electric Company of Windsor, which has recently passed through a receivership. The new company has a capital of $150,000 and the incorporators are M. E. Westover, G. E. Emmons, E. W. Rice, Jr., and Hindsill Parsons of Schenectady, N. Y., and Walter C. Fish and J. A. Dalzell of Lynn, Mass.

At its last meeting the Boston Board of Aldermen for 1902 took up the resolution for the municipal electric-lighting plant and, after a debate, referred the matter to the board of 1903.

The company which proposes to build an electric railway between Huntington and Conway, Mass., is to be known as the Huntington and Westfield River Railway Company. The company has acquired ample waterpower, and it will be able to furnish electric lights in the towns through which the railway will pass. The railway will cover a section containing 15,000 persons and it will connect towns situated on the Boston and Albany, Fitchburg and New York, New Haven and Hartford Railroads. B.

Canadian Intelligence.

Toronto, January 17.—The Hamilton Street Railway Company has decided to increase its rolling-stock equipment, and is in the market for 10 new cars of the latest type.

A new electric railway is to be built from L'Amable, a station on the line of the Central Ontario Railway. It will be about 10 miles long and run to the Mineral Range Iron Mines, in North Hastings. The company which owns the mines will build the road, and operate it. H. C. Farnum is the general manager, and will be in the market shortly for a complete electrical plant. Current will be generated from a nearby waterfall. Mr. Farnum may be addressed at L'Amable, North Hastings, Ont.

The entire electrical plant in Tweed, Ont., has been destroyed by fire, and will necessitate the purchase of a new plant. William Wray is the town clerk.

At Strathroy, Ont., the by-law for municipal ownership of the electric-light plant and the waterworks system has been carried. F. J. Craig is the town clerk.

The Cataract Auxilary Company has been incorporated by the gentlemen concerned in the Cataract Power and Light Company, to facilitate business arrangements. They will own and control the auxiliary steam plant adjacent to the Cataract Power Company's electrical sub-station in Hamilton, and have control of other arrangements of power installations in that city. The chief thing that brought about the incorporation of the new company was the big contract with the Deering Harvester Company for electrical power. This is a branch of the Deering Company in Chicago. It is also the intention of the new company to double the capacity of the machinery at Decews Falls, a sub-station between Hamilton and Niagara Falls. The capital stock is $1,000,000; head office in Hamilton and the provisional directors are J. M. Gibson, James Dixon, J. R. Moody, W. C. Hawkins and J. W. Sutherland, all of Hamilton, Ont.

The completion of the line between Montreal and Shawinigan Falls gives that city a large addition to its electrical supply. According to arrangements made some months ago, all power from Shawinigan Falls for the city and island of Montreal will be distributed by the Lachine Hydraulic and Land Company. At the present time the latter company is serving the Light, Heat and Power Company with some 3,000 horsepower daily, having done so ever since the break of the Chambly dam some weeks ago.

The Department of Public Works of Canada has had so much trouble to contend with in the workings of the Yukon telegraph line that the minister proposes to ask Parliament for an appropriation to substitute a land cable over a portion of the route, instead of the overhead wire, owing to the difficulty in planting poles in such a rocky country. The original cost of construction was about $120 a mile, but the change will involve an expenditure of $600 or $700 a mile for fully 300 miles between Manson and Telegraph Creek.

The city of St. Thomas, Ont., recently took over the St. Thomas street railway on a forfeiture of franchise, on account of the non-operation of the electric line. The civic authorities are now trying to make it pay, and are sending around canvassers to sell tickets. This scheme has for its object the educating of the people to the practice of using the street cars, and is working like a charm, it is said. H.

Information from Indiana.

Indianapolis, January 19.—The Indianapolis, Shelbyville and Southeastern Traction Company has decided to start on its Cincinnati extension and will first build to Batesville via Greensburg, a distance of 40 miles. Surveyors are at work on the proposed route, and grading will begin with suitable weather. The company officials say that it is their purpose to extend the line to Cincinnati as soon as possible.

A bill has been introduced in the Legislature requiring urban and interurban electric cars to be equipped with sanitary toilet conveniences and other necessaries for the health and comfort of passengers, the same as are required of steam cars.

Horace Stillwell of Anderson and Charles McGuire of Indianapolis are looking after the interests of the interurban companies in the Legislature to prevent, if possible, any legislation inimical to the interurban lines.

Complaints are coming up from a number of towns that invested in municipal electric-light plants built to be traded off. Some of these towns have received hard bumps, inasmuch as their plants "have gone broke," and their city treasuries are empty. These plants need new machinery and equipments, but the towns have no money to buy. The bonds are held by capitalists. Cheap electric-light plants are poor investments for towns and cities. F.

Southern Developments.

Charlotte, N. C., January 17.—The city of Valdosta, Ga., has rescinded its action to establish a municipal light plant and has accepted a bid of $75 a light from the Valdosta Light and Manufacturing Company. The contract is for five years.

The town of Lewisburg, Tenn., has contracted with the Braid Electric Light Company for a $5,000 electric-light plant. Lighting bonds were issued.

The Springfield (Tenn.) Electric Light and Power Company has combined with a local ice plant and laundry, and will put in new electrical laundry and ice machinery. The new concern will be known as the Springfield Ice, Light, Laundry and Power Company.

Work has just been started at Nashville, Tenn., on the Tennessee Interurban electric railway, which will extend to Gallatin, connecting with Columbia. The road will run through Nashville.

The Jacksonville (Fla.) Traction Company has been chartered with $400,000 capital, with the right to build and operate electric street railways, etc. The incorporators are G. W. Shook, P. A. Dignan of Jacksonville and others.

It is reported that Frank Jay Gould paid George E. Fisher $1,500,000 for his interest in the Virginia Passenger and Power Company of Richmond, controlling exclusively the electric lines of Richmond. L.

Detroit, Mich.

Detroit, January 17.—The citizens of Hudson, Mich., will hold a public meeting to make arrangements for securing a right-of-way and franchise for the new electric road that is to come to that point from Toledo.

The Port Huron Light and Power Company has purchased of the General Electric Company a 1,500-kilowatt Curtis steam turbo-alternator. The Port Huron company, it is stated, has perfected a system for house heating and cooking in 1,400 houses in that city served by the company.

The Jackson and Battle Creek Traction Company will make arrangements for two classes of service on its road. One class will be a limited service, on which the cars will be speeded up to a mile a minute, and no stops will be made except at stations. The other will be a "pick-up" service by combination express and passenger cars. The limited service, it is said, will make the 45 miles between Jackson and Battle Creek in an hour and 20 minutes, competing in time with the Michigan Central service between these points. While the Michigan Central's fastest train does not stop between Jackson and Battle Creek and has a schedule time of one hour and three minutes, the electric people will make stops at Parma, Albion and Marshall. Work on the road bed at Bath Mills is suspended on account of the inclement weather, but six weeks' work will put the road in running order.

The Postoffice Department is considering the proposition to use automobiles in connection with the rural free-delivery system and wipe out all of the fourth-class postoffices. Country service now being mapped out in a number of states will be started as soon as possible. The proposition is to map out routes 40 miles in length and have them start from salaried offices. As yet nothing definite has been accomplished, but the plan is under consideration as feasible. It would cut down congressional patronage, but would greatly improve the mail service. C. G. W.

Northwestern Notations.

Minneapolis, January 17.—A practical course in electrical engineering is given at the Central High School in St. Paul. The pupils construct their own apparatus, build miniature electric railways and telegraph lines, and operate dynamos and motors.

The council of Ripon, Wis., has passed a franchise to the Madison and Northeastern Railway Company over the mayor's veto. The company proposes an electric railway through the city.

The Highland Canal and Power Company of Duluth is now contracting to furnish power by July of 1904. Bids are soon to be taken for furnishing the equipment, both electrical and waterwheels, for the first installation of about 30,000 horsepower.

Escanaba, Mich., is about to make extensive improvements and enlargements to its electric-light plant. There is needed another dynamo, engine and boiler, and an addition to the plant. The cost of these improvements will be about $20,000.

The Des Moines Interurban Railway Company, which now has a line in operation from Des Moines to Colfax, expects to continue the line from Colfax to Newton this coming season, a total of 45 miles. The company also proposes a line to Eldora, Iowa, about 60 miles.

An electric railway is projected from Sault Ste. Marie to St. Ignace, Mich., power to be supplied

by the Consolidated Lake Superior Company. Pennsylvania interests are financing the road.

The Public Service Company of St. Cloud, Minn., expects to install a complete system of enclosed-arc lamps, changing over the street-lighting system to the new pattern.

The Wenatchee Electric Light and Power Company of Wenatchee, Wash., proposes to install a power plant on the Wenatchee River, three miles from Leavenworth, Wash., and transmit power to Leavenworth, Mission and Wenatchee. The present plans are to develop 1,000 horsepower.

The Zumbro Electric Light and Power Company has been formed to establish a power plant on the Zumbro River at Millville, Minn., and transmit electric power to Winona, Minn., a distance of 40 miles. The company can secure about 5,000 horsepower from the falls at Millville, and can secure as much more in the river above and below the falls.

An electric fire-alarm system is projected by Walter Clayton at Pipestone, Minn. He proposes to have boxes established and connected with a bell which shall ring continuously for 30 minutes when an alarm is turned in.

The council of Eldon, Iowa, contemplates placing the consumers there on the meter system. The plant is not self-sustaining, and the council proposes to make it so, as well as to improve the service.

The council of Sheboygan, Wis., is considering the matter of the city owning an electric-lighting plant.

Regina, N. W. T., proposes a new charter which will permit the municipality to borrow moneys for the construction of an electric-light plant, waterworks and other enterprises. R.

Among the Rockies.

Salt Lake City, January 16.—The extension of the franchise asked for by the Missoula (Mont.) Light and Power Company has been so vigorously opposed by the citizens of that place that C. H. McLeod, president of the company, announces that the company will withdraw its request.

The Sheridan (Wyo.) Electric Light and Power Company has been incorporated at that place. The object of the company is to light the city.

Two large power plants will soon be built between Florence, Colo., and Colorado Springs by the Woods Investment Company, to furnish light and power to the mines of Cripple Creek, water to Victor and Cripple Creek, and power to the Cripple Creek street railway. Water rights have been purchased from ranches on Beaver Creek, but a contest is expected, as Chicago men have recently filed on the ground.

It is probable that a new Independent electric-light company will be formed in Dillon, Mont., where capitalists have been visiting the Lavell Springs near Ryan's Canyon. The power will have to be transmitted 10 miles.

The properties of the Great Falls Electric Light and Power Company, the Great Falls Street Railway Company and the Boston and Great Falls Land Company, all of Great Falls, Mont., are about to pass into the hands of W. C. Conrad, a banker of that place, who will leave for the East to complete the deal in a few days. The consideration is nearly half a million. G.

PERSONAL.

Willis L. Moore, chief of the United States Weather Bureau, has been elected a member of the Royal Meteorological Society of London.

W. S. Dimmick has been appointed general manager of the Seattle-Tacoma interurban electric-railway line in place of G. W. Dickinson, resigned.

Theodore P. Gilman, first deputy state controller of New York state, has resigned his office, to accept the presidency of the General Electric Inspection Company of New York city.

Manager of Sales F. L. Hutchinson of the Christensen Engineering Company of Milwaukee visited Chicago last week. Mr. Hutchinson is now establishing a branch office for his company in Chicago.

Mr. Frank Welz, who has been for several years in the service of the Allgemeine Elektricitaets Gesellschaft of Germany, as electrical engineer, has accepted a position as technical clerk in the Department of Electricity at the St. Louis Exposition, where his acquaintance among the foreign electrical manufacturers will prove of value in interesting them in the World's Fair.

Professor W. E. Goldsborough, chief of the Department of Electricity of the St. Louis Exposition, is in the East, where he will spend several weeks in the interest of his department. Cincinnati, Pittsburg, Philadelphia, Baltimore, New York and Boston will be visited. While in New York Professor Goldsborough will have headquarters at the New York office of the Louisiana Purchase Exposition at 2134 West Thirty-fourth Street.

Anthony N. Brady, George Knapp and C. K. G. Billings, who went to Paris to look over the gas and electric-light situation there, with a view of a merger of several companies, have returned to this country, but will revisit Paris, it is said, in March. Dr. Revay, who is seeking to obtain a gas charter from the municipality of Paris, is not, he says, connected with the Brady group of capitalists, but represents other American financiers, who contemplate a new plant and new methods.

E. P. Townsend has resigned his position as electrician of the plant of the Youngstown Iron Sheet and Tube Company at East Youngstown, Ohio, to enter the employment of the United States Steel Corporation.

Included in the appraisement of the personal estate of the late John W. Mackay were various electrical securities, valued as follows: Sprague Electric Company, $279,500; American Telephone and Telegraph Company, $513,480; Commercial Cable Company, $1,071,578; Telephone and Telegraph Company, $47,135; Commercial Cable Company (bonds), $475,000. The estimated net value of the personal property, all of which goes to his son, Clarence H. Mackay, is $2,451,726.

There seems to be some misunderstanding about the coming of Professor J. J. Thomson of Cambridge University, England, to Columbia University. A statement to that effect was made in the Western Electrician of last week, but the London Electrician of January 9th says: "The Standard and some other papers announced on Wednesday that Professor J. J. Thomson, F. R. S., had been appointed head of the department of physics at the Columbia University, New York, but in reply to our inquiry Professor Thomson has wired as follows: 'Standard statement incorrect; not leaving Cambridge.'"

W. R. Brixey, of Kerite fame, who was seriously and permanently injured by the explosion in the subway in Park Avenue, New York, while sitting in his room in the Murray Hill Hotel on January 27th of last year, has begun a suit for $100,000 damages in the United States Circuit Court. Mr. Brixey has made John B. McDonald personally and the Rapid Transit Subway Construction Company and the city of New York defendants to his suit. On the morning of the explosion Mr. Brixey was reading a newspaper in the hotel in a room on the third floor, facing Park Avenue. When the explosion occurred he was thrown violently from his chair, the windows were blown in, and the furniture was destroyed. Mr. Brixey was found insensible, and was taken to the German Hospital, where he was operated upon on three different occasions. He remained in the hospital several months.

ELECTRIC LIGHTING.

Nicollet, Minn., as the result of a recent election, is to have an electric-lighting system.

J. W. McClure has been granted a franchise to erect and operate an electric-light plant in Assumption, Ill.

The Delta Electric Light and Power Company of Jackson, Miss., has increased its capital stock from $50,000 to $100,000.

The City Council of Wilmington, Ohio, has granted a franchise to the United Water and Light Company to light the town for a term of years.

City Electrician McKeith of Milwaukee, Wis., says in his annual report, that it has cost that city during the last year $1,508.92 to blaze forth to strangers the word "Welcome" from the tower of the city hall.

The Central Valley and Highland Mills Electric Light and Power Company of Montgomery, N. Y., has been incorporated with a capital of $140,000. The directors are W. H. Cowan and W. L. Dickerson of Montgomery, and Charles Rivenburg of Walden.

The Greenville Gas, Electric Light, Power and Fuel Company and the electric-light and gas plants of Greenville, Mich., are to be merged, the properties having been acquired by Henry Idema and Walter C. Winchester of Grand Rapids and John J. Foster of Greenville.

Upon the receipt of a check for $900,000 the United Railways and Electric Company of Baltimore handed over to the Electric Lighting Company the entire common stock of $2,000,000 and the bonds and stocks of the Mount Washington Electric Lighting Company. The significance of this transaction lies in the fact that it is considered the initial step in the $10,000,000 project electrically to develop the waterpower of the Susquehanna River and transmit the same to Baltimore, Philadelphia and Wilmington.

ELECTRIC RAILWAYS.

The Village Board of Wauconda, Ill., has granted a 50-year franchise to a Chicago company to operate an electric railway through that village.

Plans are being formulated for an electric railway from Great Falls, Mont., to Choteau, by the way of Farmington, on the Burton branch, a distance of 60 miles. Eastern capitalists are behind the project.

Dr. Samuel F. George, president of the Cincinnati, Dayton and Fort Wayne Railway Company, states that the surveys are all completed for the line, and the work of construction will be commenced in a short time. The road will be of the third-rail system and will be double-tracked throughout. It will go from Cincinnati to Dayton by way of Westwood, Miamitown and Hamilton. It is proposed to run through, fast trains, cars that will stop at all stations and local cars which will stop any place. A freight service is also contemplated, and trains of 10 or 15 cars will be used for this.

Homer B. McKinley of Clarksburg, W. Va., has made arrangements to incorporate a company to build an electric line from Salem to Adamston, where it will connect with the Clarksburg and Fairmont Street Railway Company. The capital of the company is to be $300,000, and it it is said that it has already been financed.

An agreement is said to have been reached by the representatives of the Toledo and Western, the Garrett, Auburn and Northern Indiana and the Chicago and Indiana Air Line Railway Companies for a through electric service between Toledo and Chicago. The Toledo and Western road has already been constructed as far as Fayette, Ohio, near the Indiana state line. The project is being pushed by a syndicate headed by Judge C. M. Stone, Luther M. Allen, and J. E. Seagraves of Cleveland, who are building the Toledo and Western. The road will pass through Goshen and South Bend, Ind.

AUTOMOBILES.

The Electric Transit Company, to operate vehicles propelled by electricity or other power in New York city, with capital of $5,000, has been incorporated in New York. The directors are John Mills, Thomas Steeley and Frank E. Taylor, New York.

According to a census bulletin, 4,192 automobiles were made by 109 manufacturers in 1900. They were valued at $4,899,443, or an average of $1,168 to the vehicle. Of the total of 4,192 there were 1,579 electric vehicles, valued at $2,873,464, or about $1,820 each. The 1,681 steam vehicles manufactured were valued at about $683 each, and the 936 gasoline vehicles at about $937 each.

SOCIETIES AND SCHOOLS.

The register of Lehigh University, South Bethlehem, Pa., just issued, shows the attendance of 581 students, from 27 states and six foreign countries. There are 52 in the teaching staff. Twelve courses of instruction are offered at the university, and 105 students take the course in electrical engineering.

The 1902-1903 catalogue of the University of Vermont and State Agricultural College, Burlington, Vt., is a book of 143 pages and contains all the information concerning the institution, classes, courses, faculty and students usually published in catalogues of this nature. William H. Freedman is professor of electrical engineering.

An example of the instruction papers issued by the American School of Correspondence of Chicago is the school's textbook on perspective drawing, which has been prepared by Prof. W. H. Lawrence, associate professor of architecture at the Massachusetts Institute of Technology. The book consists of 71 pages and several plates and has been excellently prepared with illustrations and problems for the instruction of correspondence students.

Wellesley College is to have, through the generosity of John D. Rockefeller, an entirely new and up-to-date power plant. Apparatus will be installed for heating all the buildings on the college grounds, which extend over several acres, and the grounds will be lighted by electricity throughout. Electric motors also will be used for operating elevators and blowers for ventilation purposes. Mr. Rockefeller has recently purchased from the Westinghouse company, for this plant, two alternating-current, engine-type, two-phase alternators, separately excited, one of 150 kilowatts, and one of 75 kilowatts; also a five-panel switchboard.

SPACE TELEGRAPHY.

A news dispatch from Cherbourg, France, states that the authorities there have seized a space-telegraphy station erected on the promontory by a private company. The seizure was made on the ground that it is an infringement on the state monopoly of the telegraphs and endangers the national defense.

The tests of the DeForest-Smythe wireless-telegraph system, which a board of experts has been conducting between the navy yard at Washington and the Naval Academy at Annapolis, were recently concluded. The speed of transmission attained, it is stated, was 35 words a minute. Four foreign systems have been tested from this same range by the Navy Department. The Navy Department will purchase a working outfit of the DeForest-Smythe system as a result of the tests.

A chess match by space telegraphy between voyagers on transatlantic liners is a late innovation for the entertainment of passengers. Recently the steamers Lucania and Philadelphia got into wireless communication, and a challenge from the former for a game of chess was promptly accepted by the latter. Two teams were quickly formed, that of the Philadelphia being all-American, while the Lucania's team was all-British. The Philadelphia team was victorious, their opponents resigning after 12 moves. Much interest was manifested in the playing and the promptness with which the moves were made was surprising.

MISCELLANEOUS.

At a recent meeting of the Chicago City Council an ordinance was introduced for a franchise for the Chicago Electric Protective Company, which wishes to do a fire and burglar-alarm and watchman's-service business in the city. The ordinance was referred to a committee.

Thomas Atkinson, a farmer near Green Bay, Wis., has arranged for an electric plant on his land, and will secure his power from the trolley line of the Fox River Electric Railway Company. The current obtained will operate a large motor, which will be used in cutting feed, grinding, etc. The house will also be lighted by electricity.

Some of the German technical journals attribute a large part of the prosperity of particular iron works in Germany to the greater use which they make of electric machinery driven by large gas engines using blast-furnace gas, rather than a large number of isolated steam engines scattered around the works.

Heschus, a Russian experimenter, according to the Revue Scientifique, has shown that a polished metallic substance is always positively electrified with regard to an unpolished surface of the same substance. The same rule is said to apply to other substances, for instance, of two slabs of wood cut from the same piece one cut parallel to the fibers is always positive to one cut crosswise. Of two plates of various metals, the softest is positive, while nonmetallic bodies are more positive as they become harder.

Some rather remarkable results are said to have been obtained in the Boston (Mass.) City Hospital by the use of the X-rays. Faces scarred with surface cancers have been healed, it is asserted, and skin diseases have been cured. Some of the cancerous growths cured had been previously operated upon with the knife unsuccessfully. The effect of the X-rays seems to be to soften the surface cancer, and repeated applications of the X-ray heals them perfectly, it is said. Investigations are going on, and the doctors hope to cure internal cancers.

TRADE NEWS.

At a meeting of the board of directors of the Allis-Chalmers Company of Chicago, held on January 15th, the regular quarterly dividend on the preferred stock was declared.

The Electric Light Company of Jasper, Ala., J. M. Crawford, manager, is in the market for dynamos, switchboard, engines, transformers, boilers, pumps, incandescent lamps, poles, etc.

The Carter, Lombard, Carter Company of Jackson, Mich., has been incorporated by George W. Carter, E. C. Lombard and P. L. Carter, to carry on a general power and lighting-equipment business.

The Bailey Light and Water Company, Madisonville, Ky., wants one 150-kilowatt alternating dynamo, one 250-horsepower engine, switchboards, transformers, incandescent and arc lamps, boilers, poles, etc.

The Norman Milling and Grain Company of Norman, Okla., is reported to be in the market for one dynamo of 90 to 100 kilowatts, a rheostat, 2,000 incandescent and 50 arc lamps, a switchboard, 200-horsepower engine, 15 meters, 15 transformers and 250 cedar poles. C. F. Penny, Osborn, Ohio, is said to be in the market for seven 150-horsepower boilers, three engines of 150, 350 and 500 horsepower each, with pump and heaters.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department in Washington, D. C., until 2 p. m. on February 25th, for the installation of a conduit and electric-wiring system for the postoffice building at Creston, Iowa, in accordance with drawings and specifications, copies of which may be obtained at the office referred to or at the office of the superintendent of construction at Creston, Iowa.

The Menominee (Mich.) Electric Light, Railway and Power Company is reported to be in the market (for shipment before February 15th) for two 300-kilowatt dynamos and switchboard apparatus. The Janesville (Wis.) Electric Company is to erect a new plant (combined waterpower and steam) and will need turbines, boilers, engines, generators, etc.

William F. Brewster, 29 Broadway, New York, announces to the trade that the license heretofore granted by him to the Electric Motor and Equipment Company of Newark, N. J., for the manufacture, sale and rental of the inventions covered by the patents known to the trade as "Brewster's universal sign receptacles" has been legally terminated. Mr. Brewster adds that an improved type of the Brewster universal sign receptacle will soon be offered to the trade.

David W. Eyman, the popular general manager of the Century Glass Company of Bellaire, Ohio, has resigned from that company. Mr. Eyman has been with the Century company for some time, and his executive ability and salesmanship were shown in last year's large addition to the company's factory facilities; the sum of $30,000 was invested in improvements to increase the output. Mr. Eyman will give himself a short vacation before again entering the field.

The directors of the Stanley Electric Manufacturing Company of Pittsfield, Mass., at a meeting held on January 10th, passed a resolution providing that the capital stock of the company be increased from $3,000,000 to $10,000,000. The stockholders will meet on February 11th to approve this action of the board. Plans for this great increase of facilities have been under way for some time, to the end of placing the company on a basis to compete favorably with the other great electrical manufacturers. Rumors have also been current ever since the acquirement by William C. Whitney and his associates of an interest in Stanley stock to the effect that negotiations were under way for the sale of control of the company to the General Electric Company. The authoritative statement is now made that these rumors have been founded on nothing more than a misunderstanding of what really was taking place. It will be remembered that the Stanley company recently secured an order from the New York Edison Company, aggregating over half a million dollars for dynamos and other electrical apparatus, some of which is to be the largest of its kind ever constructed. This indication that the Stanley company is invading the field of heavy work is now amply verified. Moreover, funds will be provided by this increase of capital for certain important developments which the engineers of the company have been planning for some time. Among these developments is a new system of operation for heavy long-distance electric railways, which is said to possess marked advantages over systems previously experimented with.

BUSINESS.

A. E. Whitmore, the well-known pole dealer of Minneapolis, Minn., is distributing to his friends and customers an attractive calendar which has brought him many complimentary letters.

The Electric Appliance Company, Chicago, has been appointed general sales agent for the Toler system of conduit boxes. This line of boxes is extensive enough to meet every possible condition, no matter what size, shape or style. A complete catalogue, now in press, will be ready for distribution in a few days. It will be mailed upon application.

The entire power equipment of the Slater Cotton Company of Pawtucket, R. I., was recently purchased by the Whitehead Machinery Company of Davenport, Iowa. The equipment, which will remain in service four or five weeks, comprises 300, 400 and 750-horsepower Corliss engines, large Babcock & Wilcox boilers and the usual accessory machinery. The purchaser will offer the property for sale.

The Pittsburg Gage and Supply Company of Pittsburg, Pa., is equipping two 3,000-horsepower Allis engines of the Pittsburg Steel Company, Monessen, Pa., plant with the White Star continuous-oiling system. Other contracts are the equipping of three 400-horsepower engines for the Clairton Steel Company, Clairton, Pa., and six 500-horsepower engines in the electric-light and power plant of the Union Depot, Pittsburg, Pa.

The John A. Stewart Electric Company, Cincinnati, Ohio, is doing a large business in second-hand machinery. This company carries a choice assortment of generators, motors, controllers, transformers and other electrical apparatus, besides engines, boilers, etc. The company states that it is in a position to make attractive prices, and it will be pleased to give further particulars to prospective users of second-hand apparatus.

The Mechanical Boiler Cleaner Company of Chicago has just received a letter from the Omaha and Council Bluffs Railway and Bridge Company, stating that the Garrigus cleaners put in its boilers in 1898 are still working perfectly. The company also says that the cleaners are essential to the economical operation of any boiler, and that it has found that by using the cleaners, the boilers are more efficient and expense greatly reduced.

The Chicago, Milwaukee and St. Paul Railroad Company announces low second-class colonist rates from Chicago to San Francisco, Los Angeles, Portland, Tacoma, Seattle and many other Pacific Coast points, via the Union Pacific line, every day from February 15th to April 30th. The road also gives low rates to the Northwest via this route or via St. Paul. F. A. Miller, general passenger agent, Chicago, will furnish additional information.

The Charles E. Dustin Company, 11 Broadway, New York, buyer and seller of all kinds of electrical and steam machinery, reports a most flourishing business. The company has on hand a good assortment of direct-connected units of various sizes, alternators from 10 horsepower to 300 horsepower, railway generators from 80 kilowatts to 500 kilowatts and arc generators from 45-light capacity up. It also has a large assortment of arc lamps in good working order, besides various makes of steam engines. The company has just issued a new catalogue, which it will be pleased to mail to those interested.

The Allis-Chalmers Company of Chicago took the following foreign orders during December: Fraser & Chalmers, Ltd., England, one 16 by 48 left-hand Corliss steam cylinder engine; Aktiebolaget Prospector, Finland, one standard single-drum portable hoisting engine; Traybold & McDonald, Alaska, one duplex double-acting Riedler pump, driven by a cross-compound, condensing 12 and 24 by 30-inch Corliss engine; Green Consolidated Copper Company, Mexico, one duplex differential Riedler pump, plungers, five and seven by 42, driven by horizontal cross-compound, condensing Corliss engine; Hempel Brothers Milling Company, Molucca, Mexico, one 66 by 18 horizontal boiler. Among the company's engine sales in this country during the month were the following: Pettibone-Mulliken Company, Chicago, one 24 and 40 by 48 cross-compound, direct-coupled Reynolds-Corliss and one air compressor; George A. Fuller Company (for Bellevue Stratford Hotel), Philadelphia, Pa., three 22 by 42 Reynolds-Corliss; American Locomotive Company, Schenectady, N. Y., one 16 and 32 by 42 tandem-compound, direct-connected Reynolds-Corliss and one 16 and 32 by 36 tandem-compound belted Reynolds-Corliss; Transit Development Company, Brooklyn, N. Y., two 42 and 22 by 60 vertical cross-compound, direct-connected Corliss.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 13, 1903.

718,068. Electric Railway. Frank M. Ashley, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 26, 1898.

In the system are combined two line conductors, two parallel sectional working conductors, connections between the line and working conductors, and electromagnetic switches in each of the connections, the circuits through the actuating coils of the switches being completed in shunt to the car motors successively by the passing car, the shunt relationship being maintained while the motors are receiving current through the switches controlled by the coils in the circuits.

718,069. Electric Railway. Frank M. Ashley, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 26, 1898.

This system has main and return conductors, two sets of sectional working conductors or heads, branches from the main conductors to the sets of sectional conductors or heads respectively, and electromagnetic cut-outs in the branches, the coils of the cut-outs in corresponding branches of the two sets being electrically connected in series with each other.

718,071. Electromechanical Automatic Signaling and Collision-preventing Device. Charles S. L. Baker, St. Joseph, Mo. Application filed August 25, 1902.

The locomotive wheel in passing closes the circuit through a contact device and actuates alarms and indicating mechanism.

718,076. Battery. Louis Begeman, Cedar Falls, Iowa. Application filed January 7, 1902.

The battery has a containing vessel adapted to form the positive-pole electrode, a depolarizing agent forming a lining for the cell, a lining of wire gauze or netting, in the interstices or meshes of which the depolarizing agent is partially embedded and supported, a protecting shield covering the gauze, and a negative-pole electrode situated within the vessel.

718,083. Generating Alternating Currents. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1896.

718,084. Generating Alternating Current. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 22, 1896.

718,093. Telephone Jack. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed May 8, 1902.

The jack consists of a rubber front strip, a back strip comprising upper and lower sheets of rubber and an intermediate strip of metal, and a number of jack-springs suitably arranged and clamped upon the back strip.

718,135. Electric Coffee Roaster. George C. Lester, New York, N. Y. Application filed March 8, 1902.

See page 68.

718,177. Controller for Electric Motor-driven Pumps. Thomas Trolsen, Brooklyn, N. Y. Application filed July 5, 1902.

The controller combines a pilot electromagnet, two independent contact-plates on the core of the magnet, a mercury cup, a contact therefor and means to control the movement of the contact, a circuit including the magnet and cup, a circuit controlled by the contact-plates and a motor included in the circuit.

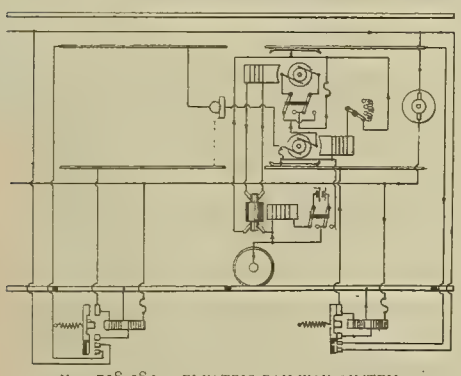
718,182. Electrically Controlled Organ Bellows. Eddy R. Whitney, Lynn, Mass., assignor to the

General Electric Company, Schenectady, N. Y. Application filed June 21, 1901.

Combined with a bellows are an electric motor for maintaining air pressure, a snap-switch in the motor circuit, means for detaining the switch at determinate positions of the bellows, and a spring put under tension by an opening movement of the bellows, to operate the switch rapidly and cut out the motor.

718,183. Electric-railway System. Granville T. Woods, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 30, 1896.

Series of working contacts or conductors upon the line of way and electromagnetic switches for controlling the current thereto are combined with three contact-makers carried on a car and arranged to engage with the working contacts, and connections from one of these contact makers to each of the others, the car motor in one of these connections and a source of counter electromotive force consisting of a motor-armature in the other in series with a coil of the switch-magnet for controlling the flow of current to the switch magnet. (See cut.)



NO. 718,183.—ELECTRIC-RAILWAY SYSTEM.

718,205. Electric Battery. Miller R. Hutchison, Upper Montclair, N. J., assignor to the Hutchison Acoustic Company, New York, N. Y. Application filed April 5, 1902.

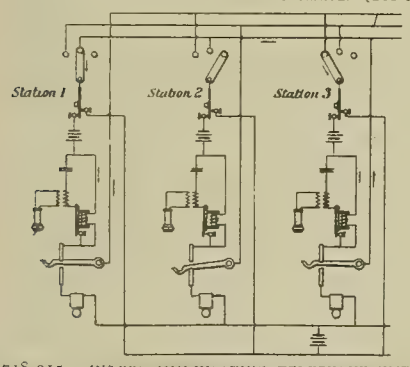
A battery cell having a reservoir for free liquid is provided with electrodes located outside the reservoir and absorbent material in contact with the electrodes, the absorbent material projecting into the reservoir to convey the liquid therein to the electrodes.

718,212. Electromechanical Movement. Egbert S. Lorimer, Piqua, Ohio. Application filed March 8, 1902.

The movement comprises a driving device, a driven device, a clutch or coupling between them, a magnet for keeping the members of the clutch coupled, a circuit for the magnet and means controlled by the driven mechanism when it has been moved to the predetermined or desired extent for changing the circuit so as to uncouple the driving and driven devices.

718,215. Telephone System. Isaac H. Parsons, Leicester, and Thomas Sloper, Devizes, England. Application filed February 28, 1902.

An intercommunication system of telephones is described. It combines a series of stations, a home line for each station connected with contact-points at other stations, a switch at each station for connecting with the contact-points, a normally inoperative receiving apparatus at each station and an electrically operated circuit-controller at each station for throwing the receiving apparatus out of and into operation. The circuit through the circuit-controller is normally open at the switch of each station so that the circuit-controllers will not be operated until the switches of the calling and called stations are connected each with the home line of the other station. (See cut.)



NO. 718,215.—INTERCOMMUNICATING TELEPHONE SYSTEM.

718,220. Conductor, Conduit and Collector for Electricity on Railways. Robert C. Sayer, Bristol, England. Application filed October 7, 1901.

The invention consists of a wheel formed as a box with ends and a periphery suspended over a hollow-toothed rail. Teeth on the wheel engage with teeth on the rail. Slots and slide blocks on the wheel are formed so that on its rotation a chamber is thrust down and meets and opens on a valve in the rail in a vertical position and remains in the position until withdrawn by the further rotation of the wheel.

718,224. Intercommunication Telephone System. Thomas Sloper, Wilts, and Isaac H. Parsons, Leicester, England. Application filed April 18, 1902.

In the system are combined a number of stations, each having a receiver, a circuit for the receiver extending to the other stations, and a transmitter at all times entirely disconnected from the receiver circuit, and adapted to be connected to the receiver circuit of another station.

718,233. Electric-signal System for Railways. James W. Williams, Spokane, Wash. Application filed May 7, 1902.

The system comprises main or feed wires, a signal circuit and electrically operated signal appliances therein and an establishing circuit between the signal circuit and the feed wires completed initially through normally open contacts adapted to be temporarily closed by a passing train.

718,235. Polarized Telephone Signal Bell. Ernest E. Yaxley, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed March 13, 1901.

The bell comprises a permanent magnet, a pair of electromagnets having projecting cores, a yoke through which the cores project, adjusting devices for causing a bodily movement of the yoke upon the cores, an armature pivoted upon and outside of the yoke, a pair of gongs, and a striker mounted to vibrate with the armature.

718,249. Electrolytic Apparatus. Max Haas, Aue, Germany. Application filed August 6, 1901.

Bipolar electrodes divide a vessel in several compartments, and long, narrow channels manufactured of an insulating material connect these compartments, the channels forming the only liquid connection between these compartments.

718,254. Machine for Making Pipe Molds. James Ingham, Joseph Poulson and John W. Moore, Phillipsburg, N. J., assignors to the Warren Foundry and Machine Company, Phillipsburg, N. J. Application filed January 29, 1902.

In the molding machine are combined a stamp, a driving member comprising a vertically reciprocating frame, and an electromagnet moving with the frame and adjustably mounted thereon and coacting with the stamp to raise the latter as the frame moves upward.

718,264. Attachment for Telephone Mouthpieces. John F. Logue, Sacramento, Cal. Application filed September 8, 1902.

A spring-wire frame is arranged to form a support to hold a sheet of paper against the open end of the mouthpiece.

718,310. Telephone Transmitter. Charles C. Cadden, Cleveland, Ohio. Application filed September 8, 1902.

In the transmitter, combined with the speaking diaphragm thereof, are an electrode attached thereto, an electrode chamber in which the electrode is movable, and a yielding medium interposed between the chamber and the speaking diaphragm.

718,332. Visible-signal Telegraph. William A. Farrell, Wellsville, N. Y., assignor of one-half to Jacob Rauber, Wellsville, N. Y. Application filed April 7, 1902.

The telegraph comprises a switchboard provided with a number of omnibus bars, and a number of wires leading thereto, a number of pull-down switches, each provided with contacts and connected with the bars, a number of lamps connected with the contacts of the switches, and controllable by movements of the switches, and a source of electricity for energizing the lamps. (See cut.)

718,334. Igniter Apparatus for Gas Engines. William P. Flint, Pittsburg, Pa., assignor to the Westinghouse Machine Company. Application filed June 26, 1902.

Combined with a dynamo, a secondary battery and an igniting device is a switchboard having a spark-coil and switches so constructed and arranged as to connect either or both of the sources of energy with the coil and igniting device.

718,371. Coil Box for Telephones. William E. McCormick, Chicago, Ill., assignor to the International Telephone Manufacturing Company, Chicago, Ill. Application filed May 4, 1901.

The coil box consists of a base, an induction coil supported thereon and carrying binding posts, and a cover hinged to the base at one side and provided with a pivoted transmitter arm.

718,378. Insulating Lining and Process of Making Same. George B. Painter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 6, 1898.

A lining for lamp sockets consists of a single piece of insulating sheet fiber shaped by molding to have a shoulder intermediate its length and with the sections on opposite sides of the shoulder of different diameters.

718,405. Electric Cut-out. Charles Wagner, Brooklyn, N. Y., assignor to Edward F. Caldwell & Co., New York, N. Y. Application filed June 25, 1902.

A contact-supporting block of insulating material is rigidly attached to a standard or support, and a contact-carrying block is mounted to rotate on the standard. The casing and the rotary block are rotated together to make or break the circuit upon rotating the parts in one direction only.

718,437. Method of Manufacturing Electrolytic or Electric-light Carbons. Herbert H. Dow, Midland, Mich. Application filed November 6, 1899. Renewed April 13, 1901.

The process of manufacturing carbons consists in mingling comminuted carbonaceous material with a binder in the form of a vapor or gas and having a temperature greater than that of the carbonaceous material, permitting such material to settle, and molding and baking the resultant deposit.

718,438. Method of Manufacturing Electrolytic or Electric-light Carbons. Herbert H. Dow, Midland, Mich. Application filed November 6, 1899. Renewed April 13, 1901.

This process consists in placing together powdered carbonaceous material, an emulsion consisting of suitable binder and a liquid in which the binder is insoluble or not readily soluble, mixing such material and emulsion, and subsequently abstracting the liquid from such mixture.

718,455. Method of Treating Glowers for Direct-current Electric Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed March 23, 1901.

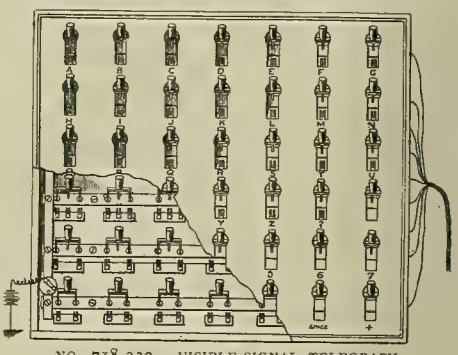
The method consists in first heating the glowers to conducting temperature and then transmitting through them a normal or overload alternating current.

718,460. Combined Switch and Protecting Device. Harry H. Hornsby and Edward W. Anger, Jr., Chicago, Ill. Application filed November 25, 1901.

Combined with a snap-switch having an insulating base are terminal contacts mounted upon the base, enclosed protective devices also mounted upon the base and adapted to be electrically connected with the contacts, and electric conductors suitably connecting the contacts with the terminals of the switch and located in slots or grooves in the back of the insulating base.

718,489. Secondary Battery. Jacob W. Madigin, Toronto, Canada. Application filed February 5, 1902.

In the battery are an electrode comprising a folded and perforated sheet of lead, two portions of the fold being separated to contain the active material and bent to form a tubular grid, and a post to the opposite sides of which the folded end of the double plate and the free end of such plate are fixed.



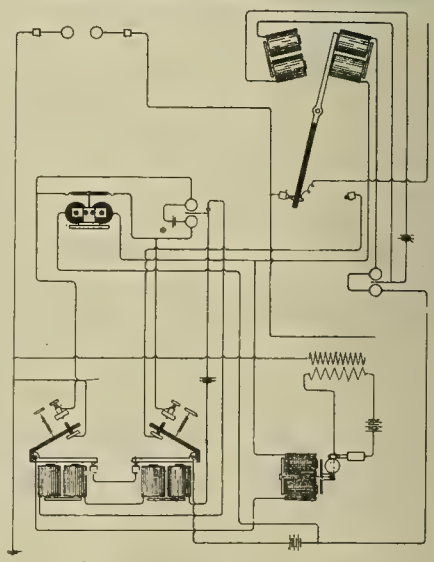
NO. 718,332.—VISIBLE-SIGNAL TELEGRAPH.

718,518. Electric Motor. Edwin S. Pillsbury, St. Louis, Mo. Application filed July 24, 1902.

In the motor, combined with a commutator, are brushes therefor, a short-circuiting device co-operating with the commutator and normally out of contact therewith, a centrifugal device for moving the short-circuiting device into position to engage the commutator segments, springs for holding the brushes in contact with the commutator segments, and means operated by the centrifugal device for engaging the springs and relieving the brushes of tension.

718,535. Wireless-telegraph Repeater. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring and the Consolidated Wireless Telegraph and Telephone Company, Philadelphia, Pa. Application filed June 11, 1902.

The repeater comprises a wave-responsive device and relay controlled thereby, a circuit controlled by the relay for insulating the wave-responsive device and for simultaneously closing the circuits, means for restoring the wave-responsive device, and means for the generation of re-transmitted energy. (See cut.)



NO. 718,535.—WIRELESS TELEGRAPH REPEATER.

718,544. Telegraph System. Edwin R. Storm, New York, N. Y. Application filed July 30, 1897.

The system comprises a transmitting instrument having levers operated by the movement of a perforated strip, and means as a make-and-break controlled by the levers, and an induction coil, whereby on the movement of the perforated strip electric impulses of like polarity, but of varying duration are caused to induce momentary currents of alternately opposite polarity of equal duration but at irregular intervals.

718,588. Electric Motor or Generator. John A. Titzel, Sr., Franklin, Pa., assignor of one-third to James C. Titzel, Glenshaw, Pa. Original application filed December 13, 1900. Divided and this application filed March 26, 1902.

REISSUE.

12,073. Wireless Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor to the Consolidated Wireless Telegraph and Telephone Company. Application filed November 8, 1902. Original No. 700,250, dated May 20, 1902.

In the system are combined in a terminal station an aerial conductor, a transmitting instrument, a receiving instrument, an electromagnetically operated and spring-returned means connected to the conductor, and a switch to make a circuit, which energizes the means to connect the transmitting instrument to the aerial conductor, the spring at other times causing the receiving instrument to be connected to the aerial conductor.

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F. W. Bowen, President Northwestern Electrical Association.

At its annual convention in Milwaukee last week the Northwestern Electrical Association chose for its president for the ensuing year F. W. Bowen of Kenosha, Wis. Mr. Bowen has been a member of the association for about six years, and during that time has been one of its most enthusiastic and valuable members. As has been especially shown at the last two conventions of the Northwestern association, he has been a power on the floor. His keen insight into business principles and his familiarity with general central-station problems have led him to speak frequently, adding to the value of the discussions and tending to promote measures which would be helpful to the association and its members.

In accepting the honor of presiding officer he voiced his interest in the association as follows: "I can assure you at the present time that whatever is to the interest of this association, as an association, whatever will best conserve its interests and will best elevate the association, I shall do if within my power. I am not at all unmindful of the honor which has been so kindly thrust upon me. I assure you that though at times I may express myself more fully than I should upon some of the questions that are brought before the association, it is not with a view of bringing myself to personal notice, but it is with a view solely and only of bringing out, if possible, the points and I think are of value to the association."

Frederick William Bowen is a native of Chicago and has lived here the greater portion of his life. He was born in 1849 and received his education in the grammar and high schools of the city. His first connection with the lighting business occurred at the time when Captain Eads was building the bridge across the Mississippi River at St. Louis. The question of suitably lighting the caissons of the bridge came up. This was before the advent of the incandescent lamp, and the forms of illumination then in common use could not be used in the caissons on account of the high atmospheric pressure. Finally the oxyhydrogen light was brought into use, and Mr. Bowen had much to do with its introduction at that time. From that period to the present Mr. Bowen has been connected with various gas and electric-lighting developments in St. Louis, Chicago and other cities. At one time he was an inspector for the fire underwriters, his territory being the Northwest. He always maintained a residence in Chicago until about two or three years ago, when he moved his family to Kenosha, Wis., where his business interests have been centered during recent years.

It was about six years ago when Mr. Bowen went to Kenosha and took up the gas plant there and rebuilt it. Three years afterward he bought the old Schott electric-lighting and heating plant and consolidated the systems under the management of the Kenosha Gas and Electric Company. Mr. Bowen is secretary and manager of the company and James Cavanaugh is president, while R. N. Kimball, a member of the Northwestern Electrical Association, is the vice-president and superintendent of the company. Kenosha is a city of 12,000 people, and Mr. Bowen's company furnishes a regular electric-lighting and power, as well as a gas service. An alternating-current system is used except for contract street lights. The company is about to begin furnishing power for the operation of the electric-railway in Kenosha and vicinity, which has been built by B. J. Arnold of Chicago. This railway connects with the Kenosha-Milwaukee line and will shortly be extended to Waukegan, to connect with the Chicago railway.

Besides his connection with the active operation of the Kenosha central station, Mr. Bowen has a wide practice in consulting work, being frequently called to examine and investigate and make engineering reports on electric and gas plants all over the country. His duties in this line take up a considerable share of his time. Mr. Bowen is also president of the Wisconsin Gas Association and is a member of the Western Gas Association. He was a director of the Northwestern Electrical Association last year, and his selection as president comes to him as a fitting and deserved compliment. Mr. Bowen is married and has two daughters.

FREDERICK W. BOWEN.

Aeronautical Engines.

President Francis of the St. Louis Exposition has received a letter from Sir Hiram Maxim, and the following extract will be of interest:

"In regard to the aeronautical part of the exhibition, I should say that as you have about 1,200 acres, you will be able to appropriate a fairly large piece of ground for this purpose. At Baldwyn's Park, where I conducted my experiments, I had a clean run of 1,800 feet, which, however, I found to be altogether too short; in fact, I was quite unable to finish my experiments there on account of the limited space at my disposal, and this notwithstanding the fact that I had 40 acres of ground.

"If there is to be an aeronautical exhibition it will be necessary to have certain buildings erected as shelters. These buildings ought to be made large enough to be useful either for flying machines or balloons, and I should say that if they had a clear width of 80 feet, a length of 100 feet, and a height of 60 feet, that would be quite ample. Each building should be provided with a pair of doors to open outward in such a manner that when they are open they form a kind of air-shield for protecting the apparatus against the wind as it emerges from the building. It will be understood that the doors are in the end of the building, so that when they are open the balloon, which fills the whole of the interior, may be drawn out. These buildings should be placed at one side of the park with a clear run free from trees and obstructions in front, the longer the better. I understand that a great number of experimenters are now at work on aeronautical apparatus to be shown at the St. Louis exhibition, but as to whether the aeronautical part of the exhibition will be a success or not is altogether another question. A true flying machine large enough to carry one man has not yet been made, although vast sums of money have been spent on experimental work. As far as dirigible balloons are concerned the French government has already spent a vast sum, and has found that it is quite impossible to make a dirigible balloon which will make headway against even a slight breeze. Santos-Dumont has perhaps done better than the French government experimenters, and I think he has gone as far as it is possible for anyone to go in the direction of dirigible balloons. Still, if we look the matter squarely in the face, I think that we shall see that even Santos-Dumont's balloon is not able to travel fast enough through the air to hold its own even against a slight breeze. So I am of the opinion that if there is an exhibition of dirigible balloons at St. Louis, that very few of them will be able to return to the point of departure. It will be found, I think, that when these balloons ascend they will travel with the wind just exactly like any other balloon, no matter which way they are pointed, and that they will descend to the earth just like other balloons, and have to be dismantled and sent back to the point of departure by some means of land conveyance.

"I do not know whether I shall attack the question again myself or not. However, in any case, I shall be pleased to send one of my steam engines to St. Louis, which I think is the lightest steam engine for its power ever made in the world. The Hon. Charles Parsons, the inventor of the steam turbine, in a lecture some years ago, said that the lightest heat engine that had ever been made in the world in proportion to the power developed, was undoubtedly the Maxim gun, which I think he said weighed 60 pounds, and developed 20 horsepower in energy. Next to this he said he would have to place my flying machine engines and steam generator, which weighed about 12 pounds to the horsepower. As a matter of fact, however, the engine that I should send to St. Louis weighs 320 pounds—this does not include the boiler—and is one of a pair that I employed. When this engine was run with 310 pounds of steam as a compound engine it developed 181 horsepower. If, however, it was used as a simple engine, both cylinders being connected direct to the boiler with high pressure in both cylinders, it would develop at least 300 horsepower. If I had given the power to these engines in the ordinary way, that is, from indicator, it would have been considerable more than 181 horsepower. The power given was actually that communicated to the screw and delivered by the screw.

"I think it will be admitted that my steam engine and boiler were very light and effective, but they required a vast quantity of water; indeed, the quantity of water was so great that even if my engine and boilers had not weighed anything at all the machine could not have been considered a success. At first it appeared to me that I should be able to condense my steam. I entered into careful mathematical computations as regards the power and lifting effect, basing my calculations altogether on formulæ which I obtained from experiments made with a very much smaller apparatus, and also from the formulæ of Professor Langley. However, it was found that a very large machine was not anything like as efficient as the small models. I had expected in the first instance that I should only require 100 horsepower, while I found by experiment that I could condense all my steam when I was running at a velocity of 42 miles an hour. When, however, I ran my power up to 362 horsepower, it was quite impossible to condense the steam. In regard to condensers, I found that with extremely thin oval tubes driven sideway through the air at the rate of 42 miles an hour, the steam for one horsepower could be condensed with one pound of copper, the temperature of the air at the time being 62 degrees F. At the time I made my experiments the steam engine appeared to be preferable to all others. Since that time, however, I should say that £1,000,000 sterling has been spent in the various countries in the world in experimental work on petroleum motors for driving motor cars, and these experiments have all been in the direction of great power and extreme lightness. The experimenter on aeronautical machines, therefore, has an advantage now which none had a few years ago. He can take the engine where the motorman has left it, and refine it still more in the direction of lightness at a comparatively small expense. The quantity of water required for keeping the cylinders of a gas motor cool is only one-seventh as much as was required to run a steam engine of the same power. It is, therefore, evident that the petroleum motor is the one which lends itself best at the present moment to experimental work on aeronautical machines."

American District Telegraph Company's Annual Meeting.

At the annual meeting of the American District Telegraph Company in New York city on January 22d the old board of directors was re-elected. President R. C. Clowry, in his report, said that there was need of a thorough overhauling of the entire plant of the company. The boxes and lines now in use needed renewal, he said, because considerable complaint had been caused among patrons by boxes failing to ring up. The gross earnings of the company were stated to be $610,042, against $624,192 in 1901; the net earnings, $96,866, against $88,648 in 1901. The total surplus was put at $98,709. The following figures were also given: Miles of wire in operation, 1,552; number of offices in operation, 85; number of instruments in circuit, 27,940; total number of messages delivered (for year), 5,223,871; total number of messages collected (for year), 2,298,036.

Automatic Voltage Regulation.[1]

By H. C. Wirt.

In order to give satisfactory electric service, where constant-potential current is furnished, the current must be supplied at almost constant pressure. A variation in pressure of only one per cent. has a marked effect in the life and candlepower of incandescent lamps. An increase in pressure of one per cent. will reduce the normal life of an incandescent lamp about 18 per cent., and will increase the candlepower six per cent. A variation in pressure will also change the speed of motors. From the above it will be seen that it is of the greatest importance to the welfare of a central station that the current be delivered to its customers at a constant voltage. It can be fairly claimed that central-station managers operating direct-current generators have given the subject of voltage regulation much closer study and are furnishing current at more nearly uniform pressure than is supplied from alternating-current stations. This is probably due to the fact that in the direct-current station the loss in pressure at full load from generator to lamp is usually about 20 per cent., while in the alternating plant the loss is about 10 per cent. The high loss in pressure in the direct-current plant has necessitated the use of feeder regulators and pressure wires, run from centers of distribution to all meters at the station, so the station attendant can constantly adjust the feeder regulators so as to maintain constant pressure at the centers of distribution. This plan of operation has given such good results that it has been found possible to use high-efficiency lamps requiring 3.1 watts per candlepower, instead of 3.6-watt lamps, as formerly used. In the alternating plants, on account of the smaller drop in the feeders, pressure wires, centers of distribution and feeder regulators are rarely used, it being generally assumed that five or 10 per cent. variation does not affect the operating of a plant materially. The majority of the alternating plants are still using lamps taking 3.6 watts per candlepower.

If the customers' circuits were supplied with current of constant pressure the output in incandescent lamps could be increased 13.9 per cent. The object of this paper is to bring to your attention some generator and feeder regulators, by the use of which central-station managers can, with small expense, supply their customers with current of uniform pressure and at the same time increase the output of their incandescent service 13.9 per cent. without any additional expense other than the cost of regulators and pressure wires.

The extensive and growing use of curve-drawing instruments has disclosed how variable the pressure is in most of the central stations of the country. No central-station manager should be without one or two of these instruments. Before attempting to regulate the pressure at centers of distribution by means of feeder regulators the main source of supply should be maintained at the proper pressure. The pressure at the generator must vary with the load, in order to overcome line losses. Generators are usually constructed to give 10 per cent. higher pressure at full load than at no load. The voltage of a generator is greatly affected by the speed and by temperature changes. From the above it can be seen that an automatic generator regulator has distinct advantages over any system of compound winding.

The first type of regulator for generators was the automatic rheostat of Mr. Edison, which was used with shunt-wound direct-current generators 15 years ago. This was used about five years, when its manufacture was discontinued in favor of the compound-wound machine. The advantage of being free from change in voltage due to change in speed and temperature was not sufficient to overcome the higher cost, as compared with a compound-wound machine. This type of regulator, to be used with modern machines, is not a success, owing to its inability to control the voltage quickly enough. In order to vary the voltage quickly, the rheostat arm would have to move a considerable distance instantly, and regulators of this type have failed to control the voltage as the service demanded. The compound-wound generator does not give proper voltage when its speed is changed, and the compound winding does not correct for temperature effects.

A generator regulator of novel design has recently been invented by Mr. A. A. Tyrrell and is about to be placed upon the market by the General Electric Company. Two types have been designed, one to be used with direct-current generators known as type-TD, and the other type-TA, for alternating-current generators. These regulators control the voltage of the generators by closing and opening a short-circuit around the field rheostat, thus cutting in and out the resistance in the field circuit of the generator, the voltage being varied by the length of time the resistance is included in circuit and out of circuit. This operation is made at a high rate of speed, varying from 50 to 800 times a minute. The movement of the contacts which switches in and out the resistance is accomplished by a relay, the motion of the contacts being about one-sixteenth of an inch.

The direct-current regulator has a control magnet, which is connected across the circuit, the voltage of which is to be regulated. A relay is located at the middle of board. The movement of the contacts of the control magnet causes the relay contacts to open and close. The relay contacts are connected to the terminals of the field rheostat of the generator. When the relay contacts are closed the field rheostat is short-circuited, which cuts out the resistance, and so causes the generator to give its highest voltage. When the relay contacts are open all the resistance of the field rheostat is inserted in the field circuit of the generator, and so causes it to give the lowest voltage, and by rapidly closing and opening the relay contacts the voltage of the generator is maintained at a constant value. This operation is done at about 800 times per minute. A condenser is connected to the relay contacts to prevent injurious sparking. The control magnet is connected by means of pressure wires to the center of distribution. A curve-drawing voltmeter, when connected to a circuit, the voltage of which is controlled by one of these regulators, will show a record as straight as if ruled with a straight edge.

The voltage of the alternating-current generator is controlled by varying the resistance in the field of the exciter. The regulator for the alternating-current generator is similar to the direct-current regulator, with the addition of another control magnet, which is connected across the exciter circuit. Fig. 1 shows the connections of the regulator for alternating-current generators, and Fig. 2 is a diagram of the working parts. In Fig. 1 (A) (B) (C) (D) are single-pole switches for four exciters in parallel on one regulator. Points (6) and (13) are connected to the condenser. The magnet on the left is the direct-current control magnet, which is connected across the exciter circuit, while the magnet on the right is the alternating-current control magnet, which is connected across the circuit to be regulated, while the relay is in the center of the board. The alternating control magnet has two windings, one which is connected across the circuit to be regulated, the other which is connected to a series transformer. The function of the second winding (CW in Fig. 1) is to build up the generator voltage in direct proportion to the current in the line, and thus compensate for the loss in the line. It has five amperes maximum capacity and is wound on the outside of the main winding and connected by posts (9) and (10) to current transformer. The compounding effect can be varied by means of two levers swinging over contact points which cut in or out various turns on the magnet. Once the regulator is adjusted, it will maintain constant potential at a center of distribution without any hand adjustment, irrespective of the character of the load. The regulation is not affected by speed changes, unless the speed is so low that the voltage could not possibly be maintained. The alternating-current and direct-current control magnets, together operate a pair of contacts known as floating contacts, which operate the relay magnet which opens or closes the shunt circuit across the exciter field rheostat as in the direct-current regulator described above. The function of the floating contacts is so to actuate the relay magnet that the voltage is maintained under all conditions of exciter and alternator voltages. These contacts bring together the alternating-current and direct-current portion of the regulator and control the voltage of both simultaneously. These contacts will usually raise from no load to full load about three thirty-seconds of an inch, while the exciter voltage may vary from 10 to 130 volts, in order to maintain the desired alternating voltage. One regulator will regulate any number of generators of any kilowatt capacity, providing they are all running in parallel and the exciters are also in parallel.

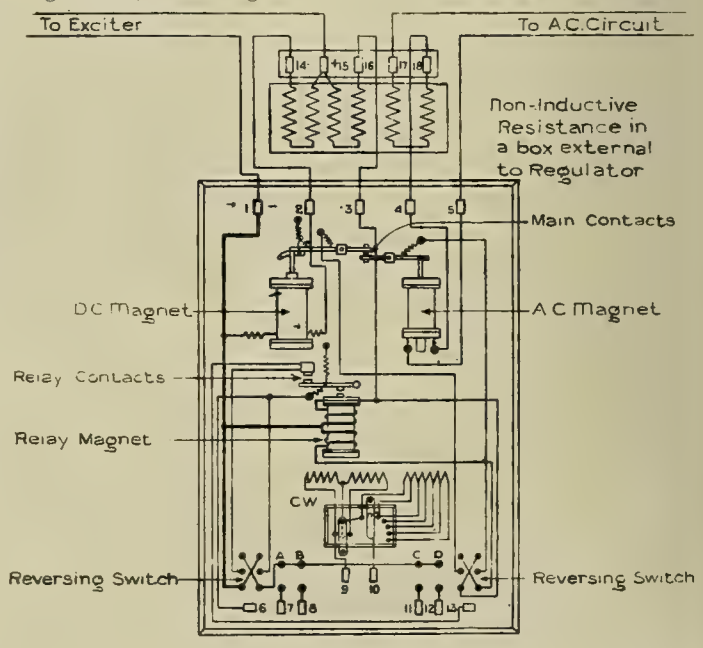


FIG. 1.—AUTOMATIC VOLTAGE REGULATOR FOR ALTERNATORS.—DIAGRAM OF CIRCUIT CONNECTIONS.

Feeder Regulation.

The voltage regulators referred to in the early part of this paper are designed to control the voltage of the generators. These regulators may be controlled by pressure wires brought back from a center of distribution, but as the distribution system from a central station is usually laid out for several centers, it is necessary to have means of automatically adjusting the voltage for additional centers of distribution.

For this purpose the automatic feeder regulator for alternating-current generators has been developed. It is usually customary to allow considerable drop in pressure from the central-station generator to the incandescent lamp or other translating device. Frequently this drop amounts to 10 per cent. of the initial voltage. With such a drop, which varies according to the load, it is manifestly necessary frequently to adjust the voltage at the central station in order to keep it at a uniform voltage at the center of distribution. At the present time this is generally accomplished by means of hand regulators, and therefore it is only imperfectly done. An automatic feeder regulator will do the work much more accurately and more cheaply than an operator with a hand rheostat.

The alternating-current feeder regulators have been made in two types, one a booster transformer of the induction type, which is similar to the well-known constant transformer, used with series arc lamps, the movement of the coils being accomplished by compressed air, operating on a piston and cylinder, the movement of the coil being controlled by a voltmeter. This type of regulator has the advantage of having no contacts, and the voltage can be very gradually varied. This type is recommended to be used in connection with generators.

Where a transformer is used in connection with a transmission plant stepping down the voltage from, say 10,000 to 2,000, a dial switch can be placed upon the transformer. The contacts can be arranged so that a portion of the winding can be cut out, thus the secondary voltage can be varied at will. The movement of the switch arm is controlled by a voltmeter, a motor furnishing the power necessary to move the switch. The voltmeter operates magnetic clutches, which apply the power to the switch. The advantage of this type of regulator over the induction type is somewhat lower first cost. The disadvantage is that the voltage has to be varied by different steps, depending upon the number of contacts employed. A variation of a volt is a little too great for the best work; therefore the induction-type regulator has advantages over the dial-switch type.

Regulators of the above types have been used in connection with waterpower transmission plants, as in such cases the drop of pressure in lines is frequently very great and the variation in voltage considerable. There seems to be a large field for the use of such regulators. In some waterpower transmission plants the variation in voltage at times has been as much as 20 per cent., which gives very unsatisfactory service to the consumers. An installation of these automatic feeder regulators has corrected the trouble and maintained almost constant voltage, so that the service is satisfactory.

Heretofore in trying to overcome troubles from bad voltage regulation attention has been given almost wholly to the question of making waterwheels operate within proper speed limits, but such means cannot be made to compensate for line losses, so that it would seem desirable to use automatic feeder regulators rather than to depend wholly on waterwheel governors.

At the present time it is almost the universal practice to use separate circuits for lighting and motor work, necessitating large expenditure on the part of the central-station management. It has been considered almost impossible to give good lighting service and have an extensive motor service operated from the same mains. With automatic voltage generator regulators and automatic feeder regulators, very satisfactory service can be obtained where lights and motors are operated from the same circuit, and several installations have been made where these results have been obtained. This new practice will undoubtedly reduce the cost of outside construction by reducing the number of feeders.

Discussion.

H. J. Gille, St. Paul, Minn.: It seems to me that we have got a question before us now that there is not a plant in the country that is not vitally interested in. We are operating a waterpower plant similar to what Mr. Wirt has described, and we must keep a man at the switchboard and one at the waterwheel governor, day and night. Has this system

1. Paper read before the Northwestern Electrical Association at Milwaukee, Wis., January 22, 1903.

been worked out so that it will handle rotary converters at the end of a 30-mile transmission line?

Mr. Wirt: We are working on that line. We can do the work all right, if we have a motor-generator set up. We are developing regulators to keep motors at absolutely constant speed. I think we can do something with the rotary converter. Before the regulator was used the cases of trouble that we had from that source were such as to cause us to throw up our hands, and it was practically a question of taking our machinery back; and we got hold of Mr. Tyrrell and sent him out with these regulators, and they think he is a nice fellow, he did the work so well. I asked him how he happened to get it up, and he said, he was standing at the switchboard (he was a dynamo attendant), and it occurred to him one day to short-circuit the rheostat of an exciter. He had a wire in use constantly as a regulator, and he said that it occurred to him that if he could effect regulation by hand he could do it automatically, and that was the starting point of the invention. In looking over the records of Mr. Edison we found that he had done work similar to this, but his work was connected with a direct-current machine, and it was not developed for an alternating machine, and his work was only of an experimental character.

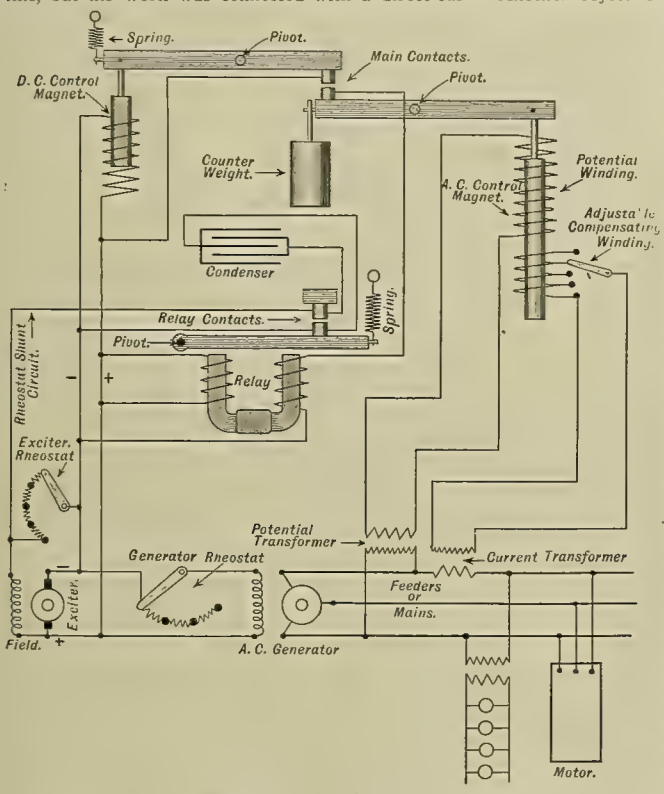


FIG. 2. AUTOMATIC VOLTAGE REGULATOR FOR ALTERNATORS.—DIAGRAM OF ELEMENTARY CONNECTIONS.

Mr. Gille: Do you believe that if this regulator was attached to the generator at the power house, it would produce the desired result?

Mr. Wirt: Yes; it could be arranged so that it would maintain practically, absolutely constant voltage at your point of distribution.

Professor W. B. Jackson, Madison, Wis.: We have found, as Mr. Wirt says, that to regulate quickly, the arm of the rheostat must be thrown clear around and brought back, which it is very difficult for a man to do quick enough. But this machine does the work. I wish to ask Mr. Wirt, and it is a point that I do not believe would really be troublesome in the regulator, but it seems to me with a very sensitive exciter there would be a tendency for a variation in the voltage passing through the generator field, and I would like to know whether any trouble of that sort has been noticed, from the heating of the fields, from the use of this Tyrrell regulator? Another point which I think is of interest is whether in the compounding of the regulator, the regulating for the inductive drop has been taken up?

Mr. Wirt: As regards the exciter, we do not notice any flickering in the light. We did until very recently notice a flickering in the light of a direct-current machine, and we were up almost to the point of recommending an independent exciter for the direct-current machine where the flickering was objectionable; but we found that by greatly increasing the rapidity of the relay magnet, we could do away with all the flickering. We have not noticed any trouble with any of the generators operated, in connection with these regulators, in the way of heating fields or otherwise. We do not simply go down a little way, but go way down, if we want to bring the voltage down. We apply so much energy to changing the voltage, that it overcomes any reluctance of the fields, and for that reason we stipulate in the operation of the regulator, that the exciter must be one where you have great range of voltage, where you can apply 125 down to 40 volts to get a 110-volt working result. As regards compounding for inductive loads, that is allowed for, and Mr. Tyrrell, who has made a special study of that, says that it compounds for the inductive loads.

[Charts were exhibited by the speaker, showing the difference in constancy of voltage with and without the regulator, the charts where the regulator was used showing a practically constant voltage in every instance, while the voltage where the regulator was not used was quite variable.]

Induction Generating System.

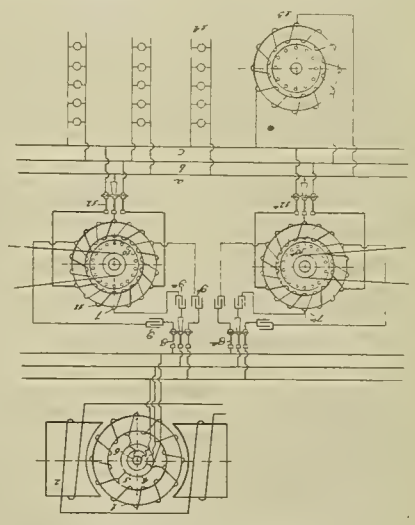
An invention relating to the generation of alternating currents by the inductive reaction of a rotary magnetic field and a closed-circuited relatively movable coöperating element driven above synchronism with relation to the rotary field, has recently been patented by Charles S. Bradley of Avon, N. Y. One object of the invention is to permit an exciter of low electromotive force to furnish the magnetizing current of a rotary field or a number of such fields. Another object is to permit a number of such generators to be thrown upon a distribution circuit supplying induction motors and other translating devices as the load may require without the necessity of bringing the several generators into synchronism.

The invention is carried out by means of an exciter capable of generating alternating currents of low voltage, these currents being connected through switching devices with the magnetizing windings of one or a number of induction generators, the co-operating elements of which are provided with windings closed upon themselves and are driven by a prime mover at a speed above that of the poles of the rotary field. The generators are provided also with an auxiliary winding, in which induced currents are developed by the reaction of the closed-circuited element on the rotary field, and this winding is connected with the distribution or consumption circuit. The magnetizing circuits, including the exciter and rotary field, are rendered electrically resonant by devices for adjusting the capacity inductance product, so that the capacity of each circuit or branch in microfarads multiplied by the inductance in henries will equal 25,300 divided by the square of the rate of alternation of the exciter. The exciter is preferably adapted to generate polyphase currents and is operated at constant speed, so that a condenser employed to produce resonance may have a constant adjustment relatively to the inductance, which latter will fluctuate but little with change of load. The interposition of condensers raises the voltage in the rotary field and produces a much greater magnetizing effect on the rotary field than would be possible without their employment.

The invention comprises a generator having a magnetizing winding supplied by an exciter through condensers and a rotor or movable element driven above synchronism in the rotary field. It comprises also an auxiliary winding in inductive relation to the rotary field for leading off induced currents. The accompanying drawing is a diagram of a system embodying Mr. Bradley's improvements.

In (1) is represented an exciter armature driven in inductive relation to a field magnet (2) charged by a direct current. The organization may be simplified by commutating the armature currents and leading the direct current thus generated through brushes to the field-magnet winding. The armature winding is tapped at a number of symmetrical points and connected with ring contacts (4) (5) (6), upon which bear brushes leading to one or more magnetizing windings (7) (7^a) of induction generators. The system is shown organized for operation with three-phase currents, though polyphase currents of any order may be employed. Single-phase currents may also be employed, as the reaction of the two generator elements will in such cases set up a rotary magnetic field. Switches (8) (8^a) are interposed between the exciter and the magnetizing windings of the generator, and in each branch of the circuit is a condenser (9) (9^a) (9^b), adjusted to a value to produce electrical resonance. The generator magnetizing windings are disposed so as to set up a rotary magnetic field. In inductive relation to the rotary field is a coöperating element (10) (10^a), adapted to be driven above synchronous speed by any suitable prime mover, indicated as a driving belt (15).

The coöperating element (10) may conveniently be provided with a squirrel-cage winding, consisting of copper conductors threading the core parallel to the axis and connected together at the ends by conducting disks. In inductive relation to the rotary field of the generator is an auxiliary winding (11), in which electromotive force is generated by the reaction following the cutting of the rotary field of force by the conductors of the rotary member. The auxiliary winding may be closed upon itself and tapped at symmetrical points connecting with a



INDUCTION GENERATING SYSTEM.

switch (12), by which polyphase current may be thrown into a distribution circuit (a) (b) (c). The distribution circuit may supply induction motors, lamps, or other translating devices, as indicated at (13) (14). It is not necessary that the auxiliary winding should have the same relation to the core as the rotary-field winding, provided it be in inductive relation to the magnetic circuit.

Mr. Bradley says: "The exciter sets the rate of alternation or time period of the whole system, and the currents generated in the generator circuits will of necessity coincide with this rate. The several generator rotors or revolving members may be given any speed, provided it be above synchronism—that is to say, provided its conductors move faster than the poles of the rotary field—and yet the period or rate of the generated currents in the auxiliary winding will be the same. It follows, therefore, that when the load varies in the distribution network additional generators may be thrown upon the circuit to maintain the current without adopting special means to synchronize them with the generators already at work. The preferable mode of procedure is first to connect the rotor with the prime mover and raise it to a speed above synchronism and then close the switches leading to the exciter and distribution circuits, respectively. By reason of the resonant adjustment of the magnetizing circuits an exciter of low electromotive force may be employed, and yet a strong magnetizing current will flow in the magnetizing winding and charge the induction generator. The auxiliary winding may of course be arranged to produce any desired voltage. By adjustment of the condensers to effect resonance a small exciter may be used, and even without a resonant adjustment the addition of capacity to the circuit permits a smaller exciter than must otherwise be employed, the capacity acting also to produce a better relation of the magnetizing and work current.

Interurban Railway in Kentucky.

Articles incorporating the Louisville and Interurban Railway Company have been filed in Louisville, Ky. The capital stock is $500,000. The incorporators, each of whom holds 25 shares, are the following: T. J. Minary, J. B. Speed, J. W. Gaulbert, Attila Cox, John Stites, Harry Bishop, Clarence Dallum. It is the purpose to build connecting with the present terminus of the Louisville Railway Company out to Jeffersontown, seven miles, and thence to Shelbyville, 17 miles, to Minoma, 11 miles, to Valley Station, 10 miles, and to Worthington, 10 miles. The company is authorized to incur indebtedness not exceeding $3,000,000.

Velocity of Propagation of X-Rays.[1]

By R. Blondlot.

After several years devoted to fruitless attempts at determining the speed of propagation of X-rays, it struck me that by applying a principle corresponding to that of Römer for measuring the velocity of light, one might recognize whether the speed of X-rays is or is not comparable with that of the electromagnetic waves. I was thus led to the following experiment:

To the poles (B) and (B′) of an induction coil (Fig. 1) are attached two wires connected with the electrodes (H) and (H′) of a focus tube. Before reaching this tube, these wires, stretched horizontally and parallel to each other, are fixed to the two halves of a Hertz exciter, consisting of two brass cylinders (A) and (A′), eight centimeters in diameter and six centimeters long, adjusted horizontally in the walls of a bottle containing vaseline oil. Below this bottle (not shown in the figure) is placed a resonator formed of a loop of copper wire (DD′C). This is shown beside the exciter, but in reality the straight portion (DD′) is placed under (AA′).

The gap (C) of the resonator is toward the focus tube, so as to receive the X-rays from it. It is

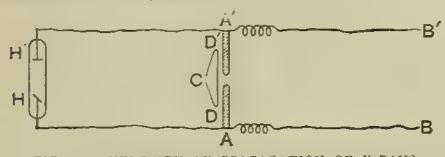


FIG 1. VELOCITY OF PROPAGATION OF X-RAYS.

protected against all other radiation by screens of black paper and a plate of aluminum.

By suitably regulating the explosive distance of the exciter in the oil, it is possible to make the focus tube and the exciter work simultaneously. This is what then happens: At every current of break of the induction coil, the difference of potential between (H) and (H′) attains a value sufficient to make the tube respond. As the difference of potential continues to rise, the spark passes in the exciter. The tube, suddenly deprived of energy, is extinguished, while the oscillatory discharge of the exciter is completed. Suppose, first of all, that the tube is arranged near the exciter, the wires (AH) and (A′H′) being as short as possible, say 11 centimeters. Enter as abscissæ (Fig. 2) the times, reckoned from the instant at which the spark passes through the oil, and as ordinates the differences of potential between (A) and (A′). Thus we have, as we know, a rapidly damped sinusoidal curve (MNPQ). Once the apparatus is adjusted, the potential necessary to make the tube work is only slightly less than the spark potential of the exciter. It suffices, in fact, to diminish very slightly this sparking distance to make the discharge not traverse the tube at all, but to pass entirely through the exciter. This peculiarity is of great importance. It follows that the tube extinguishes itself as soon as the potential has diminished a little at the beginning of the oscillatory discharge, and, therefore, at the end of a time less than a quarter period of the exciter. The curve representing the intensity of the X-rays is, therefore, a nearly horizontal curve (RS), preceding the exciter discharge, and followed by a suddenly descending portion (SU). [The wave-length of the exciter was 1.14 meters, its period was, therefore, $114/(3 \times 10^{10})$ seconds, and, therefore, (OU) is much less than $114/(3 \times 10^{10} \times 4)$ seconds.]

Let us construct the curve having for ordinates the values of the electric force produced at the gap of the resonator by the discharge of the exciter. The ordinate of this curve is zero as long as the whole discharge passes through the focus tube—i. e., up to the origin of times on the diagram. It only reaches a notable value at a time when the exciter is already partly discharged, and the maximum of this electric force only occurs when the exciter has acquired a contrary charge—i. e., at the end of a half period represented by the abscissa. It follows that when the resonator commences to act, the X-rays are already extinguished, and, consequently, there is no action of the tube on the secondary spark. This is verified by experiment, for if a plate of lead is interposed between the tube and the break, so as to intercept the X-rays, the spark is not affected.

Leaving the focus tube in position, let us replace the short wires (AH) and (A′H′) by wires 25 centimeters long, having no sudden bends. This lengthening of the wires, by delaying the extinction of the X-rays for a time required by the Hertzian waves to traverse the extra 14 centimeters, has the effect of delaying by an equal amount the disappearance of the X-rays at the break, and of allowing these rays time to act upon the spark. This is observed in fact, for the interposition of a sheet of lead makes a spark decidedly less bright. This action of the X-rays increases on still further increasing the length of the wires. For lengths of 33 centimeters, 80 centimeters and 130 centimeters it becomes more and more marked.

These experiments show that in my apparatus the X-rays are extinguished as soon as the electric discharge has ceased in the tube. Indeed, in the experiment with the very short wires, it is found that there is no action, whereas it suffices to increase the length by 14 centimeters to obtain visible action. If, therefore, there is a prolonging of emission of X-rays, or a prolonging of their action at the gap after their cessation, the sum of these intervals is very small in comparison with $14/3 \times 10^{10}$ seconds.

Let us take folded transmission wires of invariable length, say, 50 centimeters, and let us gradually increase the distance between the tube and the gap. By virtue of this increase of distance, the X-rays will experience a retardation equal to the time they take for traversing the distance betwen the tube and the gap. Their disappearance at the gap is retarded by the same amount, and if their speed is comparable with that of Hertzian waves, the effect of increasing the distance of the tube must correspond to that of lengthening the wires, i. e., an improvement in the coincidence of the epoch when the electric force exists at the gap with the epoch when the X-rays are present at it, and consequently an increase in the action of these rays upon the spark. One is, therefore, led to this paradoxical conclusion: The tube should act better from a distance than close by. To my great surprise, this experiment succeeded completely; the brightness of the spark increases with the distance of the tube. This is a certain and constant fact. The increase is due to X-rays, for if a small disk of lead is placed against the sheet of aluminum the effect disappears. The spark at once becomes feebler, and remains invariable whatever the distance of the tube.

This surprising fact is the first verification of our supposition that the speed of propagation of X-rays is comparable with that of Hertzian waves.

Let us now take transmission wires of greater length, say 80 centimeters. When the tube is taken further away it will happen at a certain distance that the X-rays will have at the gap their full intensity during the whole time that the electric force at the gap retains a notable value (Fig. 3). The efficiency of the X-rays will then be as great as their intensity allows.

If the tube is removed still further the coincidence between X-rays and the electric force at the gap will not be improved, and the X-rays will lose more and more in intensity, so that their action will have

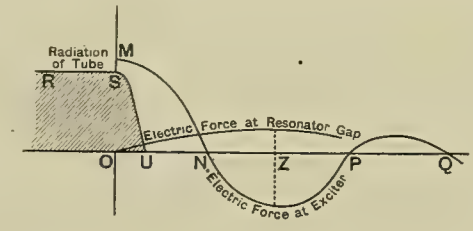


FIG. 2. VELOCITY OF PROPAGATION OF X-RAYS.

passed through a maximum. This is what was actually found: The spark passes through a maximum when the tube is about 53 centimeters from the gap. The maximum is due to X-rays, for it disappears on interposing a small leaden disk. Thus the supposition that the speed of X-rays and of Hertzian waves is of the same order of magnitude has led us to predict the existence of the maximum, and this prediction is verified by experiment. As it seems impossible to furnish any other explanation of this paradoxical phenomenon, we must conclude that the speed of propagation of X-rays is of the same order of magnitude as that of Hertzian waves. I propose to explain how the study of this maximum has given me the means of determining the ratio of the two velocities.

When in the apparatus described above the transmission wires have a length of 80 centimeters, then, as we have seen, the resonator spark shows a maximum of brightness when the tube is 53 centimeters from the gap. We leave aside the theoretic analysis of the phenomenon, only remembering the fact and making the certain supposition that the maximum is due to the circumstance that there is a distance of the tube for which the X-rays illuminate the gap during the action on the electric force with a greater intensity than at other distances. We call V and V′ the rates of propagation in centimeters per second of the Hertzian waves and the X-rays, respectively.

After determining the position of the tube giving the maximum spark, let us lengthen the wires by (a) centimeter. The cessation of X-rays at the gap is thus retarded by a/V seconds. To re-establish the coincidence of the times and the maximum, it is therefore necessary to diminish the distance between tube and gap by a length b, such that $b/V' = a/V$. The experiment gives b/a, and hence, by virtue of the proceeding equality, V/V′.

From a great many determinations, in which a was made to vary as much as possible, it results that b is always equal to a. Hence it follows that V equals V′ within the degree of approximation given by the determination of the position of the tube which makes the spark a maximum. The table below contains the results of a series of experiments. The first column gives the values of a; the second, the corresponding values of b, determined by my assistant, M. Virtz; the third, the values of b, determined by myself; the fourth, the means of the two values. Each of the numbers of the second and of the third column is the mean of five measurements.

a.	b.		
	Vi tz.	Blondlot.	Mean.
-7	-6.5	-5.9	-6.2
9	8.9	10.5	9 7
12.5	12.6	12	12.3
15	14.5	15.1	14.8
25	24.5	25.3	24.9
30	30	31	30.5
40	39.6	39.3	39.4
25	23.2	24.6	23.9

It is seen that the numbers of the fourth column differ very little from the corresponding numbers of the first column, so that the differences can be attributed to the impossibility of determining in a very precise manner the position of the tube which makes the spark a maximum.

The series of experiments, 80 in number, summarized in the preceding table give the following definite result: Replacing a and b by the mean of their values, we find $V'/V = 161.7/163.5$. Other series of experiments gave 138/139, 146/144. These ratios are very close to unity. The separate measurements often present notable variations, as seen in the above table, but the influence of these portions always disappears in the means of a great number of determinations. I have found that the values of b are independent of the size and form of the resonator.

Here is another kind of experiment, in which the time employed by the X-rays to cover a certain space is also compensated by the time taken by the electromagnetic waves to traverse a certain length of wire. But in this case it is not the transmission wires which are lengthened or shortened; it is the wire of the resonator. The ends of the resonator are separated by 0.3 centimeter, and two wires are soldered to them, representing a small transmission line. At the end of this line is attached a spark micrometer, and the new gap is brought to the position of the old one by bending the small line back upon itself. The action of the exciter upon the resonator then produces a Hertzian wave which must traverse a certain length of wire to reach the gap and there produce a spark. If, therefore, each half of the resonator is lengthened by A centimeter, the spark is retarded by A/V seconds, and to obtain the maximum spark we must increase the distance between the tube and the gap by B centimeter, such that $B/V' = A/V$. The observed value of B/A gives that of V′/V.

In this calculation B and A are replaced by their mean values in the different experiments. These, very numerous and concordant, in which A has been varied from zero to 25 centimeters, gave $V'/V = 0.93$.

This value agrees sufficiently with the results of the first method, which, indeed, appears more precise, since the retardation of the Hertzian waves is there better defined.

All the experimental results obtained by both methods may be summarized as follows: If to the length of the transmission wires is added the distance between the tube and the gap which gives the maximum spark, and if from this is deducted the length, if any, of the small line added to the resonator, the constant length of 133 centimeters is obtained.

It may be noticed that in both methods described the ratio V′/V is obtained without it being necessary to know further details. We have here sub-

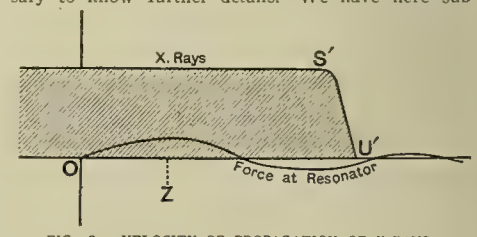


FIG. 3. VELOCITY OF PROPAGATION OF X RAYS.

stitution methods corresponding to Borda's methods for weights. Still there is a complication; the position of the tube giving the maximum spark is closer to the gap than when the intensity of the X-rays does not decrease with the distance. The decrease of the intensity suffices indeed to diminish an action which otherwise would increase very slowly with the distance. This proximity is greater for small distances than for great ones, since the decrease of the intensity is more rapid for small distances. The increase of b or B produced by this cause cannot be calculated beforehand, but the final agreement of all the results indicated is within the errors of experiment. The whole work may be summarized as follows:

Supposing, a priori, the equality of the rates of propagation of X-rays and of Hertzian waves, we are led to foresee that the reinforcement produced by the tube upon the spark must pass through a maximum at a certain distance from the tube. Experiment has confirmed this prediction. The same supposition enables us to calculate in advance the displacements which the position of the tube corresponding to this maximum should experience, either by lengthening the wires of transmission or by add-

1. Translated from the Comptes Rendus by the London Electrician.

ing a small line to the exciter. We should, in fact, be able to compensate the time taken by the electric waves to traverse a certain length of wire by means of the time taken by the X-rays to traverse the same distance. This compensation is produced in reality. Of the two methods employed, the one gives 0.97 as the ratio of the velocities and the other 0.93.

On the other hands, it seems impossible to give any other explanation of the maximum brightness of the spark, of its displacements, and of the other circumstances of the phenomena, and we are led to the final conclusion that the velocity of propagation of X-rays is equal to that of Hertzian waves or of light through the air.

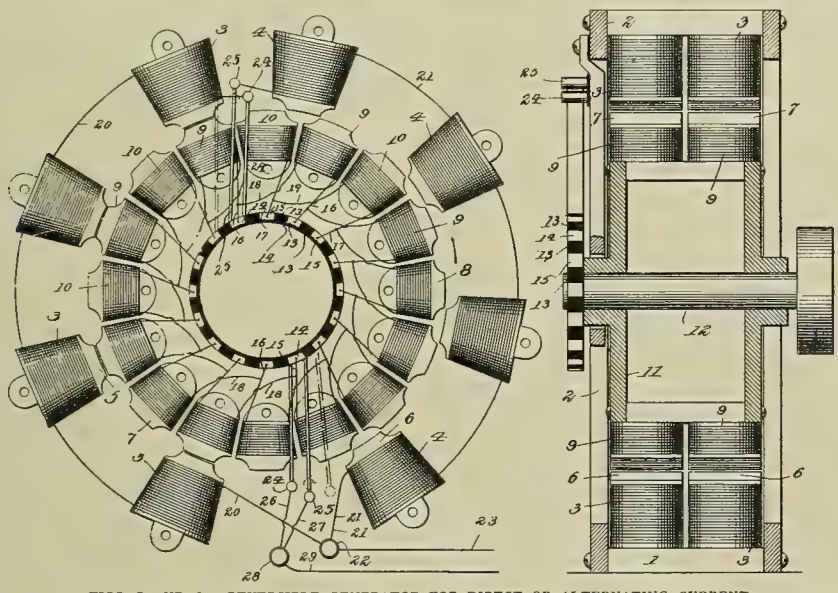
Reversible Generator for Direct or Alternating Current.

John A. Titzel, Sr., of Franklin, Pa., has been granted a United States patent for an electric motor or generator, which is designed to produce a strong and uniform magnetic field, so that the apparatus will be very efficient in either of its capacities. Fig. 1 is a side elevation of the device, and Fig. 2 is a central vertical section through the same.

The apparatus comprises a frame (1), with plates (2) for holding the field magnets and coils (3) (4). These coils are arranged in two sets, and within each set the field coils are equidistant; but adjacent or end coils of different sets are arranged unsymmetrically. Thus there are shown eight field coils —viz., four coils (3) and four coils (4). The angle separating adjacent coils of the same set is 360 ÷ 8 = 45 degrees; but at the top the adjacent coils (3) and (4) form an angle of $1\frac{1}{2} \times \frac{45}{2} = 33\frac{3}{4}$ degrees, and at the bottom of the angle separating the end coils (3) and (4) is $2\frac{1}{2} \times \frac{45}{2} = 56\frac{1}{4}$ degrees. Generically speaking, the angle separating such coils should be equal to an uneven multiple of one-fourth of the angle separating adjacent field coils of the same set—that is, in the present case $\frac{45}{4} = 11\frac{1}{4}$ degrees. The field magnets have reduced pole-pieces (5) (6), corresponding to similar pole-pieces (7) (8) of the armature magnets, the magnets (9) (10) of which are arranged in two sets, the coils of one set alternating with those of the other set. The number of armature coils is equal to twice the number of field coils—that is, 16 in the present case—and the armature coils are evenly spaced—that is, adjacent coils from an angle of $22\frac{1}{2}$ degrees, or one-half of that separating adjacent field coils of the same set. The reduced pole-pieces (5) (6) of the field magnets are about equal in width to the spaces between the reduced pole-pieces (7) (8) of adjacent armature magnets. Owing to the symmetrical arrangement of the two sets of field coils (3) (4), the field coils (4) will be half-way between armature coils when the field coils (3) register with the armature coils, as shown in Fig. 1, and vice versa.

The armature coils are mounted on a support (11), rotating with the shaft (12), which also carries a commutator having 32 sections—that is, twice as many as there are armature coils. Alternate sections (13) are unconnected or made of insulating material, and between the sections are located conducting sections (14) (15) in regular alternation. Of these, the sections (14) are connected by wires (16) with one end of each coil (9), while wires (17) similarly connect the sections (15) with one end of each coil (10). The other end of each coil (9) is connected by a wire (18) with the wire (16) of the adjacent coil (9), and similarly the other end of each coil (10) is connected by a wire (19) with the wire (17) of the adjacent coil (10). The field coils (3) (4) should be wound so as to produce the same polarity at the inner ends of the field magnets.

The coils of each set are connected in series by wires (20) (21), and one end of each wire is connected with the binding post (22), to which leads the feed wire (23), while the other ends of the wires (20) (21) are connected with upper brushes (24) (25), respectively, engaging the commutator at points distant from each other about 12 degrees ($11\frac{1}{4}$ degrees is the exact distance found by calculation). To secure contra-clockwise rotation, these brushes should be in the position shown by full lines in Fig. 1. It will be seen that this connects the brush (24) with that armature coil which is nearest to the uppermost field coil (3) in its movement toward the coil, and the brush (25) is connected with that armature coil which is nearest the uppermost field coil (4) in its movement toward the coil. At the bottom the commutator is engaged by two similar brushes (24) (25), likewise located at $11\frac{1}{4}$ degrees from each other. These lower brushes are both connected by wires (26) (27) with the binding post (28), and are so arranged that they will connect with those armature coils which are nearest the lowermost field coils (3) and (4), respectively.



FIGS. 1 AND 2. REVERSIBLE GENERATOR FOR DIRECT OR ALTERNATING CURRENT.

As the upper sector (14) is disengaging the upper brush (24) and engaging the brush (25) the left-hand field, made up of magnets (3), is being de-energized, and the right-hand field, made up of magnets (4), is just beginning to be energized. This transition occurs when the field and armature magnets are in the relative position shown, the left-hand field magnets being in juxtaposition with adjacent armature magnets (3), and the right-hand field magnets being a little in advance of the adjacent magnets (9). With the parts in the position shown the magnets of the left-hand field have just ceased to attract the armature coils (9) adjacent and the right-hand field magnets are just commencing to draw the armature coils (9), to which they are adjacent, so that the rotation of the armature is continued in the same contra-clockwise direction.

As soon, however, as the armature rotates a little farther, so that the right-hand field coils (4) are brought into juxtaposition with such of the armature coils (9) as are immediately adjacent thereto, the sectors (14) are succeeded by the sectors (15), so that the current flows through armature coils (10) instead of (9), the circuits being otherwise the same —that is, during the rotation immediately preceding the reaching of the position shown in Fig. 1, the motor has been driven contra-clockwise by the attraction of the field coils (4) upon as many armature coils (9). Immediately after reaching the position the motor is driven in the same direction by the attraction of the field coils (3) upon as many armature coils (9). Then follows a period during which the field coils (4) are energized simultaneously with as many armature coils (10), and, finally, the four field coils (3) attract as many armature coils (10). Each of these periods corresponds to a rotation of the armature through an angle of $11\frac{1}{4}$ degrees. The armature is supported upon a shaft (30) in the usual manner. A regular alternation in magnetic attraction is thus obtained. The armature coils are all wound so as to give the armature magnets the same polarity, which should be the opposite polarity to that of the field magnets.

To reverse the motor, the brushes (24) (25) should be shifted around the commutator in a contra-clockwise direction, through an angle of $11\frac{1}{4}$ degrees, thus bringing the brushes (24) to the position shown for the brushes (25), and the latter to the position shown by dotted lines. To enable the brushes to be thus shifted, they would be mounted on a carrier, as shown in the other view, having a limited turning movement about the axis of the commutator.

The apparatus is reversible—that is, it may be used as a dynamo or generator for the production of a continuous current. Further, the apparatus may be employed as an alternating-current generator. For this purpose a source of electricity would be connected with the binding posts (22) (28) to energize the field coils (3) (4), and power would be applied to turn the armature. An alternating current could then be taken off from the top brushes (24) (25) to one binding post, and the bottom brushes to the other binding post. Finally, the apparatus may be used as an alternating-current motor. The motor will start in any position, whether used with a direct current or an alternating one, and in the latter case the motor will synchronize itself with the generator driving it. The motor can be operated in either direction. The motor can also be constructed as a twin motor, as shown in Fig. 2.

Large Consolidation of Public Utilities Proposed in Indiana.

A. M. Barron of South Bend, Ind., is working on a plan which has for its object the consolidation of all the electric-lighting, gas and water plants in the state of Indiana which have proved unprofitable to the stockholders, by reason of various causes, such as bad equipment, poor installation, poor management, etc. It is proposed to organize a public-utilities company for Indiana alone and take over these plants. The cash value of the stock of each company will be ascertained and this stock will be exchanged for gold mortgage five per cent., negotiable bonds, to be issued by the consolidating company. If any of the smaller companies are already bonded, these bonds will be refunded. A sale of bonds will also be provided for for the betterment of each plant. Among the advantages of the consolidation will be that the management will be concentrated and therefore can act more efficiently and economically, and it will be possible to purchase machinery and supplies at one office, thus saving money over the present method. The engineering features will be worked out to a nicety. A standard form of power house will be adopted. Machinery not adapted to one station will be transferred to another or disposed of, modern and efficient machines will be installed and wherever possible power plants will be consolidated. Mr. Barron is confident that the plan will be successful and will be of benefit to the many small plants throughout the state which are not now conducted on a paying basis. A prominent trust company, capitalized at $3,000,000, is backing the project and will guarantee the bonds. Already 15 plants have been secured. The headquarters of the proposed new company will be in South Bend.

Electrical Advancement in St. Petersburg.

The City Council of St. Petersburg, Russia, has now definitely decided to convert all its street-car lines, hitherto run by animal power, into modern electric roads, with the intention of adopting only the newest devices. The "underground-trolley" system will be employed for the entire system, both in the city proper and in the suburbs. To cover the cost of this improvement the city of St. Petersburg is now issuing bonds to the amount of 30,000,000 rubles ($15,500,000).

To commemorate the coming two hundredth anniversary of the foundation of the city of St. Petersburg by Peter the Great, it has been decided to convert the hitherto defective port of that city into a first-class port and to name it after the founder of the city. The committee of engineers, appointed some time ago to work out the details, has made its reports, and among the many new installations the committee recommends also the erection of special plants for the electric lighting of the port. The cost of all those improvements will run up to 26,000,000 rubles.

It has been definitely decided to hold, in the spring of this year, an electrical exhibition at St. Petersburg, in order to enable a better selection of electric devices for the many coming municipal constructions decided upon recently.

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DATES AHEAD.

Independent Telephone Association of Wisconsin, Hotel Pfister, Milwaukee, Wis., February 11th and 12th.

Chicago Automobile Show, Coliseum, Chicago, February 14th to 21st.

Now that it is announced that the X-ray will cure corns, everybody can cheer up. This is a pretty good sort of a world, after all, and science is constantly making it a pleasanter place to live in by attacking the strongholds of disease and discomfort. One of the latest redoubts to fall was the annoying soft corn, but we have the authority of a Chicago skin doctor, reported in a Chicago newspaper, for the statement that it has fallen, routed root and branch by the penetrating X-ray. A short time ago it was shown that thieving employes of the Japanese mint could not successfully get away with stolen coins in their stomachs, because the X-ray brought their nefarious proceedings to light. Now, we are told that the corn has been vanquished, and by the X-ray, too. When will these marvels cease?

ONE of the most promising of recent inventions is Peter Cooper Hewitt's mercury-vapor converter or rectifier—the name to be applied to it does not seem to be accurately determined as yet—previously mentioned in the Western Electrician. In the course of his experiments with the mercury-vapor lamp Mr. Hewitt made the important discovery that a vacuum bulb supplied with positive electrodes and a small quantity of mercury acting as the negative electrode will serve the purpose of a converter of polyphase alternating currents into direct current, as the current can flow only in one direction through the mercury vapor, thus cutting out half of each alternation. The apparatus is yet in the experimental stage, but its possibilities in supplanting the rotary converter in railway work, for instance, are obviously great. We shall present further accounts of this interesting device in future issues of the Western Electrician, for electricians are watching its development with great interest.

SOME observations by Mr. Frederic Emory, chief of the Bureau of Foreign Commerce of the Department of State at Washington, in a recent "Review of the World's Commerce," are worthy of the careful attention of American manufacturers who are engaged or who hope to engage or who surmise that it may some time be necessary to engage in the export trade. After demonstrating that United States manufactures are continuing to impress themselves upon foreign purchasers, Mr. Emory says: "It would be a serious mistake to assume, from the indications which have been cited as favorable to our sustained and increasingly successful competition with the other industrial nations for a much larger share of the world's trade, that we have only to go forward on existing lines. As has been pointed out in previous summaries of the annual reports of consular officers, our success has been more a matter of accident than of design, and was largely the result of economic conditions, peculiar to ourselves, which had no relation originally to foreign trade, but sprang from our absorption in an industrial activity purely domestic and directed solely to supplying the home market. Even yet, we cannot be said to be manufacturing expressly for export to any large extent, and the study of conditions in foreign markets and the intelligent direction of industrial energy to meet them effectively has not gone much farther than the initial stage. . . . . It is within the bounds of reasonable probability, at least, to assume that, when another period of great accumulation arrives, we may find it difficult to unload upon foreign customers by merely shipping the excess abroad. We succeeded in doing this once because we took Europe by surprise, but it is by no means certain that we could do it again, now that Europe is fully awake to our industrial superiority and is equipping herself to meet us at every point. . . . . We cannot afford to rely any longer upon instrumentalities not specially shaped for promoting trade intercourse with other nations and successful in the past only because they happened at the moment to be sufficient. . . . . The measure of our success must depend not only upon the efficiency and greater productive capacity of our workmen and the superiority of our wares, but upon the ability we develop in winning trade from strenuous and skillful rivals. In other words, we must have the best machinery not merely for manufacturing goods, but for selling them when made." The exporter should make a study of the patterns, measurements, methods of packing, trade usages, terms of credit, etc., peculiar to particular localities, and will be greatly assisted in this endeavor by attentive perusal of the various publications of the Bureau of Foreign Commerce. The enormous requirements of the home market will not always exist in proportionate degree, and it behooves the American manufacturer, electrical or otherwise, to prepare himself now for the foreign trade which may be a necessity of the future.

INDEPENDENT telephone men will be pleased to learn that the Chicago City Council has enabled them to secure—for a time, at least—the long-desired connection with the center of this city. At Monday's meeting of the aldermen the Independent company operating south of Thirty-ninth Street and east of State Street in Chicago was given permission to connect its Hyde Park offices with the downtown district. City Electrician Ellicott was authorized to issue a temporary permit, pending action on the ordinance before the council, for the company to "install one underground cable, containing not more than 10 conductors, to secure communication with the office of the company, to be established in a place convenient to the general public of the city." The order is made revocable at the discretion of the mayor. It will be hailed with delight by outside Independent telephone companies, for it will at last give them some sort of connection with the heart of Chicago.

WE cannot refrain from again referring, with admiration, to the decision of the United States Circuit Court of Appeals for the First Circuit in the Berliner case, which was printed in full in last week's issue of the Western Electrician. A careful reading of Judge Colt's opinion impels us to the belief that it will become a classic in the literature of telephone-patent causes; and that that literature is voluminous and intricate all who are familiar with the art will acknowledge. From beginning to end there is not a legal citation in the Circuit Court's opinion, which is so closely reasoned and so clearly written that every layman interested in the subject may read it with pleasure as well as profit. The opinion is really a history of the development of the variable-resistance transmitter; it is comprehensive, analytical, dispassionate, and contains a valuable fund of information, not readily attainable or so well expressed elsewhere, for all who desire to inform themselves of the early history of the telephone transmitter and the credit to be awarded to its various inventors. The Berliner controversy has been in some sort an incubus on the telephone industry, but it has at least had the good effect of bequeathing to the contemporaneous and future investigator this mass of carefully sifted data, presented by intelligent and nonpartisan authority.

A MASS of valuable material was presented at the telephone meeting of the Institute in New York last week, as may be judged by the abstracts of papers and discussions presented in this issue. One reason for this was that the Institute has paid comparatively little attention to telephone engineering of late years, so that the field is, in a large measure, a virgin one to the leading electrical society of the country. But telephone engineering, nevertheless, presents some of the most interesting and complicated problems to be met with in the whole realm of applied electricity. A reference to Mr. Lockwood's able paper and to the very interesting contributions of Messrs. Carty, Gherardi, Sherwood, Allen and others is alone sufficient to show the truth of this statement, if proof were necessary. It is to be regretted that the Independent telephone engineers down on the programme were unable to be present or to remain until the end of the meeting, for the opposition companies have had to meet conditions differing in some respects from those of the older exchanges, and should be able to recite some valuable experiences. Still the volume of matter presented was ample for one evening's work—even somewhat in excess of the saturation point of mental absorption for a three-hour session, perhaps. But it was all "good stuff," to employ the expressive jargon of the journalist, and the Institute is to be thanked for making it available to the electrical public.

TELEPHONE-EXCHANGE OPERATION.

A largely attended and successful meeting of the American Institute of Electrical Engineers was held in New York on January 23d. The subject for the evening was "Telephone Exchanges." Before that topic was taken up, however, Secretary Pope announced that at the meeting of the directors held in the afternoon 111 associate members were elected, while L. W. Stanton of Cleveland and Max Osterberg and W. S. Thompson of New York city were transferred to full membership. T. C. Martin, chairman of the reception committee, gave notice that the annual dinner will be held at Sherry's on February 9th, and will be known as "The Library Dinner." Andrew Carnegie, who has donated several thousand dollars to the library fund, will be the guest of honor. The price of tickets will be five dollars a cover, without wine. A large attendance is desired and expected.

In introducing the subject of the evening, President Charles F. Scott said that the telephone is the high-speed tool of the commercial world. He added: "The telephone is not merely an invention. The elements are the work of the inventor, but the great system of conductors and connections is more properly the work of the engineer, of him who applies the scientific discoveries of the inventor and embodies them into useful apparatus in an operated system." This statement paved the way for a graceful introduction of Mr. T. D. Lockwood, advisory electrician of the American Telephone and Telegraph Company, who read a carefully prepared and very instructive paper on "The Evolution of the Telephone Switchboard."

In a few remarks prefatory to the reading of his paper Mr. Lockwood said: "Perhaps, as President Scott has pertinently observed, there never was a greater invention than the speaking telephone. I do not think I was ever more impressed with its far-reaching consequences, and that is never absent from my mind—although I have been nearly 25 years connected with the telephone business—than when I sit in an office in Chicago and talk to my home in

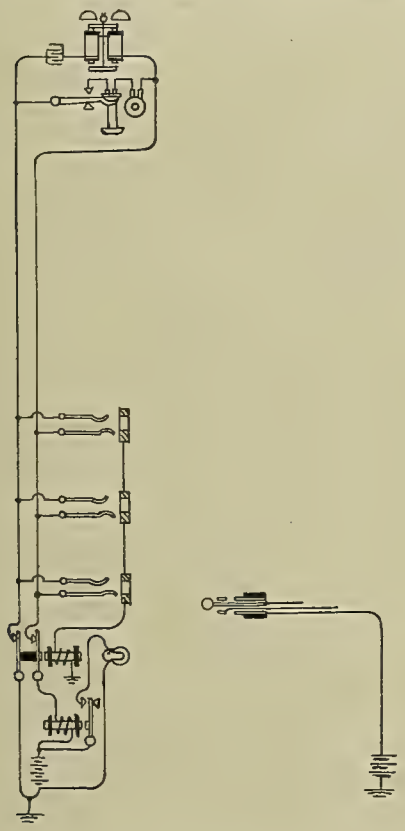


FIG. 1. EVOLUTION OF THE TELEPHONE SWITCHBOARD.

Boston, Mass. On such occasions the mystery of it comes over me, as I fear it can over very few persons; for when I think that one small iron plate can perform, under the influence of varying magnetism, all of the several functions which in the human individual require the co-operative work of the lungs, the palate, the lips and the tongue, I cannot but realize how great indeed is the intellect of man." But, the speaker went on to say, the telephone without the exchange system, would have been almost nothing.

The Evolution of the Telephone Switchboard.

BY THOMAS D. LOCKWOOD.

[Lack of space will permit the giving of portions only of Mr. Lockwood's able paper, and those toward the end. The paper is well titled; it is an analytical history of telephone-switchboard development.]

After much consideration and trials, both experimental and commercial, of many plans, the "how" of an efficient central and common-battery system for telephone circuits, and the central and sub-station transmitters, together with a system of incoming call signals and supervisory signals was as a whole devised, and decided upon. In it, the same central office source of current may be employed for both signals and transmitters. The branch terminal mode of switch-socket connection was retained, each socket being composed of a frame-piece with a test ring in front, and two or more internal contact springs. At each section are the call devices, and the answering jack for the lines which are to be answered there, and a switch socket for all lines entering the office; there being also a sufficiency of switch cords, each with a switch plug at each end.

The sub-station circuits were then arranged to be, while at rest, conductively closed at the central station through a battery and call device, and conductively open at the sub-station; but it was necessary to provide some kind of an operative circuit for the polarized sub-station bell, as otherwise calls from the central station could not be received; and the plan which seemed most promising, and which has been generally adopted, is to place a condenser between the severed ends of the two-line conductors and in series with the bell magnet. By this expedient while the circuit is open at the sub-station for a steady current, it is practically closed for the passage of the alternating ringing currents of the central-station generator, to which the bell is adopted to respond. There is also the ordinary hook switch which serves as a support for the receiving telephone when not being used; and as long as the receiver remains in place on the hook, the foregoing conditions continue; but as soon as the receiver is lifted from the hook, the metallic circuit is closed through the sub-station telephones and the current of the central battery being thus enabled to flow, causes the operation at the central station of the call-signal relay.

A small glow lamp serves as the line or call signal, possessing the great merit of being prompt and self-acting both in display and withdrawal; and in practice is placed in a short local circuit controlled by the call-signal relay, which has its magnet connected in the main line, and is responsive to the initial operation of the sub-station hook switch.

Fig. 1 indicates the arrangement, which, as regards the initial call signal, was now complete, and also illustrates the devices now to be described.

The constantly connected annunciators of the branch terminal board were thus superseded by a relay and a lamp, and the appliances formerly employed to maintain the quiescence of such annunciator were now made, instead, to operate a cut-off relay by means of which the lamp-operating relay might be cut away or disconnected, and the lamp signal thereby withdrawn, as soon as the call was answered by inserting the switch plug. This cut-off relay has two resting contacts through which the two conductors of the main circuit respectively pass, in such manner that on the excitement of the relay and the consequent attraction of its armatures, the contacts are parted and the continuation of the line, including the call relay and the normal battery connection is cut off. The cut-off relay itself is in a local switchboard circuit controlled by, and leading through, contact pieces of the switch plug and socket. The switch socket for this purpose has interior contact springs for both main conductors, thus leaving its frame piece or test ring at liberty for the local circuit; and the several test rings of each line are united by a fixed conductor extending from all of them to one terminal of the cut-off relay. The plug also has three insulated contact pieces adapted to register with the two-line springs and the test ring of the socket; the cord conductor extending between each pair of plugs comprising two main line strands which extend from plug to plug, and a local circuit strand for each plug. A battery has one of its poles connected with the plug local-circuit conductor and the other to the remaining relay terminal, so that when the plug is placed in the socket of any line, the cut-off relay circuit is closed, and the relay operates to disconnect the line terminal and relay. At the same time the potential of all of the united test rings of the line thus switched is raised to furnish approporiate conditions for the "busy test."

But this is not all. Supervisory signals are regarded as being necessary. These, also, are lamps, and two such are provided for each switch cord, and associated with the two plugs respectively, being placed in the cord section of the local or cut-off relay circuit. Thus placed, they are, of course, non-operative except when the plug is in its socket; but the plug being thus inserted, their function is to afford an indication to the operator of the condition of things at the sub-station. They can only be displayed when the hook switch at the sub-station is in its lower or normal position; that is to say, the position in which it is maintained while the receiver hangs on the hook. When in answer to a call the operator inserts the answering plug in the socket of a given line, the associated lamp does not light, because the sub-station receiver has already been taken from the switch to give the order. But when the companion plug is placed in the socket of the wanted line, the lamp signal of that plug does light, because the receiver at the wanted sub-station is not removed from the hook; it thus follows that when this receiver is taken up in response to the call, the light is at once withdrawn. Again, when the conversation is over, the replacement of either or both sub-station receivers will once more illuminate the corresponding lamps to serve as a disconnecting signal. Or if either party desire at once a connection with some other line, the lamps may be made to flash several times in succession by oscillating the hook switch. It must be apparent that such a system of supervisory signals is both ingenious and scientific. Its essential and underlying principle is that the supervisory signal of each plug is controlled in part by the plug and socket switch contacts of the local circuit wherein it is connected, and in part by the hook switch at the sub-station of the line to which the switch socket belongs; and further, that the working of the signals is dependent in the first in-

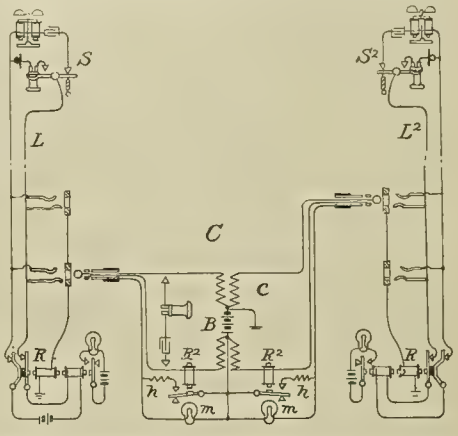


FIG. 2. EVOLUTION OF THE TELEPHONE SWITCHBOARD.

stance upon which of these two switch devices was first operated. Thus, in the case of a call being answered by the insertion of the switch plug, the signal is not displayed because the corresponding hook switch has previously been operated; but in the case of a sub-station to be called, the supervisory signal is displayed because the plug and jack switch is the first to be operated, the hook switch in this case remaining unchanged until after the call is sent.

To enable the hook switch to control the signal, a low-resistance relay is placed in the main-circuit conductors of each plug, which relay being thus connected in the main line, is responsive to the closing and opening thereof as the hook switch is moved in one direction or the other.

The sketch (Fig. 2) illustrates this arrangement, and shows that the relay in question does not act directly upon the local circuit of the lamp to open and close the same. This cannot be allowed because the same local circuit serves also for the operation of the cut-off relay and "busy test." It acts, however, by controlling a shunt round the lamp signal, closing the said shunt and preventing the display of the light when the main circuit is closed, and current consequently flows through the relay; and opening the shunt to permit the display of the lighted lamp when the receiver at the sub-station is replaced, causing the hook switch to open the main circuit so that current to excite the relay no longer flows.

In the figure (L) (L^2) are the sub-station circuits extending between the sub-stations (S) (S^2) and the central station (C), and adapted to be switched together for conversation at the latter. The switch cord (c) has the battery (B) bridged between its main conductors, and has local-circuit conductors for each plug, forming in association with the fixed conductor which unites the test rings, the local circuit; (R) (R) are the cut-off relays, (R^2) (R^2) the supervisory relays, (m) (m) the supervisory lamp signals and (h) (h) their controlling shunts.

The battery which develops the current for the main line to excite the relay, is, as shown, preferably bridged between the two main-circuit-cord conductors which respectively unite the tip and forward sleeve contacts of the two plugs, and so connected, divides the cord circuit into two well-defined sections looping from each plug. The same battery provided with an earth connection at one pole, may serve also to furnish current in the local circuit to illuminate the lamp signal, and indeed also for the operation of the cut-off relay and busy-test appliances; the several circuits being properly proportioned to the battery power and to one another by suitable resistances.

But another condition equally essential in the operation of the sub-station transmitters of an exchange from a common battery, is that by means of the switchboard devices and in their normal operation, it shall be possible at any time to disestablish this universal state of reciprocal neutrality or non-interference as regards any two circuits, and so to segregate or set aside any pair or any number of pairs of circuits, united for through communication, that the component circuits of such pair or pairs may freely communicate each with the other, but shall not disturb, or be disturbed by, any other circuits connected with the battery.

One plan of operation meeting this condition, which to a certain extent has been used, is to introduce a considerable impedance into the conductors connecting the main-circuit strands of the switch

cord and thereby the main conductors of the two circuits concerned, with the pole or poles of the battery; and to establish a short-circuit, preferably containing a condenser, between the corresponding conductors of the two component circuits, and round the impedance. The steady current of the battery finds no further difficulty in flowing through the impedance devices than that due to simple resistance, and thus readily passes over the line in either direction to the sub-station transmitters, but cannot pass the condensers; while the voice currents developed by the action of the transmitters upon this steady current being in a state of constant and rapid fluctuation, are prevented from short-circuiting themselves through the battery bridge by the interposed impedance coils, but pass with great facility round these coils and through the path which includes the condenser to the distant station.

Fig. 3, however, illustrates an alternative plan which thus far has found more general acceptance. It consists in associating the two united sub-station circuits (L) (L^2) and the common battery (B) bridged at the central station between their main conductors,

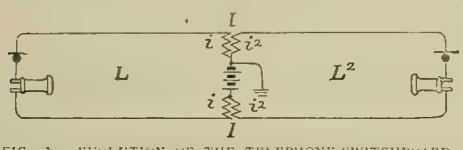


FIG. 3. EVOLUTION OF THE TELEPHONE SWITCHBOARD.

with an induction coil (I) of the type often styled repeating coils, wherein the two windings (i) (i^2) have a like number of turns and like resistances. The two windings, as is clearly shown in the figure, are connected in the component circuits respectively, so that the circuits are in inductive relation with one another. Both windings are centrally divided, and the bridged battery unites the halves of both on one side to those on the other side of the circuit. Each component circuit is thus supplied separately with battery current for the transmitter of its sub-station through its own winding of the induction coil; and each is alternately the transmitting and receiving circuit. The voice currents developed by each transmitter circulate in the transmitting component circuit only, but acting through the induction coil they develop substantially identical voice currents in the receiving circuit also, which, passing through the same, operate the distant receiver. This arrangement well complies with the second condition of success. It divides the circuit up into two sections, having no conductive connection, and thus tends to minimize the possible effect of a fault which may exist in either; and it reduces the adverse effects which otherwise would be very noticeable when the two lines connected differ considerably in length.

In Fig. 4 is illustrated the application of this plan for central and common-transmitter-battery operation to the switchboard apparatus; and, furthermore, represents in diagram the sub-station and switchboard connections of two circuits, showing how the same central source of current may be employed in connection with call signals, circuit control and speech transmission.

There is no great invention which has more thoroughly revolutionized business methods than the speaking telephone. The exceeding value of time is better appreciated now than at any previous period in the world's history; and it is universally recognized that a business man's time is a business man's best asset. Wherever the telephone is employed—and it may truly now be said that "there is no speech or language where their voice is not heard," and wherever the telephone exchange has obtained a footing, there at once is a valuable economy of this most valuable possession attained.

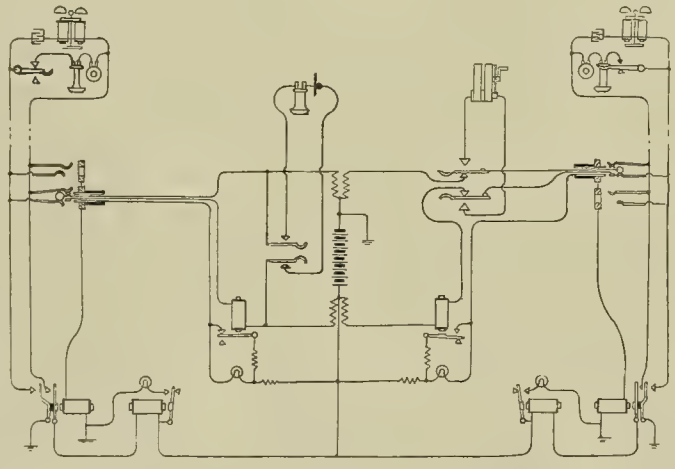


FIG. 4. EVOLUTION OF THE TELEPHONE SWITCHBOARD.

It is, however, obvious that to realize this conservation and economization of time to the fullest extent, the possibilities of usefulness inherent in the telephone itself must be competently seconded by a central-station switchboard through which all of the several operations and sub-operations requisite for the connection and disconnection of lines can be carried out with accuracy and celerity. The standard relay switchboard—as the organization of apparatus and circuits whose development I have traced has been entitled—is such an instrumentality; and by it, notwithstanding the marvelous increase of late years in the number of lines entering large central stations, and in the number of calls received and connections made in pursuance of such calls, the speed and efficiency of operation has been not only well maintained, but has exhibited marked improvement.

Here, then, at least for the present, we take leave of our theme. The efforts expended in producing the switchboard which for the time is standard, are amply justified by the general satisfactoriness of its work. True, its organization is complex, but so is that of every poly-functional machine; and why should we object to complexity if accompanied by corresponding efficiency; or unless it shall be proved that the same efficiency can be achieved by simpler means?

This switchboard, though not yet a perfect product of evolution, is at least a complete and successful machine; but evolution still goes on. It may well be that the next step in its never-ceasing progress will be in the direction of simplifying the organization either in its concrete devices or in its circuit arrangements, without any sacrifice of efficiency.

DISCUSSION (IN ABSTRACT).

J. J. Carty, chief engineer, New York Telephone Company: From the foundation work of Professor Bell down almost to the humblest improvement which has not yet been passed upon by Mr. Lockwood, the entire development which has been spoken of to-night has been the work almost exclusively of the members of this Institute. It is nowadays the fashion to talk much, especially in the daily papers, about American industrial supremacy. With braggadocio of that sort I have very little sympathy, but, nevertheless, I feel, and for a peculiar reason I will call attention to the fact, that little, if any, contribution to this art has been made by any other country except America. Of course, I must except the foundation work which was done by the noble band of immortals which the old world has given to us, headed by Farraday, and I must also except two other names, who have worked specifically in the telephone field. I refer to Van Ryssleburg of Belgium, who has given us simultaneous telegraphy and telephony, and I refer to the Rev. Mr. Hunning of the Church of England, who gave us the granular carbon transmitter, but the form in which it was given was not fitted to survive this evolution of which we have heard to-night, and it took an American to convert the granular carbon of Hunning into the solid back transmitter of to-day, given to us by Mr. Anthony White. Many of the ideas which have been discussed in the paper have been contributed directly by Mr. Lockwood himself. With reference to all of the efforts for improvement he has exercised a profound influence and toward all of them he has acted as a sort of godfather. I think it is safe to say that not a single invention in relation to the telephone has been seriously proposed for the last 25 years that has not been fully considered by Mr. Lockwood, and upon which he has not reported.

After looking over our statistics for the 100,000 instruments in Manhattan, and looking at the trouble records, I find that, using the system described, the telephone station in New York is out of order for a period of one hour and 27 minutes on an average during a given year. That means that on the average every station will be in good order during the entire year except for a period of one hour and 27 minutes.

F. A. Pickernell, engineer of the American Telephone and Telegraph Company, spoke briefly, referring to the difficulties encountered by the switchboard engineer in designing apparatus so that any particular station may be connected with any other station within the range of 1,000 miles.

B. Gherardi, chief engineer, New York and New Jersey Telephone Company, compared the functions of an electric-light station with those of a telephone central office, and said: Between the electric-light system employed in the city of New York and that employed in the city of Boston there is no necessary relation, but with the telephone system this is not so. The telephone system at Boston and the telephone system at New York must be so constructed that they will be interlocking. This is true of all large cities which enter into the problem. While telephone engineers have not daily concern with the transmission for great distances of high-voltage currents, they have to contend with a transmission problem which in point of difficulties is of a vastly serious nature. Dealing as it does with currents denying measurement, and almost infinitesimal in amount, the work of the telephone engineer is attended by obstacles without number. Not only must the telephone engineer design his transmission system so as to take care of the currents generated by the telephone apparatus, but he must so plan that system that it will be defended against the inductive attacks of electric-light and power circuits. For his own protection, therefore, if for no other reason, he must have a working knowledge of the behavior of currents of greater degree and higher voltage. At the central office itself we have no Niagara dynamos, but we have an aggregation of parts which may with precision be called a multitude.

Between this telephone power plant and the telephone switchboard proper is drawn a dead line of specially designed fuses and cut-outs. In the consideration of these fuses and cut-outs alone the telephone engineer has been obliged to study questions which to the electric-light engineer have probably not even occurred. Instead of large fusible wires or magnetic cut-outs carrying heavy currents, fine, hair-like fuses are employed, and in some cases we use heat coils surrounding easily fusible metal which melts at a predetermined point and releases a spring which operates a cut-out or sends an alarm, as the case may be. To the telephone man a one-half-ampere fuse is one that blows when that amount of current flows; to the electric-light engineer a one-half-ampere fuse is one which will carry that amount of current plus an unknown quantity for an indefinite length of time.

It is not the electric-light engineer alone who has had to do with the development of transformers. Their extended use in telephony has called for a vast deal of time and study on the part of the telephone engineer, and while the transformer problem as presented to him is vastly different from that which is presented to the electric-light engineer, it is still none the less difficult. While in the design of transformers and other electric-light and power apparatus the degree of loss which should be tolerated is oftentimes dependent upon the cost of coal, we have no such conditions in telephony, for here the amount of current generated has absolute limits and must be conserved in all of its parts if success is to be obtained. Not only is there no margin for losses of current, but in respect to frequency and the shape of the wave the telephone engineer is held to rigid limits.

E. F. Sherwood, superintendent of traffic of the New York Telephone Company, dwelt on operating conditions. He said: For the past eight years it has been the practice in New York to make service tests in such a way as to show the quality of the service received by telephone subscribers. These tests show the time taken by the operator to answer subscribers' calls, the time taken to complete local and trunk connections, the time taken to disconnect after conversations are finished, the percentage of connections on which irregularities occur, etc. Records of these tests have been valuable not only as a means of showing in what respects improvements in the service might be made, but have afforded accurate information as to the improvements brought about by the installation of relay switchboards. The first standard relay switchboard installed in New York was cut into service on November 13, 1898, and the last one, which for Manhattan Island rounded out the conversion of the entire system of local switchboards to a relay basis, was cut into service November 2, 1901. The tests of service for the year preceding the installation of the first relay switchboard in New York and for the year 1902 show the following results (time in seconds):

	Avg. time taken by operator to answer.	Avg. time taken to complete local connections.	Avg. time taken to complete trunk connections.	Avg. time taken to disconnect.
1897.....	7.7	27.6	50.7	17.1
1902.....	3.8	23.7	30.7	2.8

The improvement made in the time of answering is chiefly due to two causes: First, unlike the arrangement of magneto equipment, the answering jacks in the relay board are immediately associated with the line lamps or calling signals, so that no time is lost by the operator in locating the answering jack corresponding with the calling signal; and second, with relay equipment subscribers' lines are promptly released after conversations are finished, and delays due to slow clearing out of previous connections do not occur as they did with magneto equipment, which required that operators should listen in and ask, "Are you through?" in every case before disconnecting. The improvement in the time taken to complete connections is partly due to the use of trunk-line machine-ringing keys, which when set cause the bell of the called subscriber to ring intermittently until the receiver is removed from the hook; and partly to the use of cord supervisory signals, which show whether the called subscriber has answered or not and enable the operator to give a second or a third ring when necessary without delay. The improvement in the time of disconnection is entirely due to the use of cord supervisory signals, which immediately light when the receiver is placed on the hook, and enable the operator to disconnect without listening in on the connection. In fact the work of making disconnections is largely an overlapping operation and is frequently performed simultaneously with other operations which require the use of the operator's telephone.

During the year 1897, when the average number of subscribers' lines in service in Manhattan was 17,066, a daily average of 3.2 written complaints were received, or one complaint a day for every 5,330 lines. During the year 1902, when the average number of

subscribers' lines in service in Manhattan was 49,955, a daily average of 3.3 written complaints was received, or only one complaint a day for every 15,138 lines; or, to put it another way, at the rate of one complaint for each line every 41 years. Since the installation of the first relay board in New York the number of lines in Manhattan has increased from 20,740 to 53,792, and the number of stations in Manhattan has increased from 25,516 to 91,945. During this time the daily average number of calls originated by subscribers has increased from 243,590 to 549,940, and the daily average number of connections handled by each subscriber operator has been increased from 750 to 1,070; and yet with this very large increase in lines, stations and traffic, and the material increase in the number of calls handled by each operator, the relay switchboards have enabled us to make a very substantial improvement in the service.

Mr. Sherwood also described the New York Telephone Company's school for the instruction and training of new operators.

Kempster B. Miller, engineer of the Kellogg Switchboard and Supply Company of Chicago, was unavoidably prevented from being present, and did not take part in the discussion.

G. C. Allen, superintendent of construction for the New York Telephone Company, spoke of the work outside the exchange. With the common-battery system there is upon the lines at all times an electromotive force of 24 volts, and during conversation there is a current flowing, although in small amount. Paper has been universally accepted as being the best insulating medium for telephone conductors. But the paper must be kept free from even traces of moisture. At the present time on Manhattan Island there are installed, as part of the telephone system, outside of the company's, 222,543 miles of telephone conductors. Of this vast mileage of wire, 98.08 per cent. is wholly underground. Substantially all of these wires are paper insulated and covered with lead pipes. Within these lead pipes the paper-insulated wires must be hermetically sealed. Exposure to the air due to a perforation of the lead pipe, even so small as a pin head, would result in the ultimate failure of the cable.

An Automatic Telephone Operator.

BY WILLIAM J. HAMMER.

[Mr. Hammer referred to the original work of M. D. and F. A. Connolly and F. J. McTighe in automatic telephone exchanges. This system, he said, "has been the basis of very many of the patents which have since been taken out on automatic telephone exchanges; and it is my privilege to-night to present for your consideration a radical departure in automatic exchanges which embodies a new principle, of which it is the pioneer exponent." The "mechanical operator" is a light machine that "does the work of switching in a telephone exchange in exactly the same manner as is done by the human operator, and by exactly similar means." A further consideration of Mr. Hammer's paper will be given in a future issue of the Western Electrician.]

Concluding Discussion.

L. W. Stanton of Cleveland was on the programme, but did not speak. Mr. Lockwood made a few closing remarks. He said that the telephone engineer has to be more kinds of an electrical engineer than perhaps any other electrical engineer following a specialty, and added: "Of course, neither I nor any one else at this hour of the evening could seriously think of making any discussion on the paper which Mr. Hammer brought before us, but I think all of you will agree with me that there is certainly one advantage in the mechanical operator of which he spoke—there will not be 700 resignations in a year of operators who desire to get married."

The institute adjourned at 11:20 p. m.

Telephony Discussed in St. Louis.

The first regular meeting of the St. Louis Chapter of the American Institute of Electrical Engineers was held Friday evening, January 23d, in the rooms of the St. Louis Engineers Club. There were present 34 members and guests, and of the latter 14 made application for membership. In the absence of Prof. Goldsborough, Henry Rustin occupied the chair. The subject for consideration was "The Evolution of the Telephone Switchboard," and Mr. Lockwood's paper was read by the secretary. The discussion following was participated in by Messrs. Mock, O'Reily, Humphrey, Harrison, Devine, Burns, Welz, Skinner, Roeber, Fansler and others. Mr. Devine, who told of early telephone switchboard troubles, declared that the first switchboard was erected in St. Louis, the first connection having been made by one John F. Casey of that city.

Arrangements have been made whereby the St. Louis chapter will use the rooms of the St. Louis Engineers Club for all future meetings. Meetings will be held on the third Friday of each month (on the same date as the New York meeting), and it is the purpose of the chapter to issue special invitations to all engineers and others residing in St. Louis and vicinity, and who will probably be interested in the subject to be presented, to participate in the discussion. The next meeting will be held on February 27th, at which time papers on railway train-lighting will be read and discussed.

Northwestern Electrical Association.

The report of the committee on uniformity of advertising literature, which was presented to the Northwestern Electrical Association at its last week's convention, drew forth the most valuable discussion of all the subjects brought up for consideration. The report of the committee was accepted, and the standard sizes recommended adopted, as stated in the Western Electrician of last week. At the closing session of the convention a motion was carried continuing the committee, which consists of H. J. Gille, F. W. Bowen and A. W. Barron, and giving the chairman of the committee authority to appoint sub-committees in such states and in such territory as may to him be deemed desirable. He was also instructed to get such information as he needs and is for the interests of the association.

The following-named additional new members were unanimously elected at the last session of the convention: W. B. Jackson, consulting engineer, Madison, Wis.; Wm. J. Trott, manager of the W. E. Donley Electric Light and Power Company, Big Rapids, Mich.; J. H. Nibbelinsi, electrical engineer, Milwaukee.

Among the delegates and visitors in attendance at the Northwestern convention, not mentioned in the Western Electrician of last week, were the following-named gentlemen: W. R. Putnam, Red Wing, Minn.; R. N. Kimball, Kenosha, Wis.; J. S. Allen, Beloit, Wis.; P. H. Korst, Janesville, Wis.; B. D. Vilas, Chippewa Falls, Wis.; G. E. York, Portage, Wis.; P. F. Grover, Fond du Lac, Wis.; O. M. Rau, Milwaukee, Wis.; Charles F. French, Chicago; Thomas James, Milwaukee; C. F. Wilson, Milwaukee; C. A. Howe, Chicago; E. C. Eastman, Marinette, Wis.; C. E. Phillips, Chicago; W. T. Pomeroy, Edgerton, Wis.; Thomas Duncan, Lafayette, Ind.; Jospeh L. Barnard, Minneapolis; C. W. Bacon, Chicago; N. G. Harvey, Chicago; W. P. Bragg, Monroe, Wis.; W. R. Bonham, Chicago; G. H. Strang, Richland Center, Wis.; J. M. Strasser, La Grange, Ill.; J. R. Cravath, Chicago; W. F. Collins, Chicago; O. B. Williams, Whitewater, Wis.; E. Kuhlman, Elkhart, Ind.; H. S. Hayes, Fond du Lac; E. H. Debell, Menominee, Mich.; Edward M. Dexter, Milwaukee; Israel Lovett, Council Bluffs, Ia.; B. V. Swenson, Madison, Wis.; W. B. Jackson, Madison, Wis.; Charles Cuno, Oconomowoc, Wis.; Arthur Polacheck, Milwaukee, Wis.; Charles E. Gregory, Chicago, Ill.; A. L. Gillette, Marinette, Wis.; James Richardson, Duluth, Minn.; R. J. Russell, St. Louis, Mo.; F. G. Vaughen, Schenectady, N. Y.; Sinclair Mainland, Green Bay, Wis.; A. J. Rogers, Milwaukee, Wis.

The banquet of the Northwestern Electrical Association at the Pfister on Thursday night, January 22d, was most enjoyable but of a nature purely informal. Toastmaster Thomas R. Mercein, with his usual tact, decided this time to make the affair what might be termed a large "electrical smoker," and as a consequence no formal toasts were allotted. About 102 members of the association gathered in Hotel Pfister's beautiful new banquet hall about 9 p. m. Toastmaster Mercein introduced former Governor W. H. Upham, who explained how he became engaged in the electrical business, and then told a witty story. A telegram from Governor La Follette was read, expressing his regret that official business prevented him from accepting the invitation of the association to be present at the banquet. President W. O. Garrison, of the Columbia Incandescent Lamp Company, St. Louis, in a few gracefully put words extended the hospitality of his home city to the members of the Northwestern Electrical Association during the time of the Louisiana Exposition. Brief informal addresses and stories were also contributed by the following-named: Professors Sheperdson and Swenson and Messrs. Wolff, Brooks, Skeel, Grier, Searing, Raymond, Wirt, Cutter, Almert, Mahler, Perry and others.

Notes.

H. Ryder of the American Steel and Wire Company was there, but made no exhibit.

J. G. Pomeroy energetically exploited the Gardner rock drill as well as Adams-Bagnall lamps.

Messrs. Cushing, Bacon and Harvey did the honors for the Illinois Electric Company in their usual hospitable manner.

The Dearborn Drug and Chemical Works had a parlor under the charge of P. H. Early, who did the honors in his usual clever style.

The Buckeye Electric Company of Cleveland exhibited its lamps under the charge of W. R. Bonham. Mr. Bonham made an interesting exhibit and saw that not a delegate escaped the "Buckeye."

E. A. Jenkins, the energetic manager of the H. T. Paiste Company's western office, was one of the late comers at the Northwestern convention. Mr. Jenkins has made the Paiste company's most excellent business in the West what it now is. He is one of the most popular salesmen in the West and was this time warmly welcomed. Mr. Jenkins made no exhibit.

The Standard Underground Cable Company was as usual well represented by those two personalities so well known in the electrical trade under the name of Western Manager J. R. Wiley and E. J. Pietzcker. The Standard Underground Cable Company is never absent from a convention, and the appearance of two representatives at the Northwestern may be looked upon as a compliment to that association.

E. L. Draffen, western manager of the Gould Storage Battery Company, put in an appearance on Thursday. Mr. Draffen made no exhibit, but he reports a most excellent business for the Gould company during the last three months. The Gould company has only recently put a western representative in the field in the person of Mr. Draffen, and the excellent results indicate the wisdom of this move.

M. B. Kitt of the Minneapolis Steel Machine Company was one of the most interested visitors at the Northwestern convention last week. Mr. Kitt came from the Northwest in company with Minneapolis Manager Coale of the Columbia Incandescent Lamp Company. It was rumored that Mr. Kitt was very justly elated over the fact that, on his way down to Milwaukee, he closed a contract for a large Corliss engine, to be used in the municipal plant at Winona, Minn.

The Wagner Electric Manufacturing Company of St. Louis was represented in the person of R. J. Russell. This was Mr. Russell's first Northwestern convention and he took the opportunity to inform the delegates of the rapidly-growing prosperity of the institution which he represents. The Wagner company has of late greatly increased its business under the guidance of General Manager Layman, and if rumors are true the directors of the company are highly delighted with its present showing.

Mr. Morgan of the Osborn-Morgan Company of Cleveland, Ohio, arrived from that city on Thursday and exhibited a new arc lamp that has just been brought out by the Osborn-Morgan Company, which is operated on either direct or alternating current, according as connections may be made. Mr. Morgan met with misfortune in a damage to his Cleveland shipment, but managed to work himself out of his difficulty by strenuous efforts, and had his arc lamp in operation Thursday. This new lamp created much interest on account of its broad applicability and simplicity in operation.

Without doubt one of the most energetic visitors to the Northwestern convention was W. R. Mason. Mr. Mason was, of course, active in pushing the Garrigus mechanical boiler-cleaner. It may be said for this cleaner that it is a mechanical device for skimming the scum from the surface of water in boilers. From the testimonials which Mr. Mason has secured from some of the most prominent boiler-users in the United States, this device is most remarkable in its operation. A testimonial from the Milwaukee Electric Light and Power Company indicates that it is most valuable to boiler users.

Chicago Street-railway Situation.

Formal announcement has been made of the appointment of a protective committee of stockholders for the Chicago Union Traction Company and the North and West Chicago Street Railroad Companies. Walter G. Oakman is chairman of the committee and the other members are John J. Mitchell, Marshall Field, H. N. Higinbotham, John H. Wrenn, R. R. Govin, George E. Adams, H. B. Hollins, Norman B. Ream, Charles Steele, A. B. Widener and Oakleigh Thorne. These gentlemen represent the largest Chicago and New York stockholders. They will undertake to prepare for the depositing stockholders a plan for the settlement of the franchise question and the improvement of the railway system.

It is reported that "strong eastern interests," presumably backed by J. P. Morgan, have pledged themselves to raise $50,000,000, if needed, for improvements to the Union Traction Company's system. After the franchises have been granted, it is understood that a complete reorganization of the finances of the Union Traction Company will take place.

At the meeting of the Chicago City Council on January 26th Mayor Harrison's draft of a law providing for a referendum in the granting of street-railway franchises was rejected and his report recommending amendments to the Jackson municipal-ownership resolution adopted a week ago was tabled. Alderman Foreman offered a resolution providing that it be the sense of the council that extension ordinances be at once passed by the committee of the whole, and then held on a pledge not to take final action in the council until a favorable referendum was obtained, the submission to vote to be made at the judicial election in June. The council received from the trades unions of the city a memorial that the question of subway building be kept separate from the question of franchise extension, and also one from the United Brotherhood of Carpenters demanding that the council refuse to negotiate with the traction companies for the construction of subways.

Representatives of the Morgan interests are in the city this week in consultation with the protective committee and the city officials. The question of subways is receiving a good deal of attention. The Washburne-Alexander syndicate proposes to bid for their construction, and the Illinois Telephone and Telegraph Company may also present a bid.

DEVELOPMENT OF THE TELEPHONE FIELD.

Chicago and Central Union Telephone Companies' Annual Reports.

In his annual report to the stockholders, dated January 21st, President John I. Sabin of the Chicago Telephone Company says that the year 1902 "has been a year of intense activity and great growth. The total increase in the number of telephone stations installed has been 25,614, making a total on December 31, 1902, of 79,043. The stations within the city of Chicago increased 47.7 per cent., and the stations in the company's territory outside of the city of Chicago increased 48.7 per cent. In both cases the additional stations were very satisfactorily distributed between business and residence." There were 3,000 unfilled orders on hand at the date of the president's report. These figures are given:

	1901.	1902.
Gross revenue	$3,775,001.75	$4,570,805.84
Gross expenses (operation, taxes, maintenance and reserve for deferred maintenance	2,691,129.49	3,368,334.57
Net earnings	$1,083,872 26	$1,202,471.27
Dividends	960,000.00	1,075,192.50
Surplus for year	$ 123,872 26	$ 127,278 77

The total resources at the end of 1902 were $12,902,959.73, of which $11,207,212.74 was invested in plant. This investment in plant increased no less than $2,332,078.11 during the year. The capital stock stood at $11,903,400 at the end of the year and the surplus at $427,382.67. The dividend rates figure out 10⅔ per cent. for 1901 and a trifle less than nine per cent. for 1902. The old directors were re-elected.

Of a different character is President Sabin's report to the stockholders of the Central Union Telephone Company, also dated January 21st. As it is very brief, it is given in full:

"The large volume of the business of this company and its widely extended territory make it impossible for the auditor to prepare full figures for submission to the stockholders upon the date fixed by the by-laws for the annual meeting. The figures given below include November and December estimated, as has heretofore been the custom. The actual figures for the year ending December 31, 1902, will be completed about the first of March.

REVENUE.

	Year Ended Dec. 31, 1901.	Year Ended Dec. 31, 1902.
Subscribers' rentals	$1,716,341	$2,041,608
Toll revenue	710,011	800,784
Miscellaneous revenue	158,437	161,325
Total	$2,584,789	$3,003 717

EXPENSES.

For administration, taxes, operating and maintenance	$1,973,501	$2,341,989
Operating profits	$ 611,288	$ 661,728
Less interest, including interest on bonds	386,762	481,383
Net profits	$ 224,526	$ 180,345

"Your directors believe that the sum shown as net revenue should, in the interest of conservative management, be credited to line repair and maintenance."

The 1903 directors of the Central Union are C. H. Brownell, M. J. Carney, W. S. Chapman, Frederick P. Fish, F. H. Griggs, J. Russell Jones, Robert T. Lincoln, L. G. Richardson, John I. Sabin, John F. Wallick and Arthur D. Wheeler.

Merger at Des Moines.

A merger is in progress at Des Moines, whereby the six Independent toll-line companies which control the Mutual Telephone Company of Des Moines will be made into one company, and the Mutual exchange will be taken over and operated by the new company. The combination represents 1,200 miles of lines and reaches 20,000 subscribers. The six companies interested are the Knoxville Electric Company of Knoxville, Iowa; the Jasper County Telephone Company of Newton; the E. H. Martin Telephone Company of Webster City; the Hawkeye Telephone Company, whose headquarters are now at Des Moines, but were formerly at Perry; the Boone County Telephone Company of Boone, and the Southern Telephone Company of Mount Ayr. G. N. Bandy, manager of the Mutual, has resigned, and it is understood that his place will not be filled for the present.

Independent Connection to the Center of Chicago.

At a recent meeting the Chicago City Council ordered deferred and published an order recommended by the committee on gas, oil and electric light giving the United Telegraph, Telephone and Electric Company, a Hyde Park corporation, the right to lay in the city conduits a cable of conductors connecting its Hyde Park plant with the downtown district. The order gives the corporation the temporary privilege, pending the disposition of an ordinance now before the council, permitting it to install an underground cable containing not more than 10 conductors, for establishing connection with the downtown district. If the ordinance fails of passage the mayor may order the removal of the temporary cable from the city conduits.

Ohio Telephone Notes.

The Central Union Telephone Company has announced that it will install an exchange at Wooster, charging $2.50 a month for business telephones and $1.50 for residence telephones.

The Utica and Homer Telephone Company has been incorporated with a capital stock of $40,000 for the purpose of building telephone lines in Licking and surrounding counties. Its charter gives it the privilege of extending its lines any place in the state. Dwight E. Sapp is the moving spirit in the new company.

The Richwood Telephone Company of Richwood has filed notice with the secretary of state of an increase of capital stock from $10,000 to $20,000.

The Marion Telephone Company has been granted a franchise in the village of Prospect by the Probate Court of Marion County.

It is said the directors of the People's Telephone Company of Akron are considering the proposition to construct a line connecting the towns of Akron, Canton and Massillon. If this is done, the four Independent exchanges in Portage County may be purchased. They are located at the larger towns and villages in that territory. The company now owns the exchanges at Akron, Barberton and Cuyahoga Falls.

The directors of the Haskins Mutual Telephone Company at Haskins have chosen the following-named officers: President, J. F. Brand; vice-president, F. A. Robertson; secretary and treasurer, E. C. Thornton; general manager, W. T. Moore.

The Bell Telephone Company is endeavoring to secure a franchise to operate an exchange in Bellefontaine.

The Standard Telephone Company of Weston has been incorporated with a capital stock of $100,000 by John Bamer, Summer Cotingham, W. D. Mudge, Azor Thurston and M. L. Bamer. It is the intention to construct a system of telephone lines in Defiance, Henry, Williams, Fulton, Paulding, Putnam, Hancock, Wood, Seneca, Sandusky, Lucas and Ottawa Counties.

The United States Telephone Company is now building a line between Marion and Bucyrus.

O. M. C.

Telephone News from the Northwest.

The La Crosse Telephone Company will install a switchboard to accommodate 3,000 connections.

The Star Telephone Company of New Market, Minn., has been incorporated with $50,000 capital stock.

The Montevideo telephone exchange of Montevideo, Minn., will erect a building for its exchange office. The secretary's report shows that the cost to operate the plant, having 204 connections, is 82½ cents per month per instrument.

The Waseca (Minn.) Telephone Company has concluded to increase its capital to $40,000 and construct 30 miles of farm lines.

The Northwestern Telephone Exchange Company in Minnesota has paid the state treasurer $25,002.90 as three per cent. of its gross earnings for 1902. For 1901 the company paid $23,332.

The Iowa Telephone Company is anxious to secure a franchise from the city of Des Moines, and the council will soon take the matter up. The company is willing to submit to a gross-earnings' tax of two per cent., and will agree to erect a large building and move the headquarters of the company in the state from Davenport to Des Moines, and will construct a subway system.

The Libertyville Telephone Company of Libertyville, Iowa, has been incorporated with $7,000 capital stock to build lines through the county. The company has over one hundred subscribers, and will construct 40 miles of wire as soon as the materials can be secured.

The Wettstein Telephone Company and the Electric Light and Telephone Company of La Porte City, Iowa, have combined as the La Porte Public Utility Company.

The Rosalia Telephone Company has been formed at Rosalia, Wash., to succeed the Rosalia rural-telephone system, taking over the latter's barb-wire system. New overhead lines will be constructed and service furnished at $1 a month.

R.

Southern Telephone Developments.

The Southern Bell Telephone Company will remove its headquarters from New York to Atlanta early in the spring. A large clerical force and the offices of the auditor and secretary and treasurer are included in the move. The transfer will probably be made in April.

The board of aldermen of Richmond, Va., have adopted the ordinance providing for a merger of the Richmond Telephone Company and the Bell company. The matter will have to go before the Common Council.

The American Telephone and Telegraph Company will open an office in Wilson, N. C., for long-distance service.

Offices will be established at Rome Ga., Ringgold and other points in connection with the long-distance line from Atlanta to Chattanooga.

At Columbus, N. C., the Polk County Telephone Company is preparing to build a line to Lynn. A long-distance line has been built between Jonesboro, Sanford and Carthage, N. C.; a line has also been built from Lexington, N. C., to Yadkin College.

L.

Indiana Telephone Items.

The Union Telephone Company of Clay and Vigo Counties has been incorporated with a capital stock of $2,400. The company will build and maintain telephone lines in the two counties.

The Farmers' Co-operative Telephone Company of Mulberry made an assessment on each of the stockholders of the company to meet the $4,000 debt, and was met with such opposition that the company has threatened to disband.

The National Horse Thief Detective Association of Indiana held a meeting at Alexandria last week and perfected a thorough system of clearing the country of wrongdoers by the extensive use of rural and city telephones. The system makes it possible to put more than 500 men on the trail of a horse-thief in any part of the state. A telephone directory will be prepared for the members.

The Kinloch Telephone Company of St. Louis made connection with Terre Haute on its long-distance line last week. This act makes a connection with the Indiana Independent system, including Indianapolis.

A mass-meeting of men representing county telephone companies was held at Greencastle on January 24th, and a resolution was adopted rejecting three propositions submitted to them by the Greencastle Telephone Company, whereby they might obtain service in the city. The country lines are asking the City Council to grant them a franchise to maintain a switchboard in the city.

The stockholders of the New Long-distance Telephone Company have formed a "voting trust," the purpose of which is to perpetuate the present management for a period of five years. Ninety-five per cent. of the stockholders have signed the agreement.

F.

Independent Exchange in Buffalo Nearly Ready.

Thursday, February 5th, is the date now set by the Frontier Telephone Company of Buffalo for the commencement of its service to 3,500 subscribers. On this date the company will set a corps of operators at work at the big new switchboard, and within a week the company will be rendering a thoroughly first-class service. Superintendent W. H. Johnston says the company will start with a service to 3,500 subscribers. The company has contracts for 11,000 telephones, including party lines, and these will be installed as rapidly as possible. The ultimate capacity of the switchboard is 12,000. A new device will be used for the four-party-line service, whereby one subscriber on a party wire can be called up without any annoyance whatsoever to another subscriber on the same wire.

TELEPHONE MEN.

William Gray of Hartford, Conn., died on January 24th of apoplexy. Mr. Gray was a well-known inventor, among his inventions being the Gray telephone pay station used by a number of the Bell licensee companies and covered by a large number of patents.

Samuel Magill Bryan, ex-president of the Chesapeake and Potomac Telephone Company and prominently known in Baltimore and Washington financial circles, died on January 23d, of a complication of diseases, at his residence at Ruxton, Baltimore County, Md. Mr. Bryan had been in ill health for some time and his death was not unexpected. He was 55 years old.

C. L. Howk, manager of the Independent exchange at Shelby, Ohio, has resigned his position to accept a similar one with the Norwalk (Ohio) company. Mr. Howk has rather a remarkable record. He started as a lineman, and after he had worked at that a year he was made manager of the plant, which position he has held for two years, and yet is not quite 21 years of age.

Harvey Myers has resigned as president of the Memphis Telephone Company of Memphis, Va., and is succeeded by C. E. Stinson of Rochester, N. Y., formerly general manager of the Rochester Independent Telephone Company, and also vice-president of the Independent Telephone Association of the United States. Mr. Myers was elected chairman of the board of directors of the Memphis company. He will now devote more of his time to the other Independent telephone interests with which he is connected. J. S. Warren continues as general manager of the Memphis company.

The Mechanicsburg Telephone Company, Mechanicsburg, Ohio, has increased its capital stock from $25,000 to $35,000. D. J. Burnham is president.

Legislation Against Discrimination Sought by Independents in Tennessee.

The Independent telephone companies of Tennessee have united to secure legislation that will prevent discrimination in one city, town or section of the state at the expense of other sections. A bill for this purpose has been prepared and will be presented to the Tennessee Legislature. The measure is aimed to break up the practice of lowering rates and giving service gratis, which, it is asserted, has been done by the Cumberland Telephone and Telegraph Company, the competing Bell company. The leading companies represented in the movement are the Memphis Telephone Company of Memphis, the People's Telephone and Telegraph Company of Knoxville and the Independent companies of Jackson, Bristol, Clarksville, McMinnville and other cities in Tennessee. The Independent companies are said to be working as a unit against the Cumberland.

GENERAL TELEPHONE NEWS.

The Rawson-Brush syndicate has purchased a large interest in the Rome Telephone Company, Rome, N. Y., Ed. L. Barber and his associates disposing of the controlling interests. Theodore M. Brush and I. H. Griswold of Elyria, Ohio, have been elected to the directorate of the company.

It is said that arrangements are under way by which the Rawson-Brush syndicate and the Consolidated Telephone Company will divide the state of New York, each to have a certain portion for its construction work, and then traffic arrangements will be made between them, so that there will be no duplicate wires over the territory. There has been considerable rivalry between the two concerns.

The local telephone company, Bellevue, Ohio, will shortly close a contract for central-office equipment for Norwalk, Ohio. The equipment will consist of multiple switchboard for party-line service. Each cord circuit will be equipped with four-party selective indicating keys. The equipment will be one of the most modern in every detail. The power plant will be operated by a gas engine installed by the company. Specifications for the plant were drawn by LeRoy W. Stanton, consulting telephone engineer of Cleveland, Ohio.

The Automatic Telephone Company of Princeton, N. J., is installing its new automatic switchboard of 1,000 capacity and 150 telephones installed, which it recently purchased from the Automatic Electric Company of Chicago. A number of years ago the Princeton company entered the telephone field with an automatic switchboard and 15 stations connected up. The service grew in public favor until the ultimate capacity of the board, which was 100 stations, was exhausted, at which time the management gave the manufacturers an order for an entirely new outfit.

It is stated that the Memphis Telephone Company and the Memphis Long Distance Company, which are practically the same, are preparing to spend from $300,000 to $400,000 this year in the extension of long-distance lines from Memphis over the entire territory tributary to that city. St. Louis on the north, Little Rock and Springfield on the west, New Orleans on the south, and a connection with Louisville and Nashville are the objective points of this far-reaching plan, which, when completed, will be allied with other great Independent telephone companies so as to cover the United States.

The Commonwealth Telephone Company, a new corporation, with headquarters at Waterloo, Iowa, has acquired the lines of the Cedar Valley Telephone Company, the County Telephone and Telegraph System, the Waverly Telephone Company, Hardin County Company and the Parkersburg and Laporte systems, all of which have been closely affiliated with the Cedar Valley system. A. J. Wheeler of the Illinois Telephone and Telegraph Company of Chicago conducted the negotiations for the purchasers, the capital being chiefly furnished by Chicago men. The purchase means a revolution in telephone methods in Iowa, by the introduction of a complete automatic system in place of that now in use.

MANUFACTURERS AND DEALERS.

The Kellogg Switchboard and Supply Company of Chicago will fit the Alexander Young Hotel, Honolulu, Hawaiian Islands, with a telephone system consisting of 260 common-battery telephones and a lamp-signal switchboard.

In Duluth a short time ago a patron who was using a telephone received a shock through the exposed metal parts of the receiver, which resulted fatally, it is said. The Electric Appliance Company of Chicago asserts that its Noxem receiver is an absolute safeguard against an accident of this kind, as it has no exposed metal parts.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago has recently closed contracts for switchboards with the Buckeye Construction Company for Shawhaw, Ky., and Centerville, Ky.; D. A. Oliver, Scottsville, Ky.; W. A. Eckels, Rudd, Iowa; Clarington (Iowa) Telephone Company; Montrose (Pa.) Telephone Company; E. V. Hauser of Havre, Mont.; Pike County Telephone Company, Pleasant Hill, Ill.; State Line Telephone Company, Elmo, Mo.

Measured Service.[1]

By George N. Bandy.

Of all public utilities, gas appears to have been the only one charged for from the beginning according to quantity consumed. Until recently it was a common practice, and is yet the custom in many places, for water companies to charge according to the number of rooms in a house or number of front feet in the lot; now the modern practice is to charge a certain rate per thousand gallons. It was formerly the rule for electric-light companies to charge for a current according to the number of lamps connected, but now an up-to-date company charges according to the watts, or the actual quantity used.

The pioneers in the telephone field, who, by the way, were the various Bell licensees, not having, at the time the telephone was first brought into commercial use, apparatus by which the number of calls could be accurately recorded, adopted the expedient of charging for the service an arbitrary rate per month, having a higher rate for business than for residence telephones. This practice still largely obtains among the Independent companies, but the Bell licensees are breaking away from that custom as rapidly as possible; especially is this true in the larger cities.

There are several reasons for making the change; it yields a larger income per telephone, increases their list of subscribers, and last, but not least, rids their patrons of that intolerable nuisance known as a deadhead, who uses your service in many cases more than a regular subscriber, without paying therefor, and 99 times out of 100, not only fails to show his appreciation of the convenience by thanking the company or subscriber, but is loudest in his denunciation of what he is pleased to call "the rotten service" the company is furnishing.

Many of the Independent companies have profited by the mistakes of opposition companies, but I am sorry that there is a large number who have not made the most of their opportunities. We are now able to purchase telephone apparatus that, so far as its signaling and talking qualities are concerned, seems well-nigh perfect, and is certainly equal if not superior to anything used by the Bell licensees. This being true, why should we hesitate to adopt "measured service?" It is certainly fair to both the patron and the company, and I see no good reason why the change should not be made.

For a number of years the word "Independent" has had a wonderful influence upon the public, and during that time they have given us their confidence, good will and money, and are now not only requesting, but in many cases are demanding, that they be furnished not only with first-class, but modern service, embodying the latest ideas. It is therefore plainly a question of the survival of the fittest, and if we expect to remain in this business, it is only too evident that we must be continually on the alert for, and introduce the latest and most approved type of apparatus and inaugurate such changes in the handling of, and charges for, telephone service as seems appropriate and satisfactory to the public.

I believe that the majority of our subscribers would welcome a change from the present flat-rate system to the "pay-for-what-you-get" principle. It may be, however, that the apparatus for recording the number of calls is not sufficiently perfected to warrant our making this change, but as necessity is the mother of invention, I confidently believe that if it is shown that the apparatus now available for this purpose is not efficient, that someone will soon place on the market an instrument that will meet our requirements.

In charging for telephone service, on the meter basis, it may be necessary, of course, to have the subscriber guarantee a certain number of calls per month; for instance, a residence telephone might guarantee 25 calls at four cents each per month; all in excess of that number of be charged for at three cents per call. Business telephones, $2 per month for 40 calls; all in excess of that number three cents per call. The guarantee as to minimum number of calls per month to be varied to suit local conditions. No calls to be recorded unless the number or party called is obtained. All incoming calls free.

These are merely brief suggestions for your reflection. There are various ways offered by others for accomplishing a similar purpose. An idea, laid down by a prominent telephone man as long ago as 1895, has been adopted for practice by a number of telephone companies. It has later become the rule in some foreign countries. It is first to charge a flat rate, covering a reasonable amount for the subscriber's station maintenance; then a charge additional for the service, or a switching rate of so much per call, varying from two to six cents for exchanges.

I understand that here in Chicago the new system is based upon a similar idea, but the method of applying the rates differs. Th Chicago company may fairly be called the largest prospective exchange telephone company in the world. Recently, after the most elaborate and searching preparations, it concluded upon what it calls its new policy, of meeting the Independent and the demands of its patrons for lower rates. This so-called new policy, I am told, consists in a determination to establish message service, or its equivalent, almost, if not entirely.

The plan is to require a guarantee per month per telephone, and then an additional five or 10 cents per call on the main exchanges. The company operates a large number of exchanges outside of the main part of the city. These exchanges are sometimes called suburban exchange. For instance, if you are a telephone subscriber in Englewood, in the southern part of this city, or Rogers Park, in the northern part, you must pay a flat rate (said to cover a so-called local service) of about $30 to $60 per annum, then on each call for the main exchanges you pay 10 cents more.

I refer to the Chicago Telephone Company's service methods, because that company is known to many as being progressive, and we are better acquainted with conditions here than in other places, where this message service is being adopted. I do not go into full details, because you may readily learn more by inquiry, but I am not averse to adopting any new improvements, even if the Bell company first shows the public desire them.

This subject must have an important bearing on our future. We ought now to begin to learn all about it. I hope the discussion may indicate your desires and prepare the way for future action, remembering that "As the twig is bent, the tree is inclined."

Discussion.

A. B. Conklin of Aurora, Ill.: In the matter of measured service there are a great many items entering into it which modify the application of it to subscribers in various exchanges and in various parts of the country, and in various parts of the same exchange, and if these modifications only applied to subscribers in various exchanges and not to subscribers in the same exchange, it would be a matter very easily adjusted, and while the paper was being read I had some objections to measured service that arise in my mind, and I just want to mention a few of them. In the first place, it is the object of the Bell Telephone Company to meet competition, and it has never successfully met competition where it was against a well-operated Independent company, whether for the reason that Independent companies as a rule are giving flat rates and unlimited service or not. In paying for measured service it is true that if only the matter of the switchboard expense, the matter of connecting one subscriber with another, was taken into consideration, and a given amount for each call, three, four, five or six cents per call would apply equally to all subscribers, whether residence or business subscribers, why that is a question, but my experience in the operation of exchanges has convinced me emphatically upon this point, that the expense of operating a telephone in a subscriber's place of business or in his residence very largely depends upon the distance this subscriber's station is from the switchboard. I might have a residence subscriber four blocks from the switchboard and another one half a mile, and it seems that if we received adequate remuneration for each one coming into the switchboard, we would be compelled to reckon the expense of the maintenance of the lines of various lengths of a block to a half mile or two miles long.

In my own experience, I am inclined to the opinion that, in the first place, a flat-rate unlimited service is more popular to all telephone users; that has been my experience, and it has convinced me to my own satisfaction upon that point. In the second place, if it is a residence that is two miles from the switchboard, the expense of keeping up that line would amount to four or five times as much per call as the business man who lives within one-half block of the station, and if you are to apply to him an adequate charge for the length of line, there would be very few residence telephones you could secure. A flat rate for a residence per call costs usually very much more than a flat rate to a business man who uses his telephone 10 to 50 times as much as the residence subscriber, and who is compelled to pay twice as much for his service—he gets 10 to 50 times as much service at a cost of twice as much as a residence subscriber, but the residence subscriber, to maintain the residence subscriber's line, costs the telephone company four to 10 times as much to maintain as to maintain the subscriber's line in the business district, which is nearer to the exchange; so that the additional cost per call of a residence telephone on the idea of measured service is offset by a very much fewer number of calls, which evens it up, as you could not even it up in measured service—it would be necessary, in other words, to charge a residence subscriber 10 cents per call, in order to realize the same profit on the operation of his line as it would a business man two cents per call.

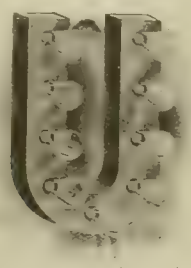
This would practically exclude residence subscribers, and for that reason I believe that the flat rate, in the first place, meets with the public approval better than a measured-service rate; in the second place, it more equally recompenses the operating public for the service. At $1.50 a month to a residence using the telephone 10 times a day would be 1½ cents; if it cost 10 cents a day to use it 10 times, it would be one cent a call, pretty near $3 a month, and a business man would have the use of it 30 times a day, and it would be one-tenth of a cent a call. Now the business man to compete with the one cent a call, would be 30 cents a day,

1. Paper read before the Interstate Independent Telephone Association at Chicago on December 10, 1902. Mr. Bandy was until recently a telephone manager at Des Moines, Iowa.

and he would repudiate your service if his telephone would cost him that much, but the company operates his business telephone within a short distance from the exchange at a very much less cost than it operates the residence telephone. Therefore, it can give a great deal more service for $30 per year and realize the same profit.

Goltz Electric-sign Letters.

Modern ideas and the requirements of safe construction and handsome appearance have entirely changed the methods formerly used in building electric signs. Wooden construction is fast disappearing, and in some cities of this country the local inspection departments absolutely prohibit the use of any woodwork in connection with electric signs. The Goltz Engineering Company of Chicago has designed and is manufacturing a metal letter which



GOLTZ ELECTRIC SIGN LETTER.

is said to be absolutely fire and water proof, the latter, of course, only if lamps are provided with rubber rings inserted between the socket opening and lamp to prevent moisture from entering the socket at those places. These letters, when enameled in the proper colors, usually white face and red or black sides, look as well in the daytime as at night when illuminated, and are practically indestructible They can easily be attached to sheet or angle-iron backs or to wood boards or wire screens. Central stations are gradually beginning to find out that handsome revenues can be derived from electric signs, and any improvements which will tend to increase this business are of interest. The accompanying illustration shows a standard 16-inch letter of the Goltz type.

The Electrical Fire Hazard.

In the quarterly fire report of the Electrical Bureau of the National Board of Fire Underwriters, issued by Secretary William H. Merrill, Jr., and dated January 10, 1903, it is shown that 42 fires, with losses aggregating $552,541, which were reported as due to electricity during the quarter were, upon further and more reliable investigation, found to have been due to other causes. Of these, a $75,000 loss and a $6,000 loss were due to spontaneous ignition; a $12,000 loss is attributed to incendiaries; an $11,000 loss was caused by a gasoline stove, and an $81,000 loss was reported due to a chemical explosion. Other fires attributed to electricity were found to have been caused by a defective chimney, a gas jet, an overheated furnace, matches, etc. Reports of 197 electrical fires, with losses aggregating $276,285, were received from different parts of the country. Reports were received of 139 fires, losses aggregating $1,357,042, which were supposed to have been due to electricity, but the causes could not be definitely proven as electrical, principally because the fires destroyed the conclusive evidences of their origins.

COMMUNICATIONS.

Bluffton Makes Its Claim.

To the Editor of the Western Electrician:

You give Asheville, N. C., credit with having the most subscribers in proportion to its population of any city in the world. This is hardly fair to the managers who have worked hard to show up their plants. We have here 1,783 inhabitants and 212 telephones inside of the corporation, making a telephone to every 8.97 people. This does not include 151 farm telephones or the telephones used by managers in office and residences. This has been accomplished by hard work and good service with old material, and other companies may do even better.

O. G. SNYDER,
Manager Bluffton Telephone Company.
Bluffton, Ohio, January 24, 1903.

New York State Laboratory Disapproved.

To the Editor of the Western Electrician:

I write to inform you that the American Institute of Electrical Engineers, at a meeting of its board of directors held yesterday, passed the following resolution:

"Resolved, That this board disapproves of the state of New York establishing a state laboratory and standardization bureau."

SAMUEL SHELDON,
Chairman special committee on state laboratory and standardization bureau.
New York, January 24, 1903.

Power Plant of the New Union Station, Pittsburg.[1]

By D. B. Kinch.

The power plant of the new Union Station is a modernized plant in every particular, both as to the constructive and economic details. Encompassed in the building directly south of the station, a multiplicity of machinery occupies every available inch of space, somewhat more crowded than it should be in an ideal plant. The space occupied by the building, 55 by 420 feet, contains a varied machinery, little thought of by the thousands of people daily passing within a few feet. The centralizing, in an isolated building, of all of the generating machinery for a terminal station and yards is an ideal condition that cannot always be adhered to, as is the result in this instance. Here, this is due to the exceptional location selected for the plant. As the Union Station is a consumer of perhaps 75 per cent. of the output of the plant, the location is certainly ideal. From an operating viewpoint, it could not be better; but, notwithstanding this simplifying condition, the engineering details that were constantly arising required careful plotting and planning and replotting and replanning, little of which is shown by the completed plant.

The power plant of a large terminal is wholly and in reality the living portion of it, and to keep it breathing regularly is of no small concern day and night. A total shutdown is the most dreaded thing that can happen to those in charge, and is the one thing guarded against so closely. The slightest appearance of a rupture by signs we all know so well are battled forthwith, and immediately. For, to the terminal and its yards, it is the living thing, and is in itself the one great potentiality. The movement of the trains, numbering hundreds daily, depends wholly upon the air compressors, and generated here is the current for the storage battery controlling these movements.

The heating and ventilation of the station, the elevators for both the offices and baggage service, the lighting of the building and yards, the filtering and refrigerating of the drinking water, the building service water, and pressure for fire mains, the entire telegraphic service, etc., are all a vital part of the whole; and the failure of one portion, for even a limited time, means a serious handicap and confusion.

Duplicated as to the most vital points, unusual provisions and precautions were provided in this installation. No false economies were made or asked to be effected at the sacrifice of the best practice. Knowing we have a very complete plant for its various uses, we also know that as to some constructive details, we will be open to the usual criticism that new plants always are subjected to, looked at from the various viewpoints of each engineer for himself. However, for these criticisms we can only offer one answer. That is that the best practices with the local conditions governed; these local conditions were wholly the deciding elements, and were always worked up to, probably in some instances at a sacrifice of the ideal.

The engine and generator equipment comprises four marine-type Westinghouse compound engines. These engines are of the standard marine-type design, the high-pressure cylinder being 17 inches in diameter, the low-pressure cylinder 27 inches, with a 24-inch stroke. The engines have a speed of 200 revolutions per minute. The high-pressure cylinder is equipped with a piston valve, double-ported, and the low pressure with a slide valve, double-ported. The engines are direct-connected to 350-kilowatt, 220-volt, two-phase, alternating-current dynamos of the Westinghouse standard type. One engine-driven and one motor-driven direct-current dynamo, each of 37½-kilowatt capacity, serve as exciters. These exciters also furnish direct current for a number of small motors, used at various points throughout the building on special apparatus for which alternating-current motors are not, as yet provided by the manufacturers in connection with their apparatus.

Current for the storage battery used in connection with the switch and signal installation is also provided from the exciters. These direct-current machines also furnish the primary current for 14 Crocker-Wheeler dynamotors, used exclusively for the telegraphic service. The output of these numerous little machines varies from eight volts on "locals" to 360 volts for duplex and quadruplex service. Battery current for telegraphic purposes is entirely supplanted by the installation of these small sets.

The switchboard panels are of blue Vermont marble, and the board is composed of 13 lower and nine upper panels, each equipped with main and auxiliary bus bars. Stairways at either end of the board give free access to the gallery around the upper panels. The lower panels are used for the generating and high-tension work and the upper panels for the distribution. It is our intention to run the alternators in parallel, and to this end the synchronizing apparatus is one of the board features.

Step-up transformers at a ratio of 10 to 1 are installed to furnish lighting and power circuits to outlying districts.

Ample circuits for series alternating-current arc lamps are provided, and for this work a combination jack and plug board is used. All transformers as well as rheostats are placed in the basement directly underneath the switchboard, thus clearing the back of switchboard to an unusual degree. The electrical equipment occupies the entire south side of the engine room, while along the north side are located the air compressors, hydraulic pumps, high-pressure pumps, small air compressor for thermostatic heat control in the office building, a Scotch yoke air compressor, etc.

The main pumping engine for hydraulic elevators is of the Riedler type, being fitted with mechanically operated valves.

It has duplex, single-acting, outside-packed plungers, 9½ inches in diameter and 24-inch stroke, with steam cylinders 13 inches and 23 inches in diameter with 24-inch stroke. This pump has a capacity of 1,400 United States gallons a minute, against a pressure of 200 pounds to the square inch, when running at about 96 revolutions per minute with a steam pressure at throttle of 150 pounds. The main feature in the design of this pump was to cut down the floor space to the smallest possible area. For this reason the valve gear was put on the outside of the steam cylinders, in order to get the cylinders close together and do away with the necessity of a passage between the gears, which would have materially widened the engine. The engine frames were made of the double-bearing type, with four-part adjustable boxes for all bearing. The entire water and steam end of pump is mounted on a substantial bed plate of box section, insuring alignment, and in order to further economize the floor space the pump end was made of the single-acting type, as this would cut down the space required about one-half of that necessary for the double-acting pump.

The distinctive feature of this pumping engine is the mechanically operated valves. As the pump is single acting, it was necessary to provide a by-pass so as to enable the pump to run without delivering water when the pressure had passed a certain point. The by-pass valve is operated by means of an air cylinder, which also operates an auxiliary throttle. The steam for running the pump is taken through a small by-pass on the side of this throttle, this by-pass having a valve in it, so that the amount of steam fed to the pump can be adjusted that the pump will not run more than 30 revolutions per minute when running on the by-pass.

The air cylinder for operating water by-pass valve and throttle is controlled by means of a pilot valve operated by an auxiliary governor, this governor only coming into effect when the speed of the engine has dropped to between 20 and 25 revolutions per minute. All the working parts of the governor are central, so that friction is entirely eliminated. As auxiliary pumps for elevator service we have installed two simple direct-acting Worthington pumps of 750 gallons each. These are also used for the night run.

The elevator equipment comprises seven high-speed elevators, to travel from train floor to top floor, a distance of 190 feet, and eight direct-lift elevators, used for baggage and express service.

For the furnishing of air to the signals and switches as well as for car-testing and car-cleaning purposes two cross-compound vertical Riedler express-type compressors are used. Sizes of air cylinders are 14 and 24 inches in diameter with a 24-inch stroke. They are driven by a vertical cross-compound, non-condensing Corliss steam engine with cylinders 13 and 23 inches in diameter and 24-inch stroke. Each compressor has a capacity of 1,500 cubic feet of free air, not piston displacement, to a maximum pressure of 100 pounds, when running at a speed of 134 revolutions per minute. The air cylinders are mounted above the steam cylinders. Both air cylinders and heads are water-jacketed. The air suction and delivery valves are placed in the heads, the suction valves being of the semi-rotative type operated by means of a wrist plate, driven from an eccentric in the same manner as the steam gear. An inter-cooler and an after-cooler are provided. The inter-cooler has a volume of about six times the volume of the low-pressure cylinder, the air being cooled by means of water passing through the tubes. After the air has been delivered from the high-pressure cylinder it is passed through the after-cooler so as to remove as far as possible all moisture. The air is then delivered to storage tanks located in what is known as the air-intake building. This is a separate building of small dimensions directly west of the engine room, and is equipped with storage tanks for air delivery to various points and also with appliances for thoroughly cleansing the air before it is delivered to the suction pipe.

A 15-ton electric crane travels the entire length of the engine room, thus assuring valuable aid in case of need.

The boiler room is equipped with Babcock & Wilcox boilers. These boilers are of standard type and are all of forged steel construction, built to carry a working pressure of 200 pounds. The boilers as installed comprise six boilers in three batteries, each unit of 300 horsepower, making an aggregate of 1,800 horsepower, space being left for an additional

1. The new Union Station of the Pennsylvania Railroad Company in Pittsburg is a modern office building combined with a railroad station. Its engineering features were recently described in a series of papers read before the Engineers' Society of Western Pennsylvania. One of these papers is herewith reproduced. Mr. Kinch is the electrician of the plant he so concisely describes.

battery for future increase. The boilers are equipped complete with Roney stokers, and installed in the boiler room is a Hunt coal and ash conveyor. Hoppers of 50,000 pounds coal capacity are located over each battery of boilers and cams are arranged at convenient points along hoppers for dumping the buckets. The conveyor movement is made by a steam engine located in what is known as the annex. The conveyor extends along the top of coal hoppers, and, passing down the side of west battery, runs along the basement floor and receives the ashes from the ash hoppers under each boiler. The buckets of the conveyor receive these ashes through an automatic filler located directly under the hoppers. The ashes are stored in a large hopper located in the second story of the annex from which chutes are arranged, and the ashes are dumped into cars, which but a few moments before contained the coal.

A coal crusher is installed at the lower end of the coal hopper and only used when lump coal is delivered.

Two Cochrane feed-water heaters each of 1,500 horsepower capacity are employed in the boiler room, and feed water is delivered to the boilers at a temperature of 200 degrees Fahrenheit. All feed-water piping to the boilers is of brass and in duplicate.

The chimney is located in the middle of the boiler room and south of the center line. The smoke flues enter chimney on basement level. Suitable dampers under automatic control are installed. The chimney is of perforated radial brick, and the actual height without base is 240 feet. The base is 13 feet six inches high. The diameter of chimney is nine feet. An 18-inch exhaust pipe extends the whole length of the chimney and extends above at top about six feet. This pipe will take care of all the steam exhausted during the warmer months. During the colder months the exhausted steam will be employed in heating the office building. The total weight of chimney, including the exhaust pipe, is about 2,600,000 pounds.

Special attention was devoted to the steam-piping system, the viewpoint always being that only partial shutdown should result in the case of ordinary repairs or accidents. The piping is all extra heavy, with screwed flanged fittings. Two headers extend along the entire length of boiler room, along the rear of the boilers and about eight feet above them. Into each one of these headers is a main from each boiler. This practically duplicates the piping in the boiler room. At the partition wall between the boiler and engine rooms the mains drop to the basement and loop around the engine room. The main steam line runs in about a four-foot space between the foundations of engines and the wall of building. At each point where a connection is made for engines valves are placed on either side of this connection in the main line. Thus the connection to any engine can be cut off from the main steam line without interfering with the supply to other points. The exhaust line extends along the center of basement and connects to exhaust line in stack and also to a large distributing tank to which the building heating system is connected. A back-pressure valve is located on exhaust line leading into the stack. At the west end of the engine room the exhaust line leads up to the roof, connected to exhaust heads. On this line, also, there are back-pressure valves.

The refrigerating and drinking-water plant is located at the partition wall between the engine and boiler rooms on the boiler room side, and is of the Carbondale Machine Company's construction. The duty performed consists of refrigeration for two refrigerators for kitchen on top floor, containing approximately 1,000 cubic feet, also refrigerating for main restaurant boxes containing about 4,000 cubic feet, the connecting mains aggregating 1,200 feet. The filtering and cooling of the drinking water supply is for about 125 fountains, located in the offices and waiting rooms. The amount of water cooled is about 750 gallons an hour, with a range of 45 degrees Fahrenheit; i. e., from 80 degrees on the intake to 35 degrees to delivery mains. The delivery mains connect with sets of risers in the basement, from which lead the horizontal supply lines to each of the floors connecting to the office outlets, by means of an additional faucet at each washstand. The risers and mains aggregate about 11,000 lineal feet of pipe in supply and return mains. The temperature of the water at the drinking fountains is about 41 or 42 degrees. The method of circulation used ensures equal temperatures at all points, freedom from air in pipes and a continuous supply at all faucets. Stop or regulating cocks are placed at all fountain loops, to provide against excessive pressures due to the height of risers. The pressure at the water-circulating pump in the basement of the power plant—a nine by 5¼ by 12-inch duplex—is about 95 pounds. The steam required is about 32 pounds per ton refrigerating effect per hour. The refrigerant used is fused calcium chloride of 1.250 specific gravity. This substance is circulated through coils in refrigerators, and very low temperatures are possible. The location of refrigerating machinery in power house was essential, and the limited available space necessitated the placing of this apparatus in a space of about eight by 30 feet, and on three different levels. The machine proper stands on a platform of steel construction 200 feet square, 12 feet above the power-house floor. The cooling and brine-storage tanks, with ammonia pump, are on the main floor directly underneath, and the water-circulating pump and filters are in the basement.

Proposed Amendments to the National Electrical Code.

The proposed amendments to the National Electrical Code which have been recommended by a joint committee of the American Institute of Electrical Engineers and the Underwriters' National Electric Association were brought up for consideration at last week's convention of the Northwestern Electrical Association. A committee consisting of W. T. Putnam, R. N. Kimball and P. H. Korst was appointed to consider the matter, and it made a report, recommending that the association indorse the adoption of the report of the joint committee. This action was taken after a brief discussion, although no delegate was appointed to attend the meeting in New York city on March 1st, when the question will be finally brought up for adoption. The report of the joint committee refers only to outside construction of constant-potential, high-tension circuits of over 5,000 volts, and thus practically affects only transmission lines.

The report which thus received the official indorsement of the Northwestern Electrical Association is herewith given in full:

It was agreed that the following additional clauses should be inserted in the National Electrical Code, under Rule 38, after clause (a):

(b) Every precaution should be taken in arranging the routes for extra high-pressure, constant-potential circuits, to avoid exposure to contacts with other electric circuits, and, on existing lines, the routes should be changed, if possible, wherever it may be mutually agreed upon by the parties in interest that there is a liability to contact between the lines.

(c) It is desirable that extra high-pressure, constant-potential overhead lines should not be on the same poles with other wires, except signaling wires used by the company operating the extra high-pressure system, and not entering property other than that owned or occupied by said company; also that pole lines carrying extra high-pressure, constant-potential wires should not approach other pole lines nearer than a distance equal to the height of the taller poles.

(d) Where extra high-pressure constant-potential lines must necessarily be carried nearer to other pole lines than is specified in the preceding clause (c), or must necessarily be carried on the same poles with other wires, the extra high-pressure wires must be carried above the other wires, and extra precautions must be taken in the line construction, in order to reduce the liability of a breakdown to a minimum; as by the use of heavy wires, widely spaced crossarms, short spans, extra heavy poles properly constructed and supported, extra heavy crossarms, pins and insulators.

(e) Where extra high-pressure, constant-potential overhead wires cross pole lines carrying other wires, the poles of both lines should be of extra heavy and substantial construction. The high-pressure wires should preferably be above the other wires. The height and length of the cross-over span should be such that the radial distance from the lower crossarms of the upper line to the nearest wires of the line crossed over should be greater than the cross-over span. Whenever it is feasible, end insulator-guards should be placed on the crossarms of the upper line.

Whenever these conditions of height and span at the cross-over are not feasible, a grounded screen of wires should be interposed between the lines at the cross-over with a current-carrying capacity greater than that of any of the upper wires, and of sufficient mechanical strength to prevent the upper wires from coming into contact with the lower.

(f) Where it is necessary to carry extra high-pressure, constant-potential overhead wires past buildings and within 25 feet of them, the wires must be carried at a height not less than that of the front cornice of the building, in order to prevent the wires from interfering with the operations of firemen, in the event of a fire in the building, and the height of the wires must be greater than that of the cornice, as their proximity to the building increases, according to the following scale:

Distance of wire from building. Feet.	Elevation of wire above cornice of building. Feet.
25	0
20	2
15	4
10	6
5	8
2½	9

(g) Extra high-pressure, underground lines must not occupy the same duct of a conduit, manholes, or handholes with those of public signaling systems.

It was also agreed that the foregoing requirements be considered as applying only when the voltage of the extra-pressure, constant-potential circuits is 5,000 volts or over, and that the matter of additional requirements for systems where the voltage is between 3,500 and 5,000 be given further consideration by the joint committee.

It was also agreed that Rule 13b should be amended to read as follows:

(b) Transformer secondaries of distributing systems should preferably be grounded, and when grounded, the following rules must be applied:

1. The grounding must be made at the neutral point or wire, whenever a neutral point or wire is accessible.
2. When no neutral point or wire is accessible, the maximum difference of potential from the grounded point of the secondary circuit to any other point thereof must not exceed 250 volts.
3. To be identical with the present clause marked (2).

The conference adjourned, with the understanding that these recommendations should be submitted to the board of directors of the American Institute of Electrical Engineers and to The Underwriters' National Electric Association.

The Omaha and Council Bluffs Street Railway of Council Bluffs, Iowa, it is reported, will spend during the present year $500,000 in a new power plant. W. A. Smith, general manager of the company, is said to have placed orders for the new machinery in Chicago. The plans as prepared contemplate the installation of three 1,000-kilowatt generators, in addition to the 850-kilowatt generator the company now possesses. This will give the company a plant capable of generating about 5,000 horsepower.

Marconi and His Work.

Having completed the equipping of his wireless transatlantic station in Cape Breton and at South Wellfleet on Cape Cod, Mass., Marconi went to New York city last week and sailed from there this week for England. In about three months he expects to have the station at Poldhu completed, and then, he says, he will be ready for commercial business across the Atlantic Ocean. The Cape Cod station has four steel towers, each tower being equipped with 100 wires. Marconi says it is possible to send 50 messages across the Atlantic simultaneously by the syntonic system. While in New York city Marconi was entertained at dinner by the directors of the Marconi company in the United States, to whom he explained the equipment and prospects of the stations on this side of the Atlantic.

Mr. Marconi says that work will soon begin on a system between Italy and Argentina, a distance of 6,000 miles. It is understood the government of Italy will allot $150,000 to equip the Italian station, which will also serve subsequently as a means of communication with Erythrea and Sardinia. The Alaskan and Cuban services between the United States and those places, Mr. Marconi said, were assured, and work will be begun on the stations soon. With the exception of a line between New Zealand and Australia, he said, the various Marconi companies had no projects for Pacific communication at present under consideration. It is stated that King Leopold of Belgium has summoned Marconi to Brussels in February, to arrange for establishing space telegraphy between Belgium and the Congo Free State.

Metal Conduits Required for Interior Wiring in Chicago.

An order has been issued by City Electrician Edward B. Ellicott of Chicago to architects and electricians, stating that after February 1st the Electrical Department of the city will not approve of the installation of concealed wires on insulating supports, which is commonly known as "concealed knob and tube-work." In all new buildings and in alteration work of old buildings all new concealed wires must be encased in approved metal conduits. In wiring or rewiring parts of old buildings which are not liable to dampness an approved metallic or non-metallic flexible conduit may be used, provided that the department receives notice before contract is let for such wiring, in order that it can ascertain that such portions of buildings are not liable to dampness. In each instance a special written permit must be obtained.

Mr. Ellicott says that the underwriters' records show that a considerable proportion of last year's fires originating inside of buildings was due to concealed wires which were not in conduits coming in contact with gas pipes, or to the breaking of the insulation in other ways. The new work, as specified, will be a little more expensive in large buildings, but the hazard will be greatly decreased and especially in flat buildings. Mr. Ellicott's new order has received the hearty indorsement of the underwriters, whose rules recommend, but do not require, metallic conduits.

General Electric Convention in Chicago.

The annual convention of the salesmen of the General Electric Company of the Chicago district was held at the Grand Pacific Hotel, Chicago, this week. About 30 gentlemen were in attendance, and the eastern offices were represented by H. C. Wirt, engineer of the supply department; Frank K. Vaughen of the meter department, P. D. Wagoner of the transformer department and H. W. Hillman of the arc-lamp department, all of Schenectady, N. Y.; W. D'A. Ryan of the arc-lamp department, Lynn, Mass., and F. W. Willcox of the lamp works at Harrison, N. J. The convention was presided over by B. E. Sunny Chicago, manager for the General Electric Company, and the matters considered were those of particular interest to the salesmen. On Thursday evening a social session was held, and after the dinner Mr. Ryan gave an interesting talk on "Light and Modern Illumination."

A New Claim for Electricity.

Dr. Albert J. Atkins of the California Medical College, in a paper read before the San Francisco County Society of Physicians and Surgeons, asserts that experiments conducted by him have demonstrated that it is electricity, not oxygen, which purifies the blood in the lungs. He has discovered, he says, that the action which takes place in the lungs in breathing is electrical, and he also affirms that experiments show that venous blood can be changed to color like that of arterial blood by the use of electricity.

Present Development of Steam-turbine Units.[1]

By Edward Yawger.

The first Parsons steam turbine was built in 1884. It was a 10-horsepower machine, and ran at a speed of 18,000 revolutions per minute. The date of this first modern-type turbine was only a few years subsequent to the introduction of the modern-type dynamo, and at first thought it would seem that the turbine has fallen far in the rear in the general march of mechanical and electrical progress. A reference, however, to the development of electric apparatus since about 1880 will indicate that the turbine has only recently been provided with a field for the application of its peculiar power-producing qualities.

When the first Parsons turbine was produced the largest dynamos were mere toys compared with the machines of to-day, and a turbine of such small capacity must run at enormous speed in order to develop its best efficiency. The great preponderance of direct-current apparatus, with its difficulties of commutation at high speeds, has further checked the application of this high-speed engine in the smaller sizes. Recent practice in the generation and use of electricity has entirely changed the relation of this prime mover to its application. The rapid growth of alternating-current generation and the increased size of units have now opened the logical field for the use of this simplest and highest type of prime mover.

The turbine is indeed the simplest of all vapor engines, both mechanically and thermo-dynamically. The entire rotative effort is produced by the passage of the steam through two simple elements, a nozzle and a moving blade. In the Parsons turbine there may be 20,000 nozzles and 20,000 moving blades, but the functions of all pairs are precisely alike, and there is no limit except considerations of general design and shop practice to the number of pairs of elements that may be combined in a given turbine. The method by which steam is made to produce the rotary motion of the spindle is by its action and reaction on the thousands of pairs of simple elements. The steam, having been admitted through the governing valve, enters an annular passage surrounding the revolving spindle. From this passage it enters the first set of nozzles. These nozzles are formed by a large number of curved vanes projecting radially from the cylindrical shell of the turbine. The shape of each nozzle orifice, therefore, is that of a narrow radial slit. These stationary nozzles or guide vanes deflect the steam to an angle of about 20° from the axis of the spindle. The steam, expanding as it passes the orifice, then impinges on the first series of moving blades, which are similar to the guide blades, only they are attached radially to the periphery of the rotating spindle.

From the curved moving blades the flow of steam is again deflected back to its original direction, and passes on through the next set of deflecting vanes, which again cause expansion impact and deflection as before. There are anywhere from 20 to 100 of these radial sets of nozzles and blades, according to the conditions of size, steam pressure and vacuum desired. In order to secure the full benefit of the energy of the steam, it must, of course, be permitted to expand in doing its work. Each row of nozzles has therefore greater discharge area than the one preceding it. This is accomplished by increasing the diameter of the shell and increasing the length of the blades. With a proper arrangement of guides and blades, the increase in volume of a unit weight of steam is a measure of the economy of operation.

With initial steam pressure at 150 pounds and a pressure in the last row of blades of two pounds absolute, we would have the steam expanded to 58 times its original volume. In an ordinary compound condensing steam engine the lowest working pressure feasible is about eight pounds absolute, thus giving with 150 pounds initial a final volume of 16 times the initial. A reciprocating engine could be designed to provide for 58 expansions instead of 16, and in that case the low-pressure cylinder would have to be nearly four times the volume that is given it in ordinary practice, but the friction due to the increased size, together with condensation losses, due to wide difference in temperature between beginning and end of stroke, would more than eliminate any gain due to the increased expansion, and the net effect would be to retard the engine with diminishing economy.

On the other hand, with the turbines, there are no condensation losses, and the addition of a few rows of low-pressure blades to absorb the final energy of steam does not add to the friction of the machine.

It is thus evident that the highest degree of vacuum is of great benefit in turbine practice. It may be added that the turbine is singularly adapted to the us of superheated steam. In addition to the increased efficiency inherently due to superheat, there is a further advantage in the reduction of the fluid friction in the passage of the steam through the blades, and there are none of the attending evils of warping valves and imperfect lubricants.

The exact amount of friction in the turbine cannot be demonstrated, owing to the impossibility of securing, by any instruments now available, any equivalent of the indicator diagram. The fact that a turbine without load will continue to revolve for about one-half hour after steam is shut off, indicates how slight must be the friction, especially that of a mechanical nature.

We turn now to the various mechanical details of the machine. Next to the essential working parts described above, we would naturally consider, as in other engines, the main bearings to be of the greatest importance. This is emphatically true of the turbine, since a pair of main bearings and a cylinder filled with blades is essentially all that goes to make up the machine. The duty of these main bearings is much less arduous, however, than that of the bearings of the ordinary engine. There is none of the immense weight of flywheel and reciprocating parts, with their attending impact to be upheld and resisted. The turbine bearings support the weight of the revolving spindle only. This spindle, however, at its high speed must revolve about its gravity axis, and this brings in an important function of the main bearing. The gravity axis may differ by, say, 0.004 of an inch from the geometric axis, and hence it is necessary to introduce that degree of flexibility into the main bearings. This is accomplished by enclosing the bearing shell proper within two or three loose-fitting sleeves, and the whole is surrounded with an outer cast-iron shell provided with accurate means of adjustment.

The bearing and sleeves are lubricated by a forced circulation of oil, and while the shaft is firmly held in place there is no restraint to its revolving with slight eccentricity. These bearings form the only important rubbing surfaces to be found in the machine, and in case we can prophesy that they will stand up for years against continuous operation we may consider it a mark of the general durability of the machine. The experience of three or four years in this country and much longer abroad shows that the wear at this point is practically nothing. After a continuous run of 2½ years, 11 hours a day, the bearings of the turbines at the Westinghouse Air Brake Works were examined, and the bearing shells proper were found to be absolutely free from wear, the original tool marks being visible on both the surrounding sleeves and the bearings.

As stated above, the only essential parts of the turbine are a suitable number of nozzles and blades properly mounted and a pair of main bearings. We have only to turn on the steam, and our spindle begins to revolve, blown around by the force of 20,000 steam jets. It would soon be found that the combined pressure of the blades and spindle in one direction would create a disastrous end thrust. This is treated in the most natural way possible by providing for a balancing pressure in the opposite direction. A disk with equivalent steam pressure mounted on the spindle is all that is required.

On a modern reciprocating engine the governor and valve mechanism is considered almost equal in importance to the real working parts of the engine. The eccentrics, rods, bell cranks, links and pins must be kept up to a perfect state of fit and alignment, else a slight wear in one of the joints will cause the valve to give a faulty steam distribution, with its attending pounding, heating and loss of economy. With the turbine, the governor and admission valve need have only the remotest mechanical connection with the engine itself. In fact, the whole paraphernalia of governing and admission could be run by an independent motor, or by means of the main generator. The only function of the turbine governor and valve is to let in the right amount of steam. It matters not whether steam is admitted at one precise instant or another, and almost any conceivable amount of wear could take place without interfering seriously with the performance or economy of the turbine. As a matter of fact, the governing mechanism is operated by worm gearing on the main shaft. It is of the fly-ball type, and so designed that the speed will be maintained at any desired uniformity, with the further provision that in case of an extraordinary load, like a short-circuit coming on the machine, the governor at once cuts off all steam. Again, should any part of the governor break or for any reason fail to maintain its steady motion, the result would be an immediate shutting off of all steam.

The accessibility of all parts for inspection is almost a novelty in connection with a steam engine. Here it is a case of lifting the cover off, and the internal workings are at once exposed.

The obvious advantages of the steam turbine are many, and they have been ably expounded in numerous papers and press articles on the subject. They may be briefly recapitulated as follows:

Increased economy.

Better regulation.

Smaller repair and maintenance account.

Less first cost of plant for a given standard of economy.

Smaller percentage charged against depreciation.

Most of the above considerations have been treated very fully in the paper presented by Mr. E. H. Sniffin before the meeting of the American Street Railway Association at Detroit.

The disadvantages of the turbine are not yet in sight. I think they will remain in obscurity until some inventor shows us how we may extract the power latent in the coal pile without the crude necessity of first passing the heat of fuel into gas or water as a medium of transmission.

1. Read at the recent convention of the Ohio Electric Light Association in Columbus.

CORRESPONDENCE.

London Letter.

London, January 17.—The first installation in Great Britain in which the actual distributing network is run at 3,000 volts, three-phase, has just been put into operation at Erith, in Kent, under the auspices of the local authorities. In point of size the works are insignificant, only three small sets having been installed, comprising British engines direct-coupled to Belgian three-phase alternators. The scattered nature of the town is the chief factor in the novel design of the installation, which, by the way, in spite of more than one failure in this respect, includes Nernst lamps for the street lighting, as well as a few ordinary open arcs. The Nernst lamp is gradually coming into favor for shop lighting, and no doubt the few failures which have taken place in connection with their application to street lighting, have taught some valuable lessons, for I notice that they have again been installed in public streets in more than one instance.

The London County Council's conduit tramways are expected to be opened in about two months' time. Eventually a large main generating station will be erected at Greenwich, but in the meantime two temporary ones are being built, each containing Ferranti-Dick, Kerr generating sets. The total length of track being converted at present is the equivalent of 17 miles of single track, but the total track to be equipped electrically is some 50 miles. The feeders are high-tension lead-covered three-phase cable, as well as some low-tension lead-covered single cable, the line voltage being 500. There are at present on order 100 double-truck, double-deck cars and 80 single-truck similar tram cars, there being two motors on each.

The opening of the Great Northern and City railway, an electric line, mentioned previously, has taken place to a modified extent, viz., inspecting trains have been run over the greater portion of its length. An extension of the line further into the city has been sanctioned.

For some years the war office and the admiralty have been experimenting with wireless telegraphy, but nothing much has been made known concerning this work. Operators certainly went to South Africa during the war, but the results were not over complimentary, due to more causes than one. Recently, however, the two government departments in question have been giving their experiments a little more publicity, and at Manchester, where a military exhibition has been in progress, communication was set up between the exhibition buildings and several towns a number of miles away, with very satisfactory results, by military operators. The other day, however, a much more elaborate experiment was carried out, viz., communication between Aldershot, the inland military base, and Portsmouth, the seaport naval base. At the latter place the transmitting station was worked by blue jackets aboard a torpedo boat, and at Aldershot, a captive balloon, managed by the Royal Engineers, received the messages, which are stated to have been practically continuous.

A deal of interest is being taken in the proposed canal which is be built from Rochester, to run into the Thames near Sheerness. The chief points about this are that a large proportion of it is in tunnel, which will be lighted electrically, and further electrical haulage will be adopted. The cost of the canal and equipment is some $1,400,000, and the scheme received parliamentary sanction last session. A start will not be delayed very long, as it will in all probability work hand-in-hand with the Kent electric-power syndicate, which also received parliamentary sanction in 1902. W.

New York Notes.

New York, January 24.—A novel plan for relieving the congestion at the entrance to the Brooklyn Bridge and for handling the people at the Manhattan terminal of the Williamsburg bridge has been submitted to the Board of Estimate and Apportionment. It provides for the construction of a moving sidewalk from the Williamsburg end of the new East River bridge to the Wall Street district in Manhattan. The proposed scheme is said to be backed by powerful financial interests organized as the Multiple Speed and Traction Company. The subway as planned would be 30 feet wide. Inside it, it is proposed to operate two moving sidewalks, connected by a loop at each end. The speed of the carrying platforms will be about 10 miles, and the carrying capacity 70,400 seated passengers per hour. It is said by the projectors of the scheme that only 12 or 15 minutes would be required to make the trip from Williamsburg to Hanover Square under this system. It is proposed to place a station at every other block, so that passengers would not have to walk more than one block to take a train. Such a moving sidewalk, it is stated, would provide seats far in excess of any demand. The fares over the proposed route are not to exceed one cent during rush hours. At other hours and on Sundays and holidays the fares are to be two cents. The whole plan would have to be submitted to the Rapid Transit Commission before it could be undertaken. Commissioner Lindenthal is in favor of creating a special commission to consider the whole question.

Plans for the new Blackwell's Island bridge over the East River have been approved by Bridge Com-

missioner Lindenthal and will now be considered by the Municipal Art Commission. The new bridge will be a cantilever structure, and from the entrance on each side of the river will cover the distance of 7,449 feet. It will be 135 feet above high water, or about the same height as the Brooklyn Bridge. There will be a roadway in the center 36 feet wide, allowing three teams to move in one direction abreast. There will be four trolley tracks. The bridge will be a double decker, and on the upper deck will be two elevated tracks and two promenades. The trolley and elevated roads on the bridge, it is said, will have a yearly carrying capacity of 150,000,000 passengers.

The Metropolitan Street Railway Company has announced that during the present year $4,500,000 will be expended for improvements, mainly in the way of equipping old lines with the electric underground conduit system. The Eighty-sixth Street cross-town line will be so equipped. The Thirty-fourth Street line will be changed from storage-battery power to underground trolley. The West Eighty-sixth Street Railway Company has been incorporated at Albany, with a capital of $10,000, to operate a 2,000-foot electric railway on Eighty-sixth Street. This is believed to be another attempt of the Metropolitan Street Railway Company to obtain the right to operate on that street between Central Park West and Amsterdam Avenue, thus connecting the two now divided sections of cross-town tracks and giving the Metropolitan street railway another complete cross-town line from river to river.

It is announced that a company composed of John Dunfee, A. K. Hiscock and Charles F. Taylor of New York city, Stephen Peabody of Albany, William L. Elkins of Philadelphia and Robert C. Shailer of Boston will be organized to bid for the contract for the construction of the Pennsylvania railroad tunnel under the Hudson River. All of the men mentioned except Mr. Peabody and Mr. Elkins are interested in the Boston Tunnel Construction Company, engaged in tunneling Boston harbor for Boston's new rapid-transit system.

At a public hearing of the State Railroad Commission on Thursday, F. H. Shepard, special expert on transportation, hired by the commission, made a report on the surface-railway conditions in Manhattan. He made recommendations for immediate and future relief, among the latter being the construction of a track subway for the Broadway cars at Thirty-fourth Street.

The American Society of Civil Engineers was in session here during the week and over 500 members were in attendance. It was voted to co-operate in the establishment of a congress of engineering at the St. Louis Exposition. On Wednesday afternoon a large number of the members visited the rapid-transit subway under guidance of Chief Engineer William Barclay Parsons. The annual reception was attended by about 350 members and guests. On Thursday a steamboat excursion was made to engineering works of interest in the vicinity of New York.

A director of the Pennsylvania railroad said to a representative of the New York press the other day: "You seem to have overlooked one item of interest in connection with the entry of our road into your city. Of course, all trains in the tunnel will be propelled by electricity. This means that all trains passing from New Jersey to Long Island will be electric; which means that in a short time all through trains to Boston and New England in general will be electric; which means—well, to be plain and frank, the building of the tunnel and its electric equipment means that in a short time there will not be a locomotive on the Pennsylvania railroad between New York and Philadelphia."

The Appellate Division of the Supreme Court, Third Department, has handed down a decision in the case of the Metropolitan Street Railway Company, holding that the special franchise-tax law of 1899 is unconstitutional in so far as it takes the power of taxing franchises from the local boards of assessors and gives it to the State Tax Commission. This decision does not vitiate, however, but expressly admits the state's power to tax franchises under the designation of real estate. In no one of the four opinions accompanying the decision is the principle of franchise taxation questioned.

The Manhattan Railroad Company, it is said, has drawn up plans to install escalators (moving stairways) at its stations at Thirty-third Street and Forty-second Street for both the uptown and the downtown platforms. The receipts of the company's uptown station at Sixth Avenue and Twenty-third Street have increased at a greater ratio than at any other station of the system since an escalator was installed there, about two years ago. The Subway Construction Company has arranged to install at several of its stations moving stairways similar to those which the Manhattan road is to make use of. O.

New England News.

Boston, January 24.—Boston's tax rate, this year, is $14.80 a thousand, and the various companies' tax bills are as follows: Boston Elevated Railway Company, $51,190; Edison Electric Illuminating Company of Boston, $132,564; West End Street Railway Company, $99,358; American Telephone and Telegraph Company, $23,591; New England Telephone and Telegraph Company, $29,798.

Euclid Madden, the motorman, and James T. Kelley, the conductor on the car that collided with President Roosevelt's carriage in Pittsfield, Mass., last September, pleaded guilty to the charge of manslaughter, last Tuesday. Madden was sentenced to the House of Correction for six months and fined $500, but Kelley's case was placed on file. Both men have been working for the Pittsfield Street Railway Company since the accident, but not in their former positions.

The following-named companies have petitioned the Connecticut Legislature for authority to increase their capital: New London Gas and Electric Company wants an increase of $75,000, making its capital $500,000; Branford Lighting and Water Company wants to make its capital $500,000, an increase of $400,000; Willimantic Gas and Electric Company wants to make its capital $300,000, an increase of $280,000; Stafford Springs Street Railway Company wants to make its capital $1,500,000, an increase of $800,000.

In his annual report, H. J. Blakeslee, electrical inspector of the Hartford (Conn.) Board of Fire Underwriters, states that the past year was remarkable for the number of installations of large electric-light systems and the introduction of innovations in apparatus. He says that the lights in two installations, completed during the year, nearly equal the total increase in the year 1901. During the year he received 351 contractors' reports of new installations.

The Bangor (Maine) City Council has authorized the preparation of plans for placing electrical wires in underground conduits and for a fireproof central controlling station in that city. The New England Insurance Exchange has ordered an increase in insurance rates in Bangor, unless the electric-light and fire-alarm wires are placed underground.

The Willimantic (Conn.) Gas and Electric Light Company is expending $130,000 in additions and improvements to its gas and electrical plants.

The Stuart-Howland Company, dealer in electrical supplies, this week moved from 283 and 285 Devonshire Street to larger and more convenient quarters next door—corner Devonshire Street and Winthrop Square—formerly occupied by the Pettingill-Andrews Company. B.

Southern Developments.

Charlotte, N. C., January 24.—An electric railway will be built at Opelika, Ala. The new company has purchased the plant of the local electric-light company.

J. S. Manning, R. H. Wright and H. A. Fanshee are named as incorporators of the Chapel Hill Trolley Company, proposing to build a line from Durham, N. C., to Chapel Hill, a distance of 12 miles.

The city of Chattanooga, Tenn., will build a $125,000 electric plant if the proposed bill for improvements goes through the Legislature.

The bond election for issuing $20,000 for an electric-light plant at Huntsville, Ala., has been carried.

The Chattahoochee Terminal Railway Company, capital $250,000, is being organized at Atlanta, Ga., to build a line to Marietta, 20 miles distant. The petitioners for a charter are represented by Thomas A. Gramling, N. A. Morris and others. The company asks for the privilege of increasing to $2,000,000.

Plans have been practically completed for the development of Etowah River, Cartersville, Ga., by the Etowah Power Company, capital $500,000, in connection with the establishment of a $1,500,000 cement plant by Chicago capitalists. W. E. Dorwin, president of the Portland Cement Company, proposes to erect the latter plant.

The J. Morgan syndicate, builder of electric and steam railroads, Toledo, Ohio, has written to the mayor of Athens, Ga., desiring to work up a company to build an electric road to Atlanta, Washington and other towns. L.

Texas and Mexico.

Austin, Texas, January 22.—The electric street railways and interurban lines promise to be made the subject of a considerable amount of legislative action at this session of the state Legislature. Already two bills have been introduced affecting these interests and a strong fight is being made to secure their enactment into laws. The more important of the measures regulates the fares for students and children, and the other bill seeks to place interurban roads under the jurisdiction of the Railroad Commission. A bill has been prepared and will soon be introduced, providing for separate apartments for white and colored passengers on all street cars. This bill is a copy of the Louisiana statute on the subject.

It is announced that the Palestine Traction Company of Palestine, Texas, which was recently incorporated under the laws of this state with a capital stock of $150,000, is to build immediately a complete system of electric street-railway lines in that city and that a belt line around the town is proposed. The incorporators of the company are J. S. Tittle of St. Louis, Mo., E. J. Spence, M. C. Wade and R. W. Hodges of Texarkana, Texas. These same people have formed the Palestine Light and Power Company, with a capital stock of $150,000, for the purpose of installing an electric-light plant at Palestine.

The Guadalajara Electric Power Company of the city of Guadalajara, Mexico, has purchased a large tract of land, upon which will be located a large electric power plant. This company is also preparing to construct an electric interurban line to connect the village of Posita with Jardin de la Union and Presta de la Olla.

Application has just been made to the Mexican government by Manuel Macotela of Tultenango, Mexico, for a concession to establish in the El Oro mining district an electric plant for motive power to be derived from the Lerma River. This electric power is to be used in operating machinery of mines in that district.

A company of local capitalists is being organized at Autlan, state of Jalisco, Mexico, for the purpose of installing an electric-lighting plant in that city.

The Mexican government has granted a concession to Rudolfo Reyes of the city of Mexico, to use the water of the Matamoras or Pilon Rivers with which to generate electric power for the purpose of lighting the city of Montemorelos. It is stipulated in this concession that the proposed electric plant shall be completed within seven years. H.

From the Buckeye State.

Columbus, Ohio, January 26.—The Cleveland and Southern Railway Company of Cleveland has been incorporated with a capital stock of $5,000,000. This is a consolidation of the Cleveland, Elyria and Western and the Cleveland and Southern, both of which are owned by the Pomeroys and Mandelbaums. Of the capital stock $3,000,000 will be common and the remainder preferred. A. H. Pomeroy will be president of the new company and E. F. Schneider, secretary. The two roads, one running west from Cleveland and the other south, will now be under the same management, which will insure a saving in operation. The Cleveland and Southern branch will probably be extended further south in the future.

The Zanesville and Southeastern Railroad Company has increased its capital stock from $10,000 to $1,000,000.

At the annual meeting of the Tuscarawas Traction Company, held at New Philadelphia a few days ago, the following-named officers were chosen: President, F. T. Pomeroy, Cleveland; vice-president, J. A. Rutherford, Cleveland; secretary, J. O. Wilson, Cleveland; treasurer and general manager, Will Akins, New Philadelphia. Plans for extending the lines south 22 miles from New Philadelphia to New Comerstown were discussed and a committee was appointed to investigate the advisability of the step.

It is reported that the Cincinnati, Milford and Eastern Traction Company will have its road in operation by next fall. The line will be seven miles long and will enter Cincinnati over the city lines.

The first through cars over the Columbus, Delaware and Marion line between Columbus and Delaware made the trip Saturday morning. A two-hour service will be established.

The Central Electric and Manufacturing Company of Youngstown has been incorporated with a capital stock of $20,000. W. L. Goodhart, E. F. Foreman and others are interested.

The Covington, Bradford and Versailles Traction Company of Dayton, Ohio, has been incorporated with a capital stock of $15,000. B. M. Hopkins, E. C. Spring, Dennis Dwyer and other Dayton men are interested in the new company.

The Toledo, Port Clinton and Lakeside Railway Company has filed notice with the secretary of state of an increase of capital stock from $10,000 to $1,800,000.

The directors of the Dayton and Kenton Traction Company have elected the following-named officers: President, E. M. Hopkins, New York; vice-president, W. W. Chambers, Dayton; secretary, H. S. Forgy, New Carlisle; treasurer, C. H. Pomeroy, Saginaw, Mich. The plans and surveys are in the hands of the Falk Construction Company for an estimate, and that company will probably be given the contract for building it.

The Mansfield, Crestline and Galion Railway Company of Crestline has been incorporated, with a capital stock of $10,000, for the purpose of building a line from Galion to Mansfield. F. N. Wilcox, Frank Butler and others are interested in the company.

The Scioto Valley Traction Company has been given a franchise by the town council of Circleville. Much opposition was met there at the hands of merchants who feared that the electric roads would cause their business to go to other towns. O. M. C.

Detroit, Mich.

Detroit, Mich., January 24.—Preparations are under way to use some of the large profits of the Detroit East Side Electric Light Company for the erection of a new building as part of its improved plant.

The Grand Trunk Railway has announced a reduction in fare between Detroit and Pontiac, a distance of 26 miles, to 25 cents. The 25-cent tickets will not entitle the holder to check baggage free. The electric road charges the same rate, and does the most business.

The Detroit Edison Company of New York, which recently filed articles at Albany, N. Y., to manufacture electricity, ice, salt, steam and other products for light, heat and power purposes, has a capital of $6,000,000. Alex Dow, manager of the Edison Illuminating Company, says the corporation above mentioned has been organized to build the new

power plant at the Rouge River. It is entirely distinct from the Edison Illuminating Company, but will furnish the latter with its light and power, to be retailed to its customers. The eastern company will not be incorporated under Michigan laws, because the latter fix $5,000,000 as the limit of capitalization.

The expensive dam at Marquette, Mich., on Dead River, which provides power for the municipal-lighting plant, is in danger. Logs are wedged in solidly from the bottom of the river to a considerable height above the water and stretch across the river, effectually blocking it. Back of the logs is a 10-foot head of water, which is backed up for several miles, and it is considered certain that should the jam be broken suddenly and the immense body of water be released, the municipal dam will give way.

It is expected that the new electrical equipment for the Lansing, St. Johns and St. Louis Railway, now operated by steam, will be received in time to allow the commencement of electrical transportation by February 1st. At a recent meeting of the stockholders the present directors were re-elected. John A. Mills will be president.

The Otsego Power Company, limited, capital $200,000, has filed articles of association. The officers are: Chairman, G. D. Smith, Jackson; secretary, E. H. Marrinane, Grass Lake, and treasurer, J. H. Bootes, Jackson. This is the third company to propose building a big dam in Allegan County; it is believed to have something to do with the development of electric roads.

Plymouth, Mich., is desirous of owning its own electric-lighting system, and President Robinson is collecting data with the idea of submitting the proposition at the annual election, while others favor letting some private concern take the responsibility.

A test of the efficiency of the Detroit, Ypsilanti, Ann Arbor and Jackson electric road will be made this week by Ralph Morton and Ernest Schaeberle, seniors in electrical engineering at the University of Michigan. Their report will be a basis for a thesis for graduation. The test will be a continuous one, lasting 21 hours. Twelve underclassmen will assist them.

At the recent meeting of the stockholders of the Detroit United Railway, held in this city, no changes were made in directors or officers; H. A. Everett retains the chairmanship of the board, and J. C. Hutchins was re-elected president and general manager. The gross earnings of the company for last year were over $3,500,000, net earnings over $1,500,000, increase $155,000, surplus $719,000. The expenses per cent. of receipts show an increase of 1.23 per cent. During the year there was a considerable increase of interest on bonded debt, and the operating expenses were larger, on account of the advance in wages. Considerable new equipment was also purchased. The net earnings for the second week of January show an increase of $2,747.87. Of 1,600 men working for this company, about 71 passed under the merit system with a clean record.

C. G. W.

Information from Indiana.

Indianapolis, January 26.—The stockholders of the Indianapolis, Greenwood and Franklin interurban line held a meeting last week and changed the company's name to the Indianapolis, Columbus and Southern Traction Company, and voted to increase the capital stock from $150,000 to $285,000. The action of the directors in issuing $300,000 bonds was also ratified. It was decided to remove the general offices of the company from Indianapolis to Columbus, the resident city of J. I. Irwin, president of the company. A large power plant will be built at Edinburg, and the completion of the Columbus extension pushed rapidly.

The traction line to be built between Toledo and Chicago through Northern Indiana is assuming definite form. The following roads are included in the combination: The Toledo and Pioneer, the Garret, Auburn and Northern to Goshen; the Indiana Railway, Goshen to South Bend; Chicago and Indiana Railway, South Bend to Chicago. It is announced that contracts for the material for both the roads above mentioned, which are not yet constructed, will be placed at once and work begin with suitable weather. The syndicate is headed by Luther Allen and C. M. Stone of Cleveland, and F. R. Seagrave of J. R. Seagrave of Toledo.

E. P. Roberts & Co., engineers for the Dayton and Muncie Traction Company, have closed contracts for the construction and equipment of the line. The Westinghouse Electric and Manufacturing Company will furnish the electrical equipment for the power house at Winchester, and sub-stations at Union City and Greenville and for the cars. Contracts for the engines go to the Buckeye Engine Company. The Chase Construction Company of Detroit has the contract for 90 miles of the line work. The Gould Storage Battery Company of Buffalo will furnish batteries for the power house and sub-stations.

The Evansville, Mount Vernon and Uniontown Traction Company has been granted a 50-year franchise to enter and operate an electric line over the streets of Mount Vernon. Mount Vernon has been promised the power house and machine shops, and the citizens are elated over the prospects of interurban travel.

A bill has been introduced in the Indiana Legislature providing that all interurban and street-railway companies hereafter wishing to cross steam roads may do so by taking the regular statutory course and building and maintaining an interlocking switch at the crossing. This law is being opposed by interurban men, because the entire cost is exacted from the interurban lines.

The gross earnings of the Union Traction Company of Indiana show an increase of $205,634 for 1902 over the amount for 1901. The total for 1902 was $948,288, against $742,654, in 1901. The monthly average for 1902 was $79,624, a monthly increase of $17,137. These figures are based on the earnings of the 153 miles in the system.

The first car over the Muncie, Hartford City and Fort Wayne traction line ran from Eaton to Muncie Sunday. A regular schedule will be established the 1st of February, and another line will be added to the Indiana system of interurban lines, making connection with Indianapolis.

Nearly the entire force of employes of the Indiana Railway Company went on a strike Sunday and practically tied up the street and interurban service in and between South Bend, Mishawaka, Elkhart and Goshen. The strikers demanded a nine-hour day, with 25 cents an hour on city runs, $2.25 a day on interurban runs and 25 cents an hour for overtime. They also ask that the matter be adjusted by arbitration; that their union be recognized and that 10 conductors and motormen, who were discharged, be reinstated. By the aid of inspectors and a few old employes a few cars were operated, but the service was very irregular. The company's officers insist that they are not opposing the formation of the union, but propose to fight the demands of the men to the end. The strikers are well organized, and a prolonged fight is anticipated. F.

Northwestern Notations.

Minneapolis, January 24.—W. I. Gray & Co. of Minneapolis were the successful bidders for the installation of a municipal electric-light plant for Winona, Minn., at $44,890.

William G. Conrad of the Conrad Banking Company of Great Falls, Mont., has negotiations pending for the purchase of the Electric Light and Power Company and the Great Falls Street Railway Company. Local capital is interested in the deal.

The Warfield Electric Company of Bemidji, Minn., contemplates a number of improvements to its light plant, including the erection of a brick building, an additional engine of 400 horsepower and a 6,000-light dynamo. This will give a duplicate plant, for which orders have already been placed.

The Highland Canal and Power Company of Duluth has given up its plan of an immense waterpower scheme, draining the watershed back of Duluth, and will develop the waterpower of the St. Louis River. A subsidiary company, the Great Northern Power Company, has been formed for the purpose. Engineers report that there is 300,000 horsepower available in the St. Louis River. It is expected that the company will be able to deliver power in Duluth and Superior by May of 1904.

Pelican Rapids, Minn., will vote on bonds for $15,000 for the construction of an electric-lighting plant.

The engineer who surveyed the falls at Chappe Rapids and White Rapids above Menominee, Mich., states that there is available power for 18,000 horsepower at Chappe and 14,000 at White Rapids. The two falls are but three miles apart. Dams could be constructed at a cost of about $45,000.

War is on between the municipal electric-light plant at New Ulm, Minn., and the New Ulm Electric Light Company. The city plant made a price to the county commissioners of 10 cents per thousand watts for lighting the county courthouse and jail, which was accepted. The New Ulm Electric Light Company quoted a price of eight cents to the board, which promptly rescinded its action accepting the city's bid, and accepted the lower bid. The council thereupon waxed indignant, and proceeded to cut prices for general commercial lighting to eight cents per thousand watts.

The Seattle Electric Company of Seattle, Wash., reports gross receipts for 1902 of $1,168,661.99, on which it paid the city a gross-earnings' tax amounting to $25,250.10. R.

On the Pacific Slope.

San Francisco, January 21.—The Fresno City Electric Railway Company is preparing to build three more miles of roadway. Of this trackage, two miles will be within the city limits and one mile will be outside.

P. R. Clark, C. R. Holcomb and C. Lunchford, Spokane, Wash., are organizing a company to construct an electric railway from Wachtucna to Odessa, Wash., a distance of 65 miles. The plans contemplate the developing of 2,000 horsepower at Hooper Falls on the Palouse River. The estimated cost of the entire plant is $1,500,000.

Manager Faulkner of the Olympia Light and Power Company, Olympia, Wash., states that plans are being drawn up by Messrs. Cummings and Ransome for the rebuilding of the company's electric plant at Tumwater. The new plant will, it is estimated, cost $100,000.

A directors' meeting of the Stockton Electric Railway Company was held at Stockton on January 3d. The officers elected were: President, ex-Governor James H. Budd; vice-president, H. E. Huntington, and secretary and treasurer, W. R. Clark. Mr Clark will also act as local manager for the road.

On December 13, 1902, the plant of the Haywards Electric Light Company, Haywards, Cal., was sold to the Suburban Electric Company, San Francisco, for $4,600. The Suburban Electric Company secures its power from the lines of the Standard Electric Company.

George Henderson, Oakland, Cal., engineer for the Klamath River Power Company, states that the intention of the company is to develop 500 horsepower on the Klamath River. This power will be transmitted to the lumber regions of Northern California, to be used in the various logging camps. It is expected that the plant will cost in the neighborhood of half a million dollars.

The Solano County Board of Supervisors has granted a franchise to Hartzell Bros., Vallejo, Cal., for 60 miles of electric railway in Solano County. The proposed road will enter Solano County from Napa County on the west, and will connect with the towns of Cordelia, Rockville, Manka, Fairfield, Suisun, Vacaville and Dixon. From Dixon the line will run to Woodland.

The city trustees of Santa Ana, Cal., have instructed the superintendent of the waterworks system to prepare a rough estimate of the cost of building and operating an electric-light plant in connection with the waterworks. A.

PERSONAL.

Charles T. Yerkes sailed for London on the Cunarder Lucania on January 24th, his decision to sail having been made suddenly.

D. G. Mead has accepted the position of electrical engineer for the Guanajuato Power and Electrical Company at Guanajuato, Mexico.

C. T. Coley, a graduate of Stevens Institute of Technology, has been appointed instructor in electrical engineering at Union College, Schenectady, N. Y.

The many friends of G. M. Willis of Chicago will be pleased to learn that he has recovered from a severe illness and is again actively engaged in his profession as an electrical engineer.

O. W. Brain, electrical engineer of the New South Wales government railways, who has been making an extended tour of the United States and Canada, sailed from San Francisco on January 8th.

Fred A. Wood, who has been in the employment of the St. Louis Electrical Supply Company, with headquarters at Marshalltown, Iowa, has accepted a position with the Central Telephone and Electric Company of St. Louis, and is to take charge of the western branch of that company's business, which is to be established in Omaha.

Henry Morton Brinckerhoff, manager of the Metropolitan West Side Elevated Railway Company of Chicago, was married on January 20th to Miss Florence Louise, daughter of Mr. and Mrs. Benjamin Bates Fay, also of Chicago. The ceremony was performed by the Rev. John Henry Hopkins. Mr. and Mrs. Brinckerhoff will reside at 349 Ashland Boulevard.

George A. Damon, managing engineer of the Arnold Electric Power Station Company of Chicago, gave an address before the electrical-engineering students of McGill University, Montreal, Que., on January 21st, upon the invitation of Professor R. B. Owens, who is at the head of the electrical-engineering department. Mr. Damon's subject was "The Engineering of Electric Power Plants."

ELECTRIC LIGHTING.

J. Ingles Matthies of Philadelphia, Pa., has a contract for erecting an electric-light plant at Cheraw, S. C.

The Village Board of Coulterville, Ill., has granted a franchise to Thomas M. Matthews for a term of 35 years for the operation of an electric-light plant.

The Rapid City (S. D.) Light and Fuel Company has been incorporated with a capital stock of $20,000 J. H. Evarts, C. L. Wood and George F. Schneider are among the incorporators.

According to the daily press the electric-light plant at Wabash, Ind., had to shut down on the night of January 24th, owing to the failure of the coal supply, thus leaving the city in darkness.

The United Water and Light Company, which will own the water and light plants of Wilmington, Ohio, has been incorporated in New Jersey with a capital stock of $3,000,000. It already operates a number of such systems and will build and buy more.

The City Council of Columbus, Ohio, has passed an ordinance authorizing the establishment of an electric-light plant for the city and to provide for

the issuance of bonds in the sum of $122,000 to raise money for the construction and completion of the same.

The Freeport Electric Company of Freeport, Ill., with a capital of $5,000, has been incorporated by A. P. Goddard, W. N. Cronkrite and A. J. Goddard.

An ordinance granting the Watertown (Wis.) Electric Company a franchise for a term of 20 years, with a contract for street lighting for 10 years, has been passed by the council of that city.

The recommendation of the special committee of the Chicago City Council embodying an act providing for municipal ownership of gas and electric-lighting plants was brought up at the council meeting on January 26th and made a special order for the next meeting.

Among the recent incorporation notices is the following: "Detroit Edison Company, New York (to manufacture electricity, ice, steam and other products for light, heat and power purposes); capital, $6,000,000; directors, Charles W. Wetmore, George R. Sheldon, Edwin M. Bulkley and Charles A. Cobbin, New York."

The Fort Dodge (Iowa) Light and Power Company is to expend from $275,000 to $300,000 in improving its plant. Among the improvements contemplated are an extension of the street-car line, rebuilding of the gas house and equipment of the electric-light plant with new machinery and generators.

The City Council of Covington, Ky., has approved the contract with the Union Light, Heat and Power Company for lighting the city for one year, 320 lights to be furnished. There is a provision that the contract may be renewed upon the same terms, or, in case it is not, that the company will sell its poles to the city at a price fixed in the contract.

At the recent annual meeting of the Columbus Edison Company of Columbus, Ohio, the following-named officers and directors were elected: President, Adolph Theobald; vice-president, John Siebert; secretary and general manager, A. W. Field; treasurer, Emil Kiesewetter; directors, C. H. Lindenberg, John Siebert, Emil Kiesewetter, Louis Siebert, George W. Bright, F. W. Hubbard, F. E. Drake, Adolph Theobald, A. W. Field, Carl Hoster and W. A. Gill.

ELECTRIC RAILWAYS.

The electric railway to be built between Florence and Canon City, Colo., is a surety, the final franchises having been passed. Mr. Whitted, the consulting engineer, says that 500 men will be put to work immediately.

The Illinois and Iowa Railway Company has let a contract for the construction of an interurban railway between Clinton and Davenport, Iowa. The distance is 42 miles and the company expects to have the line in operation by August 1st.

The project for the construction of an electric railway between Eau Claire and Menomonie, Wis., as an extension of the Chippewa Valley Electric Railroad Company's system is under consideration by the business men of both towns.

The Eastern Electric Express Company of Maine is endeavoring to secure from the Legislature a charter for the building of an extension of the line in Lewiston, through Auburn to Turner, the object in view being to secure freight and express business.

The Florence Electric Street Railway Company of Colorado has recorded a trust deed for $2,700,000 with the Eastern Trust Company of New York city as trustee. The purpose of the company is to build 125 miles of electric railway to connect cities and towns in the Arkansas Valley.

The Toledo Railways and Light Company has placed an order for 40 new cars at an aggregate cost of $160,000. This is the largest order ever placed at one time by the Toledo company and increases the total number of new cars ordered to date to 60. The cars are of the latest pattern, with Detroit platforms, and two 50-horsepower motors each.

The first through trip from Fond du Lac to Oshkosh, Wis., over the new Oshkosh-Fond du Lac electric interurban railway was made some days ago with one of the regular city cars of the Fond du Lac Electric Railway and Lighting Company. New cars have been built for the line, and it is expected the regular trips will be made in an hour each way.

The Puget Sound Electric Railway Company has filed in the Hudson county clerk's office at Jersey City, N. J., an amended certificate of incorporation, fixing the capital stock at $4,500,000, of which $1,000,000 consists of six per cent. non-cumulative preferred shares. The company operates electric railways and light and power plants in the vicinity of Puget Sound.

The franchise of the Lansing City Electric Railway Company of Lansing, Mich., has been revoked by the City Council of the city, which alleges that the system is not up to the standard fixed by the ordinance. Before the order could be put into effect an injunction was secured by the company restraining the city from interfering with the company in the operation of its system until a hearing of the points involved had been had in the Circuit Court.

The Swedish government, it is reported, has decided to take a serious step in the matter of electric traction. A committee, which was nominated on the subject some time ago, has presented a report declaring that electric traction must be realized as soon as possible on the whole system of the state railways, which compose Sweden's main lines. If a beginning is made this year, the committee hopes that all the Swedish state lines will have electric traction by 1905.

SOCIETIES AND SCHOOLS.

Over 500 students of the engineering department of the University of Michigan are scheduled to take the shop courses at the university during the remainder of the year. This is the largest number of students ever taking the shop courses at one time.

"One Thousand and One Stories of Success" is a pamphlet issued by the International Correspondence Schools, Scranton, Pa., in which are given the names of more than a thousand of its students who have advanced either in salary or in position as a result of the schools' correspondence training by mail. The booklet is being sent to prospective students.

The annual meeting of the American Institute of Mining Engineers will be held at Albany, N. Y., beginning February 17th. The programme will include the following papers: "Electric Power Transmission for Mining Purposes," by F. O. Blackwell of Schenectady, N. Y.; "Electricity in Coal Mining," by W. B. Clark of Schenectady, N. Y.; "Electric Lead Refining," by A. G. Betts of Troy, N. Y. A trip will be made to the works of the American Locomotive Company and the General Electric Company at Schenectady. Theodore Dwight, New York, is acting secretary of the Institute.

AUTOMOBILES.

The board of automobile examiners of Chicago, in its annual report, shows that there were 500 licenses issued during 1902 and 424 reissued, the receipts being $1,930. Eight accidents were recorded during the year, one being fatal.

The Electric Storage Battery Company, manufacturer of the Exide battery, has recently opened a new Exide battery depot in Rochester, N. Y. Although an Exide battery station is located in Buffalo, owing to the increasing use of electric vehicles in that portion of New York state, the opening of the above office has been found necessary. It is located at the establishment of J. J. Mandery, at 158 South Avenue, Rochester. Owners of electric vehicles equipped with Exide batteries in this district are notified to use this depot for any matters requiring information or attention.

PUBLICATIONS.

Johnson & Morton of Utica, N. Y., in a recent pamphlet describe their J. & M. panel-boards and accessories, together with prices and illustrations. Ten styles of panels and boxes are listed.

The application of storage batteries to railway-car lighting is described, with suitable illustrations of railroad coaches, in a bulletin recently issued by the Electric Storage Battery Company of Philadelphia, Pa.

MISCELLANEOUS.

The Mechanical Electric Company of New York city has been incorporated in that state with a capital of $10,000. The directors are Francis Lewis, P. M. Randall and Gaetano Damato.

The McCreary Electric Company of New York city was recently incorporated with a capital stock of $25,000 by A. A. McCreary, H. W. Brooks, Jr., and H. M. Brooks of New York city.

Announcement comes from France of the proposed construction of a submersible boat which will be larger than any ever built. The boat will have a displacement of 350 tons. It will be able to attack an enemy's ports and will also be able to cruise on commercial routes.

A bill has been introduced in the New York state Legislature, creating the office of state gas and electrical chemist, the officer to test the illuminating power of gas and electric light whenever requested to do so by an inspector of gas meters or other properly accredited municipal officer.

The committee on gas, oil and electric light of the Chicago City Council has recommended for passage an ordinance giving the United Pneumatic Fire Alarm Telegraph Company the right to lay for 20 years wires in the streets for conducting an automatic fire-alarm system. The company already has wired 50 downtown buildings, operating without an ordinance. A compensation clause providing for 2½ per cent. of the gross receipts after five years and five per cent. in the third five years and seven per cent. in the fourth five years was inserted in the measure.

The National Electric Purification Company, with its principal office in Camden, N. J., has been incorporated by William T. Henderson, Harry W. Henderson and C. V. D. Joline. Its object is to manufacture appliances for purifying water, and its capital is $1,000,000.

A certificate of incorporation has been filed at Dover, Del., for the New York Lines Company of Pittsburg, Pa., to acquire telephone, telegraph and electric-light lines and all other like enterprises. Incorporators are William M. Clarke and C. M. Harold of Pittsburg, and William S. Hilles, Wilmington, Del. The capital is placed at $40,000.

The members of the New York State Electrical Commission find that over $1,500,000,000 is invested in electrical enterprises in New York state and recommend an appropriation of $275,000 for the establishment of a state electrical laboratory which, they consider, would be exceedingly valuable in finding the best means of protecting life and property against damage by increasing high-power currents used in commercial enterprises; in insuring standardization of instruments and appliances; in affording experiments and tests to establish facts in electrical controversies and in carrying on investigations for the development of electrical science.

TRADE NEWS.

Earl Cogdell, Granbury, Texas, wants an alternator, 12 transformers, three arc lamps, poles, lamps, wire and insulators.

Col. W. S. Waite of Wartrace, Tenn., is said to be in the market for a 35-kilowatt alternator, incandescent and arc lamps, two transformers, a switchboard, wire, etc.

Thomas M. Matthews of Coulterville, Ill., is in the market (for shipment, up to February 17th) for a dynamo, rheostat, switchboard, meter, incandescent and arc lamps, iron and cedar poles, insulators, etc.

Notwithstanding a recent official denial on the part of the Stanley company, rumors of the sale of the Stanley Electric Manufacturing Company to the General Electric Company are again circulated in Wall Street.

Stone & Webster of Boston, Mass., in addition to the large electrical plant at Seattle, Wash., already mentioned, are preparing plans for another at Ponce, Porto Rico. All buying will be done through their Boston office.

Plans and specifications for a new electric elevator for the courthouse at Warren, Ohio, are on file at the commissioner's there, and bids will be received up to February 7th. The motor is to be of 15 horsepower, and the car is to travel 250 feet a minute and to be equipped with automatic stop valves.

Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until 2 p. m., on March 5th, for the installation of a conduit and electric-wiring system for the United States Postoffice at Janesville, Wis., in accordance with the drawings and specifications, copies of which may be obtained at the above-named office, or the office of the superintendent of construction at Janesville, Wis.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 9th, for the installation of a conduit and electric-wiring system for the United States Postoffice, at Jamestown, N. Y., in accordance with the drawings and specifications, copies of which may be obtained at the office of the supervising architect, or at the office of the superintendent of construction.

In its recent "Copper Gossip" circular the National Conduit and Cable Company of New York says that on January 16th Lake copper was quoted at 12¼ to 12½ cents a pound, and electrolytic at the same price. A year ago prices were 11 to 11⅛ cents a pound. The company says: "From the information that is obtainable, and from comparison with past figures, the stock on hand on January 1, 1903, is said to be over 250,000,000 pounds, being as large, if not the largest, ever in the hands of producers. There are also millions of pounds of copper bars which were sold last year to new enterprises, such as the New York rapid-transit subway, the Pennsylvania Railroad, the underground electric railways of London, and others; also to the manufacturers of copper products; all of which must be consumed this year and next, before the enormous surplus stock can be called upon. In the meantime, the producers of copper are turning out each month an amount of copper which is largely in excess of the average amount of consumption, and either the consumption

must increase, eliminate or the production be curtailed, or the producers will have a load which will be impossible for them to carry."

BUSINESS.

The Ohio Brass Company has decided to substitute alternating-current power distribution for the direct-current system at present in use in its shops at Mansfield, Ohio, and a recent purchase from the Westinghouse Electric and Manufacturing Company comprises a 180-kilowatt, 7,200-alternation, two-phase alternator, a direct-current exciter, switchboard equipment and the following induction motors: Two of 40 horsepower, four of 30 horsepower, one of 20 horsepower, one of 15 horsepower, and one of two horsepower.

The Phelps Company of Detroit, Mich., manufacturer of the Hylo lamp, is distributing facsimile letters from the Lamp Testing Bureau of New York city, noting that the bureau was testing two lots of Hylo lamps. One lot had burned about 3,000 hours, and the other about 4,000 hours, the small filament alone burning. The company was asked how much longer the test should be continued, to which Mr. Phelps replied: "We would like to have you burn the Hylos out on that line, if it takes all summer."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) January 20, 1903.

718,610. Electric Clock. Walter J. Dudley, Bangor, Maine. Application filed August 20, 1902.

An electromagnet enters into the operation of the device.

718,619. Electric-heating System. Edward E. Gold, New York, N. Y. Application filed January 10, 1900.

An electric heating system for a single car comprises a number of heaters in the car, a circuit connecting in series a heating element of each of the heaters, an additional heater (or number of heaters) in the circuit and in the car, a shunt connected to short-circuit the additional heater, a circuit-breaker in the shunt, and means for cutting off the heat entirely from the heaters and also for varying the degree of heat therein.

718,624. Combined Lamp Guard and Shade. William J. Hartwig, Detroit, Mich. Application filed January 10, 1902.

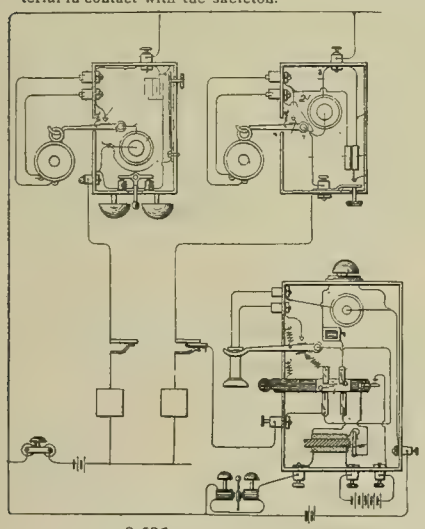
The guard is for use with incandescent lamps.

718,632. Electrical Fuse or Junction Box. Montgomery H. Johnson, Utica, N. Y. Application filed May 31, 1902.

The box has an outer casing, a lining for the bottom and lower portion of the box, opening for electrical conductors into the lower portion, fixed terminal pieces secured in the lower portion of box, a removable tablet carrying the electrical distributing or other mechanism mounted on tablet with circuit terminals juxtaposed with the casing terminals and screws engaging the tablet and casing terminals, electrically connecting them and securing the tablet in position.

718,637. Secondary Battery. Isidor Kitsee, Philadelphia, Pa. Application filed April 28, 1900.

The battery has an elect ode consisting of a conducting strip bent in a manner so as to form spaces and a series of independent blocks placed in the spaces. Each of the blocks consists of a conducting skeleton and active material in contact with the skeleton.



NO. 718,686.—TELEPHONE SYSTEM.

718,639. Vehicle with Electromotive Power. Oskar Lasche, Charlottenburg, Germany. Application filed June 3, 1901.

Combined with a wheeled axle, are a body, springs supporting the body on the axle, a motor frame and springs carrying the motor frame and located in the same vertical planes with the body springs.

718,660. Thermal Electric Cut-out. Thomas E. Scantlin, Lafayette, Ind. Application filed September 5, 1901.

The cut-out consists of two separable bodies, an easily fusible cement uniting the same, and a resistance medium of aggregated parts adapted to be heated by an abnormal current to fuse the cement and forming a broken or interrupted electrical connection of low conductivity between the bodies through which a current passes by jumping from part to part.

718,686. Telephone System. Frank B. Wood, New York, N. Y., assignor to Frank B. Wood, Jr., and Catherine Wood, New York, N. Y. Application filed August 29, 1901.

A telephone and calling system is described. It comprises a central office and stations, an independent line extending between central and each station, a common return wire whose circuit is normally open at each station, means for producing calls at central from the stations, telephone instruments at the stations for connection with the lines, telephone instruments at central, a branch wire for connecting the telephone instruments at central with the common wire, and means for connecting the instruments with either of the first-mentioned lines. (See cut).

718,695. Electric Clam Dredge. Ephraiem Chaquette, New Rochelle, N. Y. Application filed November 20, 1901.

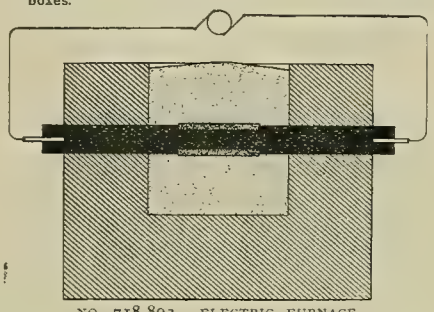
The dredge consists of a suitable float, a clam carried thereby and mechanism for raising and lowering the same vertically at the edge of the float, an electric motor located in the clam and devices, whereby the clam is automatically opened at the top of its ascent and closed when it reaches the bottom.

718,697. Induction Motor. Cummings C. Chesney, Pittsfield, Mass. Application filed July 30, 1902.

In an armature for an induction motor are combined an armature core, separately formed conducting U-shaped pieces therein, and a conducting ring to which the ends of the U-shaped pieces are secured.

718,698. Apparatus for Delivering Mail. Golla Condory, New York, N. Y. Application filed April 16, 1902.

The apparatus consists of a carrier, boxes designed for ejection at the different floors above the ground floor and electrical means to raise the carrier for the ejection of the boxes and to lower the carrier for the collection of the boxes.



NO. 718,892.—ELECTRIC FURNACE.

718,758. Electrically Operated Type-writing Machine. John S. Harrison, Savannah, Ga., assignor to the Prendergast Electric Typewriter Company. Application filed April 12, 1902.

One claim reads: In a type-writing machine having a type-wheel, keys, mechanism controlled by the depression of the keys for moving the wheel to printing position, hammer-operating mechanism, and controlling mechanism for releasing the carriage and hammer-operating mechanisms, the combination of an electromagnetic device, a link connection between the electromagnetic device and the controlling mechanisms for moving the type-wheel to printing position and for releasing the carriage and hammer-operating mechanisms, and means for closing the circuit through the electromagnetic device, as each key is depressed, whereby, as each key is depressed, the magnetic device is energized and the controlling mechanisms operated through the link connection.

718,774. Accumulator Plate. Wilhelm Kraushaar, Neumühl, Germany. Application filed June 20, 1902.

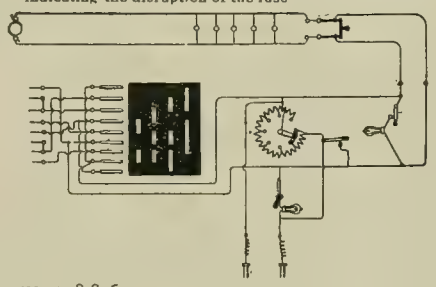
The plate comprises a grid having longitudinal flat ribs the ribs being connected together by a web integral therewith, and being provided with mutilations disposed upon opposite sides of the web.

718,775. Quick-break Electrical Switch. Fredrick A. La Roche, New York, N. Y. Application filed December 14, 1901.

A manually operated electrical switch is described. It combines with a switch and its contacts, a motor adapted to be energized by the pressure contact of the switch when moved to the closed position, a latch for restraining the motor independent of the switch, and a finger-operated lever for moving the latch to release the motor and permit it to force the switch outwardly.

718,797. Safety Fuse. Joseph Sachs, Hartford, Conn. Application filed September 30, 1901.

The device combines with a case of insulating material and terminals therefor, a fuse electrically connected to the terminals, means interposed in the fuse to be heated by excess currents to disrupt the joint connecting the means and the fuse, means secured to the casing and electrically connected to the fuse for conveying high-potential discharges to ground, and means for externally indicating the disruption of the fuse



NO. 718,896.—ELECTROTHERAPEUTIC APPARATUS.

718,846. Battery Connection. William W. Keirstead, Grand Rapids, Mich. Application filed May 10, 1902.

Combined with a series of battery cells are a pair of bus-bars, circuit-closers adapted to connect the respective poles of the cells in multiple to the respective bus-bars, circuit-closers to connect the cells to each other in series and means for operating all of the circuit-closers.

718,855. Telephone Set. Kempster B. Miller, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 23, 1901.

In the telephone wall set described, combined with a back-board, are a condenser receptacle, a hook-switch mounted upon the front wall of the receptacle, and a bodily removable enclosing box comprising a top piece, side and front pieces, the box being arranged in its closed position to inclose the switch and to close the receptacle, and when opened to expose the switch entirely and to open the receptacle.

718,891. Method of Reducing Metallic Oxides. Edward G. Acheson, Niagara Falls, N. Y. Application filed December 4, 1900.

The method of reducing metallic compounds consists in passing an electric current through an electrical conductor placed in proximity to the compound to be treated and shielded therefrom by a body of refractory carbide.

718,892. Electric Furnace. Edward G. Acheson, Niagara Falls, N. Y. Application filed December 20, 1900.

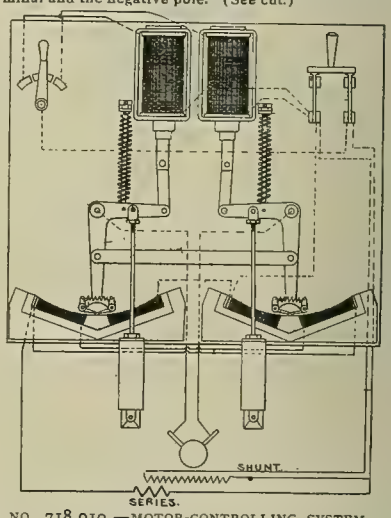
The furnace has a carbon electrical conductor with a protecting layer of refractory carbide and electrical connections at the ends of the conductor. (See cut.)

718,896. Electro-therapeutic Apparatus. William H. Ames, St. Louis, Mo., and Edward E. Clement, Washington, D. C.; Clement assignor to Ames. Application filed June 14, 1902.

In the system are a source of current supply, electrodes, a heating device, a single rheostat and switch, and connections from the source of supply to the heating device and the electrodes so arranged that the rheostat may be connected as an adjustable shunt for either or both, at will. (See cut.)

718,910. Process of Controlling Electric Motors. William H. Chapman, Portland, Maine. Application filed October 22, 1902.

The process consists of connecting each armature terminal with each pole of the line through suitable resistance and simultaneously and equally increasing the resistance between one of the terminals and the positive pole of the line and decreasing the resistance between the terminal and the negative pole of the line and decreasing the resistance between the other terminal and the positive pole and increasing the resistance between the latter terminal and the negative pole. (See cut.)



NO. 718,910.—MOTOR-CONTROLLING SYSTEM.

718,925. Block System for Railways. Harnett J. Fuller, Winchester, Mass. Application filed March 5, 1901.

The system comprises a single-track electric railway divided into blocks by turnouts, and having in operative relation to the tracks at each turnout insulated sections in the conductor from which current is supplied to the car motors, and automatic mechanism by means of which current is cut out from the sections to prevent the first arriving car from leaving a turnout until the arrival thereat of an approaching car.

718,927. Recovering Tin from Tin-scrap. Robert H. Gould, Surbiton, England, assignor to Cæsar Gustav Luis, London, England. Application filed August 27, 1900.

The method of recovering tin from tin-scrap and generating electric energy consists in inserting the tin scraps to be treated in a suitable vessel to form the anode of a galvanic cell, and a cathode or cathodes of a material electro-positive to tin and iron in an electrolyte containing an alkaline chloride, and closing the circuit of the cell.

718,929. Typewriting Machine. John S. Harrison and Hermann Hill, Savannah, Ga., assignors to the Prendergast Electric Typewriter Company. Application filed April 12, 1902.

Combined with the printing elements and the key levers are an electric motor for actuating the printing elements having an intermittently operated movable element, and continuous connections between the movable element and all of the printing elements controlled by the movement of any key lever for actuating the printing elements for printing and spacing of the characters.

718,935. Water Purifier. Joseph Johnson, Minneapolis, Minn., assignor of one-half to Claus Mumm, Minneapolis, Minn. Application filed September 23, 1902.

An insulator is provided in a pipe, fitting snugly against the walls thereof, and electrodes are arranged within the insulator and have their edges supported within the grooves in the inner walls thereof, the electrodes being insulated from each other and connected respectively with the opposite poles of an electrical generator.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, FEBRUARY 7, 1903. No. 6

Electrical Features of a Great Newspaper Establishment.

At the southeast corner of Madison and Dearborn Streets is a new tall building, of plain exterior, but containing equipment of exceptional interest. As a modern office building, providing space in its 17 stories above the street level for about 700 offices, it is an excellent example of the best construction in that line, but it is as the home of the Chicago Daily Tribune, with its many mechanical and electrical appliances and other facilities for rapid and efficient newspaper making that it possesses, perhaps, the greatest interest for the readers of the Western Electrician. The building has a frontage of 144 feet on Dearborn Street and 121 feet on Madison Street. For the first four stories the exterior facing is of Bedford stone, and above that a gray pressed brick is used with terra cotta trimmings.

Unlike all other large office buildings in the city the basement extends down a distance of 30 feet below the street level. This basement space, which really constitutes three floors, is given up entirely to the presses, heating plant and various kinds of printing and auxiliary machinery. In the lower floor, or sub-basement, are placed the heavy foundations for the presses, the electrotyping department, machine shop, ink and roller-making plant, boiler plant and part of the heating and ventilating equipment. The electric motors that drive the large presses are also located here. In the basement proper, just above, which has a larger area than the sub-basement, is the press room, 86 by 148 feet in size, and also the stereotyping room and pump room. On a still higher floor, and one that corresponds to the ordinary basement of other buildings, is a gallery running around the press room for the use of the mailing department and visitors. On the same level at the rear of the building is located some of the pumping and ventilating machinery. The business office of the Tribune occupies the corner of the main or ground floor, the rest of that floor being taken up by stores and a handsome entrance of white Carrara marble. The publisher's and editorial rooms, etching and art departments, library, etc., are situated on the third floor, while on the fourth floor are the large composing and make-up room and rooms for the telegraph editors, proofreaders, etc. Part of the fifth floor is also used by the Tribune, while the second and all floors above the fifth are devoted exclusively to tenants.

Every provision possible has been made to keep the rented portions of the building entirely separate, and free from any indication of the nature of the work that is carried on on the newspaper floors. To this end separate ventilating and heating systems are provided, the separating walls and floors are double, and but one of the passenger elevators has access to the fourth floor. What is of still greater importance is that distinct foundations are provided for the heavy presses and for the building proper. For the latter caissons were sunk to a depth of 80 feet and the holes filled with concrete, and upon these pillars the bed plates for the steel columns of the structure were placed. The foundations for the presses are built of brick and rest on separate concrete beds, while the basement floor is supported by these foundations, the sub-basement retaining walls and iron columns. In this way the presses and the whole floor upon which they are placed is independent of the building steel work, and no vibration is noticed in the tenanted part of the building while the presses are in operation.

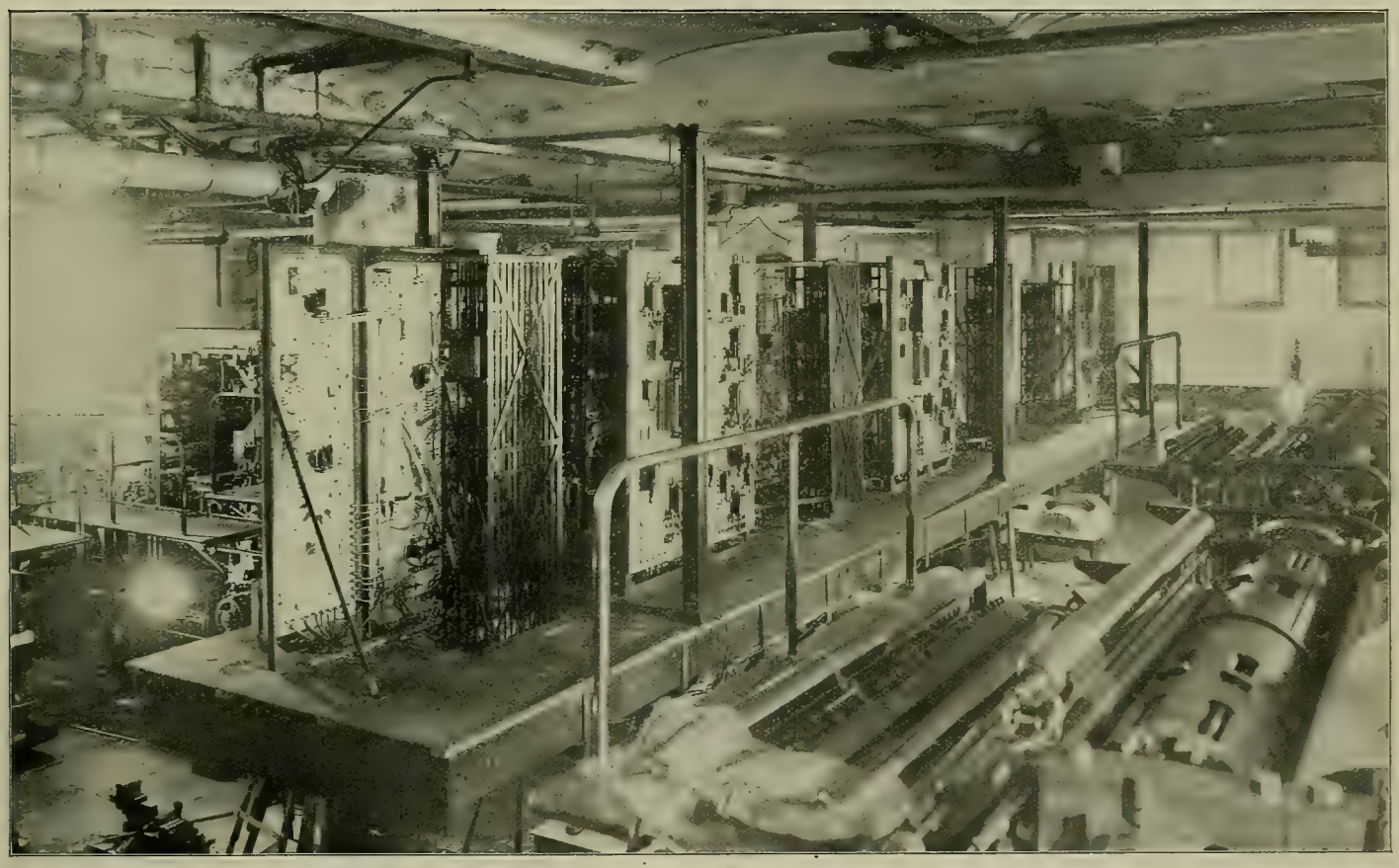


FIG. 1. ELECTRICAL FEATURES OF A GREAT NEWSPAPER ESTABLISHMENT.—CONTROLLER-SWITCHBOARD GALLERY IN CHICAGO TRIBUNE PRESSROOM.

Electric Service.

One would naturally think that, in a building of this character, where thousands of incandescent lamps are required and power machinery aggregating nearly 850 horsepower is necessary, an excellent opportunity would be afforded for the installation of an isolated electrical power plant. Such, however, were the advantages of a central-station service, as set forth by the engineers of the Chicago Edison Company, and the need of practically all the available basement space for the printing machinery and necessary auxiliaries, coupled with the urgent need of getting into the building at an early date, that the management decided to postpone the installation of a generating plant to some future time and entered into a contract with the Edison company for a number of years. The Tribune's engineers think it possible that a reserve plant may eventually be installed, the equipment to consist of three direct-connected units of a total capacity of 1,250 horsepower.

At present the building is entirely dependent upon the Edison service, although precautions are taken so that the chances for a total breaking down of the power supply are very remote. Three distinct services are brought to the building—one from the State Street mains, one from the Dearborn Street system and the third from the rotary-converter substation under the Boyce Building. These services are brought into the building at two different points and are run to a service board at the northeast corner of the basement. Ordinarily, the three sets of cables are thrown together in multiple, but in case of accident to any one set the load may be carried on the other two. From the service board 15 1,000,000-circular-mil cables lead to a general distributing switchboard, a short distance away. This latter board is of white marble and contains the necessary switches, meters and fuses for the distribution of the two-wire, 220-volt, direct-current power circuits and the three-wire, 110-volt, direct-current lighting circuits.

There are five sets of power feeders, supplying in all a total capacity of 834 horsepower in motors. The largest of these feeders operates the presses and has a capacity of 600 horsepower. Of the other sets, one goes to the stereotyping room, one to the electrotyping and machinists' rooms, one to the ventilating and hot-blast fan motors, and the fifth to the miscellaneous motors in the composing and etching rooms.

The arrangement of the lighting feeders is such that the lights for the Tribune's offices, basement, work rooms, corridors and space for public use are separated from the lights used by the tenants of the building. In all cases the lights for a floor or department are controlled from distributing centers, consisting of steel boxes, lined with slate and having iron doors. The Tribune plant is equipped with about 2,200 16-candlepower incandescent lamps, while the total number of lights in the building is about 6,500. For general illumination in the basements and composing and engraving rooms there are provided 54 enclosed G. I. arc lamps, this num-

ter including four lamps on the outside of the building.

All wiring, whether for lights or motors, is run in iron-armored conduit, the sizes of pipe varying from five-eighths inch to 2½ inches in diameter. In order to provide for the five new stories which have recently been added a new Edison service runs to the southwest corner of the building on Dearborn Street. The average power supplied to the entire building is about 50,000 kilowatt-hours a month, which is almost exactly the amount that was originally figured on by the Edison company's engineers in making estimates. In addition to supplying all the electric power, the Edison people placed all the wiring and conduit for lights, motors and bells and the conduit for telephones.

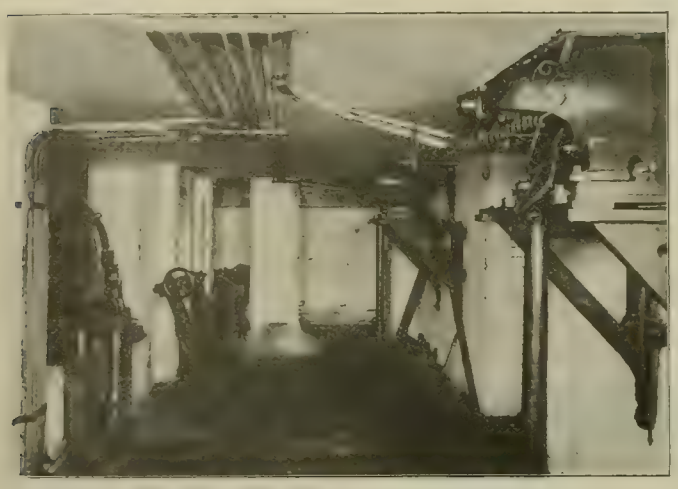


FIG. 2. MOTORS DRIVING PERFECTING PRESSES IN SUB-BASEMENT OF CHICAGO TRIBUNE BUILDING.

Press Operation and Control.

By far the most interesting machinery in the building is the printing presses and their electric-controlling mechanism. Space is provided in the press room for eight large presses, and seven have been installed. Six of these are octuple web-perfecting presses and the seventh is a color press, all of them the largest of their type and the only ones of their kind in the West. Each of the black-ink octuple machines is made up of two quadruple presses, both of which are complete and independent machines, capable of running singly or of being geared together into one machine, the capacity of the double press being 96,000 eight-page papers in one hour. Each press has one main 75-horsepower driving motor and two 10-horsepower slow-motion motors, made by the Milwaukee Electric Company. These motors are geared to the press and are located beneath in the sub-basement. Fig. 2 is a view of one of the enameled-brick chambers in the sub-basement between two presses. On the left is seen a portion of a main driving motor that is geared to a shaft at about the center of one press, while the two motors shown on the right are the auxiliary motors on another press; each of the motors being connected through a worm gear and automatic clutch to one-half of the press.

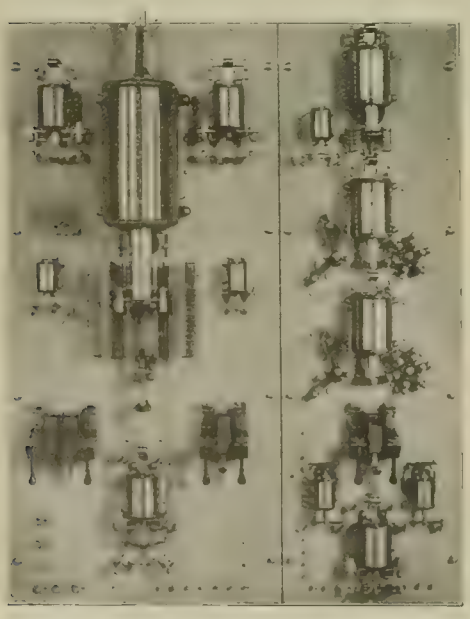


FIG. 3. CONTROLLER SWITCHBOARD FOR OCTUPLE PRESS.

The system of electrical operation and speed control of these presses is remarkable for its ingenuity, and although it is quite complex possesses advantages which are both time-saving and labor-saving, and which also increase the production and save power. The system is that of Kohler Brothers of Chicago and has grown out of the electro-pneumatic system that was installed some years ago on the presses of the Chicago Daily News. That system, which was described in the Western Electrician of April 16, 1898, was the result of the combined work of Irving Stone of the News, George Gibbs and Kohler Brothers. Since that time Charles A. Dresser, general superintendent for Kohler Brothers, has invented the purely electrical system, which, as now perfected, has been successfully installed on the Tribune presses and several other in this and other cities.

The controlling mechanism for each press consists of a double automatic solenoid controller and other mechanism mounted on a two-panel switchboard, 6½ by five feet in size. These boards, which are built of pink Tennessee marble are set in a row on a hanging galley in the center of the press room, each board facing its press, as shown in Fig. 1. The face of one of the boards is shown in detail in Fig. 3.

Located at equally distributed points on each press are 12 push-button stations. Each station consists of a small iron box, about four inches wide, eight inches long and three inches deep. Across one end of the box are arranged three push buttons indicated by the words "on," "stop" and "off." At the opposite end is a snap safe switch turning to the position of "safe" and "run." In Fig. 4, which shows one of the octuple presses, three of these stations are indicated by arrows. Any combination of the press can be operated from these stations, it being possible for the pressman to start, increase or decrease the speed and stop the press at will by pushing a button at any station. There are 30 running speeds of the press, and it is guaranteed that the control shall be from a start of five revolutions a minute of the main driving shaft on the press through the various steps to any desired speed up to maximum, or from maximum speed down through these steps to standstill, or the press can be operated at any one of these intermediate speeds. This wide range of speeds is accomplished through the use of the auxiliary and the main motors. The lower speeds are obtained by cutting out resistance on one of the auxiliary motors, and when a certain speed is reached the smaller motor turns the larger one mechanically, thus giving it inertia, so that when still more resistance is cut out the large motor is cut into service without any jar. As the speed is still further increased, the load is taken entirely by the large motor and the small one is automatically cut out by dogs on a clutch flying out from centrifugal force and freeing the connection. Similarly on reduction of speed the clutch throws the small motor into service as the large one is cut out.

For putting blankets or plates on the cylinders, the press can be brought to any position desired and absolutely stopped. An exact movement of one-eighth of an inch on the plate cylinder can be made. While the press is being made up and a pressman is working in any part of it, he turns the safe switch to "safety," and while so turned it is impossible for anyone to start the press until he has turned the safe switch to the "on" position.

When the press is brought to the desired speed for threading paper, the safe switch can be turned; and so long as on "safe," it is impossible to increase the speed, thus reducing the liability of accident to the pressman. The safe switch can also be used to prevent an increase above any desired speed, as, for instance, a moderate speed for color work, but it is always possible to decrease the speed, or stop. It is said to be impossible, no matter how the pressman may handle the push button, to start or stop the press with a jar or jerk.

The time required to bring the press from standstill up to maximum, or from maximum to standstill, is adjusted to suit the pressman, but is usually 20 seconds. The press can be instantly stopped while operating at any speed from any station. The time required to stop the press is only the few seconds necessary to prevent stripping of gears. By this system, any undue load on the press, such as hot-boxes, undue friction, etc., causes the press to stop. If for any reason, whether by failure of current, mechanical accident or by design, the press is stopped, the controller immediately and automatically returns to the starting point.

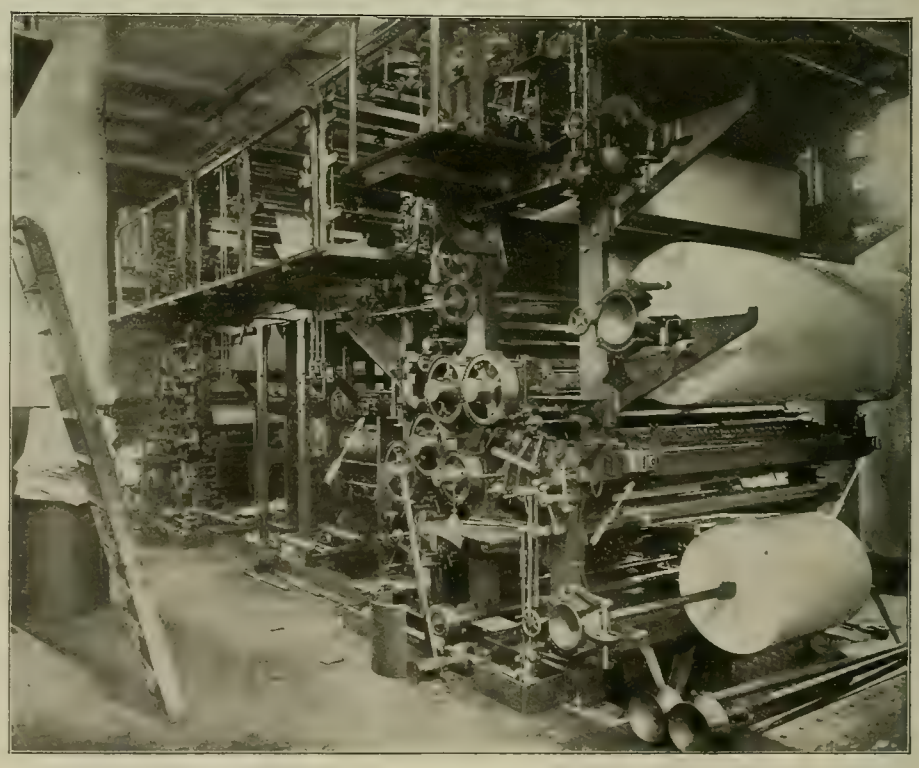


FIG. 4. PERFECTING OCTUPLE PRINTING PRESS, SHOWING LOCATION OF THREE CONTROLLING STATIONS.

The push-buttons are so arranged that it is said to be impossible to make any mistake, that is, if half of the press is to be run at full speed, the push buttons on that half will bring it to full speed, while if the other half is to be run at a "dressing" speed, the push buttons on that press will only bring the press to a dressing speed. If the conditions are reversed and the half that formerly ran at full speed is to be run at dressing speed, the same push-buttons which before brought it to full speed will now only bring it to dressing speed, and the other half which was running at slow speed can be brought to full speed from the same push-buttons which formerly ran it only at dressing speed; or if the entire press is to be run as an octuple, any push-button will

bring it to any desired speed. The two halves of the octuple presses are operated together or separately by means of levers from the press-room floor.

The color press, which is technically a double-width, nine-cylinder, multi-color electrotype web-perfecting press, is similarly operated by means of a 75 horsepower main-driving motor and a 10-horsepower auxiliary slow-motion motor. Only one panel on the controlling gallery is required for this machine. The press can be operated under a number of different combinations. When running one roll of paper it will print 44,000 four-page papers, the cover pages in five colors and the inside pages in two colors. The controlling system used is especially valuable on the press, as when it must be adjusted to a slow speed and kept at that speed, the "safe" switch is turned whenever the proper motion is reached, and, while this speed may be decreased or the whole press stopped from any other station, the speed of the press cannot be increased until the switch is turned.

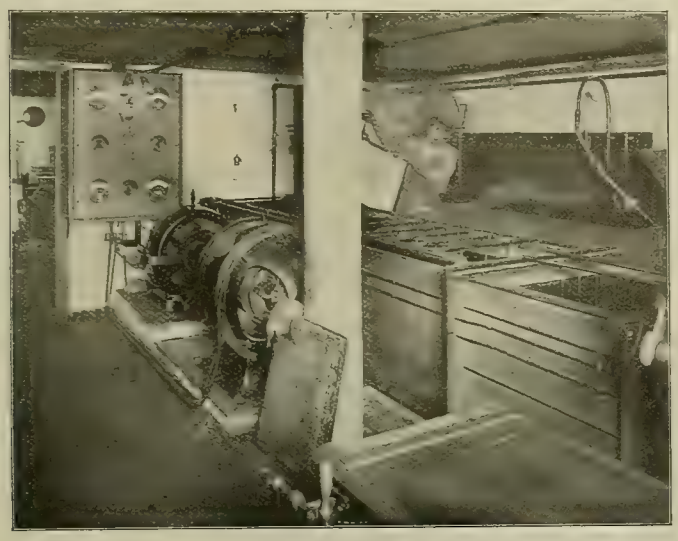


Fig. 5. Electrotyping Room, Showing Electroplating Outfit.

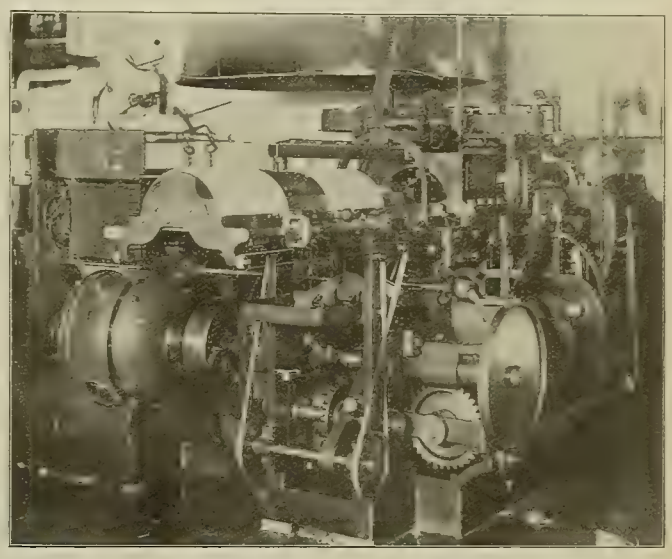


Fig. 7. Automatic Stereotyping Machine.

ELECTRICAL FEATURES OF A GREAT NEWSPAPER ESTABLISHMENT.

Electrotyping Department.

Of the other departments of the Tribune plant probably the most interesting is the electrotyping room where the electrotype plates are made for the color press. In one of the rooms is placed an electroplating apparatus, shown in Fig. 5. It consists of a large plating tank operated by a Jantz & Leist electroplating machine. The generator has a capacity of 1,500 amperes at six volts and is driven by a 15-horsepower Jenney motor at 600 revolutions a minute. Either nickel or copper plating can be done, and the machines are controlled through a handsomely trimmed slate switchboard. The wax forms upon which, when black-leaded, the metal is electrodeposited are molded in a hydraulic press, capable of exerting a pressure of 5,000 pounds, the water being pumped by a five-horsepower motor. From the press, the wax plates go to the wax shaver, shown in Fig. 6. This machine is driven through gearing by a 1½-horsepower motor. A black-leading machine, belt-driven by a 1½-horsepower motor, next deposits a coating of black lead upon the wax, which is then ready for the electrolytic bath.

After the electrotype plates are backed up with lead, so that they may be used on the printing press, they are taken to an adjoining room where they are sawed, shaved, trimmed, routed and bent to the form of the cylinder and are ready for use on the color press. The machinery here consists of a saw driven by a two-horsepower motor, a head trimmer and beveler whose motor of one horsepower is built into the pedestal of the machine, a three-horsepower shaver and a three-horsepower rougher. A round routing tool is driven at a speed of about 18,000 revolutions a minute by a two-horsepower 1,700-revolution motor. The plate bender is operated by a two-horsepower geared motor and has an automatic attachment, so that the machine stops when one revolution is completed. The edges of the curved plates are sawed by a one-horsepower machine, and if necessary are also run through a two-horsepower geared plate reducer.

Stereotyping Machinery.

In the stereotyping room is located the most valuable and the latest piece of auxiliary printing machinery to be developed outside of the presses themselves. It is known as an autoplate machine and is used to cast automatically the stereotype plates (used on the black-ink presses) from the matrices as they are received from the composing room, delivering these plates in curved form, ready to be trimmed and finished by other machinery. Fig. 7 shows one view of this machine. It is driven by a 15-horsepower motor directly connected through a mechanical clutch to the operating shaft. This motor revolves from 500 to 650 times a minute and can be controlled to give a speed of one, two, three, four or five plates a minute. The machine can cast as many as 100 plates from one matrix. The matrix-making machine used in connection with the autoplate is on the fourth floor in one part of the composing room. It is driven by a three-horsepower geared motor, and a duplicate machine is installed for use when necessary. To carry the matrices from the composing room to the stereotype room is a Burdette & Rowntree automatic electric dummy elevator, designed to carry 50 pounds. This mechanism is driven by a five-horsepower motor at the fast speed of 750 feet a minute and is controlled automatically by push buttons. Provision is also made so that the opening of a door automatically stops the elevator wherever it may be between floors.

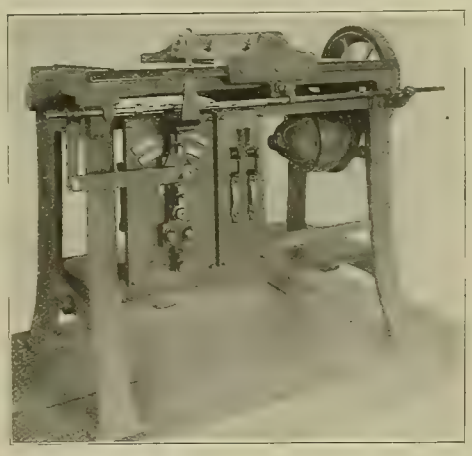


FIG. 6. ELECTROTYPER'S WAX SHAVER, ELECTRICALLY DRIVEN.

The other machinery in the stereotype room includes four old-style tail cutters direct-connected to five-horsepower motors, two single-page curved-plate shavers driven by two and three-horsepower motors, respectively, and a double-page curved-plate shaver. This last machine is shown in Fig. 8. It is driven by a three-horsepower motor and is arranged automatically to make but one complete revolution at a time. Other machines in this room comprise a metal saw, metal trimmer, a flat-bed shaver, a matrix roaster and a combined jig saw, router and drill, each tool being separately driven by an electric motor.

Etching and Composing-room Machinery.

Passing to the third floor further use of electric power is found in the etching or engraving room. Here are two vertical 1½-horsepower motors, each driving a routing tool at a speed of 2,200 revolutions a minute, a three-horsepower flat shaver, a three-horsepower saw, a two-horsepower beveler and a 1½-horsepower motor operating the etching tubs. A blower is also motor-driven. At one end of the room are the arc lights used by the photographers.

On the fourth, or composing-room floor, located along the Dearborn Street side, in three rows, are the linotype machines, 43 in number. Each machine is direct-connected to a one-fourth-horsepower motor. Red signal lights at each machine and an annunciator call are also provided to summon the machinist in case of accident or derangement of any part of a machine. A variety of other machinery located on this floor and used in connection with the linotype machines, includes two milling machines, two drill presses, a lathe, two grinders, a punch, a polishing machine and three metal saws. In the basement there is also a machine room with machines for the linotype department, all the tools on both floors being independently electric driven. The great majority of the auxiliary printing machinery heretofore mentioned, as well as the seven large presses, were built by R. Hoe & Co. of New York and London. All the motors in the stereotype and electrotyping departments, those on the linotype machines and all but two or three in the composing room were furnished by the Jenney Electric Manufacturing Company of Indianapolis, Ind.

Miscellaneous Equipment.

The boiler equipment, which is used for the hydraulic elevator pumps and to assist the exhaust from the pumps and other auxiliaries in heating the building, is located in the southeast corner of the sub-basement. It consists of one 300-horsepower and two 200-horsepower Scotch marine internally fired boilers, equipped with Morrison corrugated furnaces and with Hawley down-draft furnaces attached. They were made by the S. Freeman & Sons Manufacturing Company of Racine, Wis. During the summer months gas is used as fuel and coal is burned in winter. A pressure of 130 pounds is allowed. A draft of 1¼ inches is obtained from the high stack that runs through and surmounts the building.

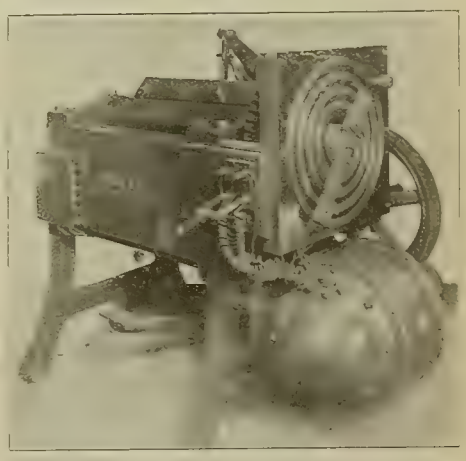


FIG. 8. ELECTRICALLY DRIVEN CURVED-PLATE SHAVER FOR STEREOTYPING.

Hydraulic elevators are installed in the building.

seven passenger and one freight, and they operate on the Crane high-pressure accumulator system. The pressure on the pumps is 750 pounds. The largest of the three elevator pumps is a three-cylinder compound high-duty pump with cylinders 18 and 20 inches in diameter and a 24-inch stroke. The other two pumps are a duplex compound and a single-cylinder duplex. In addition to the elevator service there are 19 direct hydraulic lifts at the presses and other parts of the basement. They have an average lift of about 20 feet and are mainly used in handling the 1,200-pound rolls of paper, from the street to the press.

The rented portion of the building is heated by direct radiation, but for most of the Tribune plant the indirect forced system of heating and ventilation is used. For this purpose there are installed a 20-horsepower, a 15-horsepower and two 10-horsepower motor-driven American fans of 160, 140 and 120 inches diameter, respectively.

A five-ton Kroeschell ice machine driven by a 15-horsepower motor is installed, and a one-horsepower motor belted to a triplex pump circulates ice water for the Tribune offices and departments. Hot water is supplied from a 1,000-horsepower Berryman heater. Additional machinery in the basement includes a high-duty air compressor and a low-pressure compressor for the pneumatic tubes, two Yeomans 35-foot lift electric five-horsepower bilge pumps, and two Westinghouse air-brake compressors for operating the devices that open and close the doors on the passenger elevators. An electric-lamp signal system for the elevators has been installed by the Elevator Repair and Supply Company and is operated by two one-half-horsepower motor-genererators, delivering a six-volt current. Speaking and pneumatic tubes and bells are installed in the Tribune plant and a private exchange of the Chicago Telephone Company is equipped with 33 instruments. In the telegraph editor's department there are 24 telegraph instruments.

Holabird & Roche of Chicago were the architects for the building, and the heating contract was executed by the L. H. Prentice Company, also of this city. The mechanical oversight of the Tribune plant is under charge of P. J. Masterson, general master mechanic, while J. A. Cameron is chief engineer and J. H. Mau is chief electrician.

Municipal Ownership of Lighting Plants Favored by Chicago Council.

At its regular meeting on February 2d the Chicago City Council unanimously adopted a bill authorizing the building, owning and operating, by municipalities, of gas and electric-light plants for public or private use, and the bill was ordered sent to Springfield for consideration by the Legislature. In its amended form the law favored by the council provides that a city desiring municipal ownership of its gas or electric-lighting plants, or both, shall first pass an ordinance directing that the question be submitted to the voters. A petition for the adoption of such an ordinance, signed by 10 per cent. or more of the legal voters, shall make it the duty of the council to pass such an ordinance. Then, after proper advertising, the proposition shall be voted upon at the first regular election, on a separate ballot. If a majority of the ballots cast are in favor of the proposition, it shall be legally adopted.

The Stanley-General Electric Rumors.

Rumors that the General Electric Company has acquired control of the Stanley Electric Manufacturing Company of Pittsfield, Mass., have been repeated with increasing vigor during the last few days. Stanley representatives say that the report is unauthorized, but do not say that it is untrue. The fact is admitted that negotiations for a change of ownership of control of the Stanley company are pending, but the control of the company, it is stated, has never passed into the hands of William C. Whitney. The plan to increase the capital stock of the company to $10,000,000 has not been abandoned, and the permanency and enlargement of the works at Pittsfield is one of the details agreed upon in any event, it is asserted.

An Ashland (Neb.) press dispatch says: "Another party of surveyors for the new electric railway to be constructed from Lincoln to Omaha arrived here on January 26th from Lincoln, and is now operating south and east of this city. Nothing definite as to their plans for the route could be ascertained, but it is almost certain that Ashland will be included in the line. The party is working under instructions from H. H. Wilson of Lincoln, and E. C. Hurd, who represent Ohio capitalists."

Faller Automatic Telephone Operator.[1]

By William J. Hammer.

For a considerable period of time the public mind has been steadily educated up to a high appreciation of, and great confidence in automatic time, energy and money-saving appliances. In the telephone field the subject of automatic telephone exchanges has been one which has attracted a great deal of attention ever since the original work in this direction of Messrs. M. D. and F. A. Connolly and F. J. McTighe, whose system the writer had the pleasure of examining as long ago as 1881, at the first electrical exhibition held in Paris.

The above system has been the basis of very many of the patents which have since been taken out on automatic telephone exchanges; and it is my privilege to-night to present for your consideration a radical departure in automatic exchanges which embodies a new principle of which it is the pioneer exponent. It is the invention of Mr. Ernest A. Faller, and is a most meritorious and ingenious piece of apparatus, and is termed the "mechanical operator," in contradistinction to all other types of automatic exchanges, as it is the only invention which does the work of switching in a telephone exchange in exactly the same manner as is done by the human operator, and by exactly similar means. It is a light machine, and occupies comparatively little space. It is driven by power, and moves mechanically the equivalents of the ordinary plugs and cords in the usual switchboard, connecting the subscribers' terminals together, when desired, signaling both parties, and disconnecting the same automatically, when parties have finished speaking; and accomplishing this without necessitating any departures from the general arrangement of circuits met with in standard practice; and doing away with all but a fraction of the relays, magnets, electrical contacts and connections essential in all other systems, both manual and automatic.

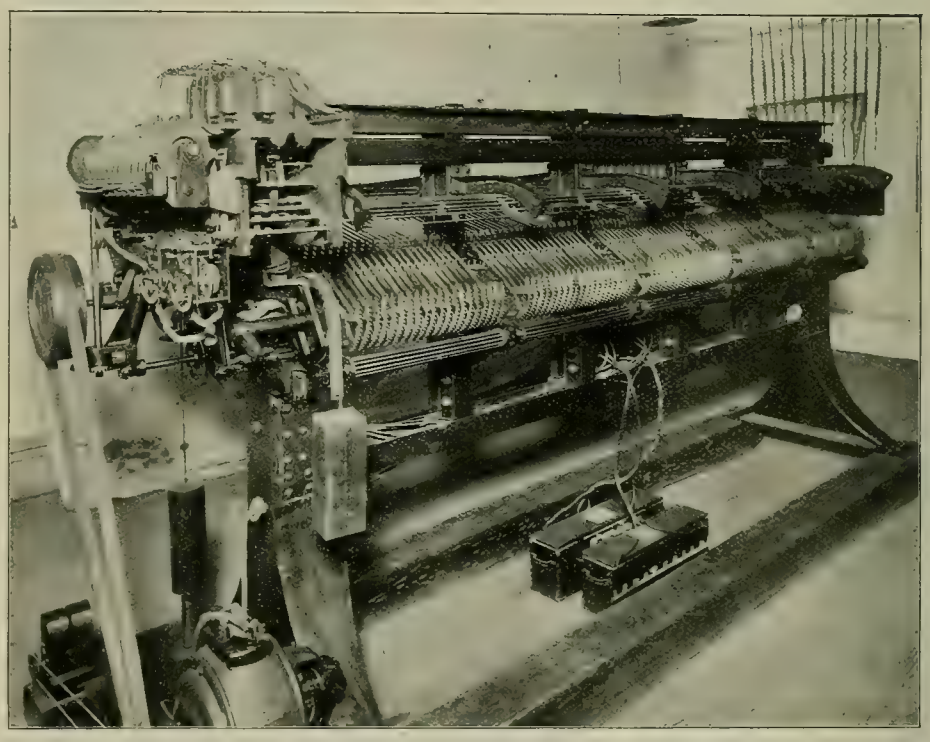


FIG. 1. FALLER AUTOMATIC TELEPHONE OPERATOR.—ORIGINAL FORM.

The multiple system of telephone exchanges has now reached a very high degree of perfection, and it has become more and more costly; and it is well understood that as the number of subscribers connected to any manual or automatic exchange increases the operating and maintenance expenses, increase in far greater proportion than the number of subscribers, because of the increase in the number of multiples.

There is an urgent demand to-day for a system which will very materially cut down these very heavy expenses, and cut off the very heavy outlay now necessary for operators' salaries.

Before entering into a description of the apparatus itself, it will perhaps be as well to consider just what the functions are which the human operator fulfils in connecting and disconnecting subscribers, and in what way the mechanical operator duplicates these functions; and I will, therefore, place them side by side:

Cycle of Operations.

The Automatic System.	Manual System.
1. The subscriber sets his sender to the number wanted, and winds it; his responsibility ending there.	1. The subscriber takes the receiver off its hook.
	1a. Operator notes "pilot" light signal and individual signal light.
2. The exchange drops his (the subscriber's) terminal shuttle, which starts his sender going.	2. The operator places an answering plug in his jack upon seeing his signal displayed.
3. The sender sends a signal into the exchange selector, thereby establishing one of a hundred local circuits.	3. Operator raises the listening key cam, which depresses the key, thus enabling her to communicate with the subscriber.
4. The exchange drops shuttle of subscriber wanted.	4. She asks "Number" (this operation has no parallel in the automatic exchange, as the starting of sender is a natural consequence of the dropping of shuttle).
5. The motive power at exchange lifts both shuttles into an idle bus-bar. (This operation has no parallel in manual working).	5. The subscriber gives the number wanted.
	6. The operator repeats the number to prevent error.
	7. Operator must select "jack" wanted.
	8. Operator makes a busy test by tapping with tip of her plug the collar of the multiple jack of the line wanted.
6. The ringing device rings bells of both subscribers.	9. The operator plugs the multiple jack of subscriber wanted.
	10. Operator presses ringing key, thereby ringing up subscriber wanted.
7. The subscriber on hearing signal, takes off his receiver. (This operation not in manual practice, as receiver there is off already.)	11. Operator restores the listening key, cutting herself out.
	12. Operator notes that subscriber's signal lamp goes out.

Next, conversation begins.

Upon its termination,

8. Subscriber hangs up receiver.	13. Subscriber hangs up receiver.
	14. Two keyboard signals light.
9. Clearing-out magnets drop both shuttles back to rest.	15. Operator removes both plugs of the pair from jacks.

This is the entire series of operations gone through in a "successful switch." Should, however, a busy line be called, then the following happens:

Busy Test.

The Automatic System.	Manual System.
1, 2, 3, same as above.	1, 2, 3, same as above.
4. Operator attempts to drop called shuttle, but it is out of the way, and a special circuit is opened.	4. Operator in multiple board taps the collar of the multiple jack of the line wanted, and she receives a series of "clicks" known as the busy test.
4a. Shuttle is for a moment hung up, but then clears out again.	5. Operator tells calling party, line is busy.
(No further operations follow, as subscriber waits for bell before taking down receiver.)	6. Subscriber hangs up receiver.
	7. Operator removes answering plug from calling subscriber's jack.

It will be noted from above that the number of operations necessary varies, and favors considerably the mechanical-operating system, those requiring the subscriber's attention are less in the automatic, and he need not wait for the operator to question "Number?" and after receiving the same repeating to prevent error, and saves that time as well as the time often lost in getting the operator to understand the correct number, etc.

Comparison of Apparatus Forming Salient Features of Both Systems.

The Automatic System.	Manual System.
1. Subscriber's instrument.	Same.

1. Abstract of paper read at the meeting of the American Institute of Electrical Engineers in New York on January 23, 1903.

2. Sender.	Not in manual.
3. Subscriber's line.	Same.
4. Protective devices, lightning arresters, heat coils, etc.	Same.
5. Subscriber's terminal carriage with contact springs and connecting rod.	This is represented in a manual exchange by subscriber's line jack.
6. Individual magnet.	This is equivalent in office to subscriber's drop or lamp signal and its operating relay, cut-off relay, also puts line lamp out by cutting out line relay.
Above comprises the first group of exchange apparatus, and there are as many above items as there are subscribers.	Same.
AUTOMATIC.	MANUAL.
Group 2—	Cords and plugs.
1. Bus-bars.	
2. Shuttle locks.	
3. Clearing-out magnets.	Clearing-out drops or supervision signals.
The apparatus in this group is present in a number equal to one-tenth of the number of subscribers.	Same.
AUTOMATIC.	MANUAL.
Group 3—	Same.
1. Battery and leads therefrom, or dynamo.	
2. Operating power.	
3. Operating mechanism proper.	These two items are represented by the operator, in a manual exchange.
The apparatus in this group is provided once only per section of 100 lines.	Same.

DESCRIPTION OF THE AUTOMATIC SYSTEM AND ITS OPERATION.

It is difficult to give a complete technical description of this system without recourse to many numbered drawings, diagrams, photographs, etc., and those who are specially interested in this subject will find it of great service to witness the actual operation of the system itself, which may be seen at the present time in New York city.

This system comprises two separate devices: First, a "mechanical telephone operator," situated at the telephone exchange, the original form of this being shown in Fig. 1; second, a "sender" or signaling apparatus, as shown in Fig. 2.

THE SENDER.

Let us first consider the sender and its functions. It is preferably placed near each subscriber's telephone, and by its means each and every subscriber is enabled independently to control the mechanical operator at the central exchange. There is no mechanical connection of any kind between the subscriber's instruments and the "sender;" and it can be attached without cutting the circuit, it being only necessary to connect it in parallel across the existing line and to ground. The ground connection is one made for the switching act, when the instruments are idle and during conversation they are free from ground.

The subscriber's "sender" or calling apparatus consists of a small metal box containing a set of disks, numbered on the periphery from 0 to 9—one comprising the units and the other the tens; and in the case of higher numbers being employed additional disks are attached—three disks would give numbers up to 1,000; four disks would give numbers up to 10,000, and five disks up to 250,000. The number of the subscriber to be called is displayed in a line across the "sender" face, and a series of impulses corresponding to this number are sent over the line to the exchange by means of a clockwork started by turning the calling lever projecting from the front of the "sender." This lever, upon being turned upward, winds the spring of the clockwork; it then returns to its first position, where it is locked, thus preventing further interference until the call has been sent and properly received at the central exchange. When the "sender" starts the varying series of impulses which are sent over both legs of the metallic circuit simultaneously, the ground (which has been automatically thrown on) is used for a return circuit. The "sender" also contains a magnet whose armature normally retains the clockwork until the magnet is energized by current from the exchange. As in the case of a messenger call or fire-alarm box, the calling lever must be turned to its full extent to send a signal, and after this has been done, the protective devices in the sender, as already stated, keep all the essential parts of the sender locked during the dispatch of the signal. When the switch is completed at the exchange, the subscriber, as well as the party whom he has called, receives a bell signal. There are four of these signals given to called subscribers, covering a period of 30 seconds time, this period giving the called subscriber time to reach his telephone. As soon as he has taken off the receiver the signals cease and conversation begins.

MECHANICAL TELEPHONE OPERATOR.

We will now consider the operator (shown in Fig. 1), and its functions:

All subscribers' circuits are normally free from ground, and, as already stated, the subscriber's calling device or "sender" is normally open, both as to ground and metallic circuit. In Fig. 3 is shown a diagram of the circuits. All apparatus is shown in solid lines and wiring in dotted and broken lines. Broken lines show circuits closed; dotted lines show circuits open.

Each subscriber's line terminates in one place only at the exchange—this being a feature not possessed by other automatic systems—each subscriber's line, consisting of two wires, is connected at the exchange to two parallel rods on the mechanical operator. These rods are insulated from the rest of the machine, each pair supporting a carriage mounted so as to slide on these rods. This carriage holds the subscriber's terminal springs, which are insulated from each other, but each spring makes an electrical contact with one of the two rods. The springs on the carriage are adapted to slide by, or at some particular point to make contact with one of a series of bars laid in a grill at right angles to and above the carriage rods.

All of the rods or bars employed in the machine are of such dimensions as to have practically no resistance, and the conducting bars and loop circuits connected with them containing impedance coils, and a source of electrical energy, such as a storage battery, and constitute the equivalent of the cord circuits of the manual exchange, and in their functions correspond identically therewith. While the number of subscriber's terminal carriages is equal to the number of subscribers' lines, the number of cord circuits or pairs of parallel bars necessary need not be more than 10 per cent. of this number, this figure having been found safe in manual-exchange practice. There are instances in which boards have had to be equipped with 12 and even 16-cord circuits per 100 lines, but the average present multiple practice is from seven to 10. It is never found that all subscribers wish to talk at one and the same time.

When the subscriber's line, terminal switch or carriage at the exchange is at a position of rest, one of the subscriber's line terminal springs makes a contact with the ground spring, which is connected to one of a circle of commutator pins. These pins are swept over by a revolving brush attached to the shaft of what is termed the "busy wheel" and which is normally in rotation. There are as many pins on the commutator as there are subscribers, and the revolving brush establishes a connection between a ground spring (subscriber's line) and a battery, operating magnet and ground.

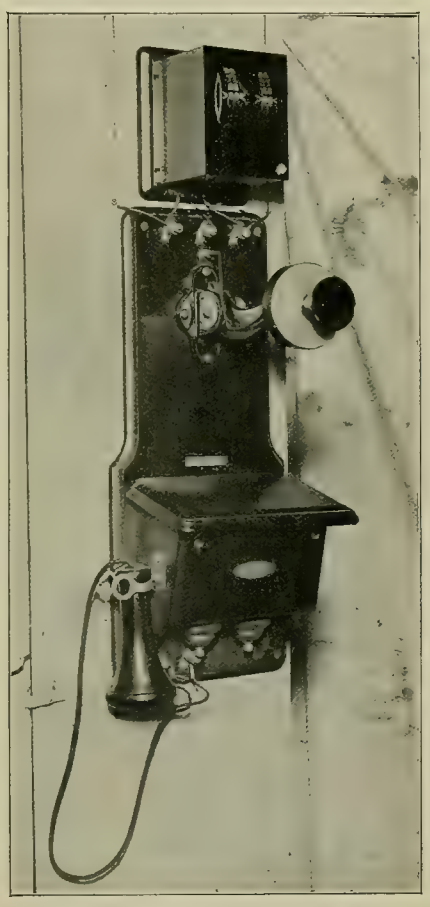


FIG. 2. FALLER AUTOMATIC TELEPHONE OPERATOR.—SUBSCRIBER'S INSTRUMENT AND SENDER.

The busy wheel to which the commutator brush is attached is driven by a friction clutch from a power device operated preferably by an electric motor, and is arranged to be stopped by a pawl and ratchet, controlled by the operating magnet termed the starting magnet, which initially controls the entire switching operation of the exchange. The energizing of the starting magnet stops the busy wheel and starts the operating gear, which passes through its complete cycle, after which the busy wheel is again started, continuing to revolve until the starting magnet is again energized.

A second magnet, termed the "restarting" magnet, is employed to start the "master shaft" going again, in order that the carriage-moving or cord-circuit operating device of the called subscriber may be thrown into gear. These two starting and restarting magnets operate in conjunction with the subscriber's sender through the medium of a controlling contact apparatus and selector.

The commutator above referred to consists of two sets of circularly disposed contact pins, the number of the pins in each circle representing the number of subscribers. There are also two metal contact rings, one of which is solid and the other divided into 10 equal segments. The rotating trailer arm attached to the busy-wheel shaft sweeps over these contacts. The contact pins of one circle are each connected to a separate ground terminal spring, and one of the contact rings is connected in circuit with the starting magnet, a battery and ground connection. The purpose of the contact device is to prevent any other subscriber from throwing the starting magnet into operation while switching is going on, the circuit in this starting magnet being always opened, save when the master shaft is at its point of rest. Each subscriber's line is brought into connection with the ground once in each revolution by the revolving contact arm.

The busy wheel which has been referred to consists of a shaft extending through the entire length of the "mechanical operator," which carries, mounted upon it and disposed around it in the form of a helix of a single turn, a series of resilient fingers of thin sheet steel, their number corresponding to the number of subscribers.

When the busy wheel, which is normally running, has been stopped by an impulse sent through the starting magnet, one of the steel fingers, which is always the one in a perpendicular position, remains resting against the latch holding that particular subscriber's terminal carriage. Next the power mechanism, acting through a clutch and cam, shoves forward a light shaft termed a rack, which is studded with pins corresponding to the number of steel fingers and latches, and which runs parallel with the axle of the busy wheel. As this rack moves longitudinally, the upright steel finger is bent over by a rack pin tripping the latch and thus releasing that subscriber's rod and shuttle, which drop into contact with a long lantern pinion; this pinion then rotates through an arc dependent upon the number of subscribers' lines busy at that time. Instantly a lever engages the two subscribers' shuttles, lifting them up, so that their hook heads engage a shuttle detent. There are as many of these detents as there are talking circuits, i. e., one-tenth the number of subscribers (in this machine the number being 10).

A circuit is now established between the springs of the subscriber's carriage and the grid bars representing the cord-circuit terminals. The magneto-generator is now thrown on the circuit, ringing the bells of both calling and called subscribers. The length of this signal may be varied to suit requirements, and is controlled by a timing device. In the meantime the power mechanism has been automatically thrown out of operation, and the busy wheel again rotates until another call is sent in.

When the subscriber takes his receiver off the hook a clearing-out magnet prevents the switch from clearing out; but when both receivers are hung up, the clearing-out magnet becomes de-energized, and its armature causes the shuttles connected to return to their position of rest.

INDIRECT OR TRUNKING SYSTEM.

Up to the present time we have considered the original type of the operator, as illustrated herein, and applicable to small exchanges up to 100 subscribers and employing the so-called direct connection, requiring a single machine accessible periodically to all subscribers. There have recently been made very important changes in the general design of the operator and its mechanical details, without altering the general principles under which the system operates. These changes have greatly increased the speed of making connections, cutting the time down to 3½ or four seconds for a trunked connection. The new operator is considerably smaller and lighter in weight, more compact, more "get-at-able," and much cheaper in cost of construction. In this machine also is embodied the indirect or trunking system, applicable to exchanges from 100 up to 250,000 or more subscribers, uniting all, if required, into a single system without sacrificing the plug and cord principle, and without multiplying the subscribers' contacts, as in all other systems, and, finally, making it entirely practicable to subdivide the lines into groups of 100, thus keeping the dimensions of the connecting machines within moderate limits.

The act of connecting subscribers consists of three functions, each represented by an independent section of the operator. In the order in which these devices are thrown into use in establishing a connection, they are termed the "originator," the "pilot" and the "terminator."

The "originator" performs the office of establishing a connection of the calling subscriber's line with the A trunk. These A trunks are conductors connecting the originator and "pilot," and their number represents the maximum number of subscribers which would at any time be simultaneously using the section. It is well to note here that these A trunks always have their beginning and ending in the originator and pilot of one and the same unit of 100. In this initial act of the originator, no selective connection controlled from the subscriber's station takes place, but the A trunks which are already in use are made inaccessible to subsequent calls, the originator always selecting a free and idle A trunk. The end of the first free A trunk is connected in the pilot, with a receiver or selector, which immediately upon the establishing of the connection between the A trunk

and the subscriber's line receives a group signal referred to later, and thereupon selects a B trunk corresponding to the signal received. Immediately the mechanism of the pilot connects the A trunk and the B trunk, at the same time breaking the connection between the A trunk and the selector, and putting the selector in connection with the next idle A trunk, the B trunks referred to connecting the pilot and the "terminator."

The ends of all the B trunks, coming from one and the same section of 100, are distributed over all the terminators of the exchange, rendering it possible by the aid of one of these B trunks to establish a connection between the pilot and any one of the terminators. Here again, as many B trunks are provided for each terminator as are necessitated by the maximum demand for simultaneous conversations between the two groups.

In the terminator the first idle B trunk is again connected with a selector, which, upon the connection of the B trunk with the A trunk, receives the number signal. Immediately the connecting machinery establishes a contact between the B trunks and the contact element in the terminator, representing the number of the subscriber wanted, which number has been transmitted to it.

Each subscriber, it will be understood, belongs to a certain group of 100, and in this group he possesses a contact element, both in the originator and terminator, these being connected to his line in parallel, protective devices being provided, by means of which, as soon as the subscriber making a call has caused this particular contact element in the originator to leave its normal position, his corresponding element in the terminator becomes inaccessible to other calls, and should any be made they would result in a "busy" signal.

The ringing up of subscribers, conversation and the clearing out is done in precisely the same manner as in the direct method of connection previously described.

Certain of the Construction Details.

The sender is identical with that already described and employed upon the original type of the operator. The mechanism at the exchange, as I have already stated, embodies the originator, pilot and terminator.

The Originator.—This consists of the switchboard, the movement and clearing-out device. The switchboard consists of 100 perpendicular tracks, upon which 100 shuttles independently ride up and down. The track rails are insulated from one another, and connect in pairs to the subscribers' lines. The shuttles consist of two metallic parts in contact with the rails,

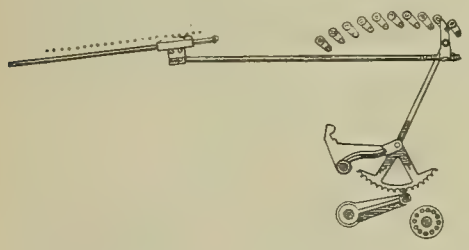


FIG. 4. FALLER AUTOMATIC TELEPHONE OPERATOR.—SUBSCRIBER'S UNIT (ORIGINAL FORM).

but insulated from each other, each carrying a contact spring, by means of which they may be brought into contact with the A trunks.

The A trunks in the originator consist of horizontal metallic rods placed at right angles to the tracks, enabling each one of the shuttles to be brought into metallic contact with any one of the trunk rods. They are arranged in two parallel vertical planes, one in front of and the other behind the shuttle tracks. The ends of these rods are metallically connected to similarly disposed rods in the pilot. It is self-evident, therefore that when a subscriber's line is connected to an A trunk this is practically an extension of this line into the pilot.

Each shuttle is provided with an actuating rod, by means of which it may be operated by motive power. In the position of rest this rod is supported by a trip, which, on being actuated by a magnet, allows the shuttle to drop. This magnet receives the current as soon as the subscriber winds his sender, this act resulting in putting the shuttle into its initial working position. The moment the shuttle reaches this position a projection upon its actuating rod protrudes in the path of a helical projection mounted on a continuously rotating drum, so that the shuttle is carried into its second working position.

The actuating rod cannot be moved further in this direction, owing to a stop in its path; consequently, the drum, which is driven by friction, is brought to a standstill. The moment this happens, the main mechanism is started, actuating the working beam which extends across the entire switchboard. A projection on this beam seizes the shuttle rod and lifts it into the so-called speaking position, i. e., that in which its springs make contact with the first idle A trunk.

On completing its stroke, the working beam returns to rest. This stops the connector movement, and the drum driven by friction is again started. The shuttle in the meantime remains in the position in which it was placed. In this position the shuttle-actuating rod rests upon a clearing-out bar, which prevents it from dropping back. There are as many of these clearing-out bars as there are A trunks. These have a lateral movement, and when moved they release any shuttles which happen to be suspended from them. How this is accomplished will be referred to later.

At the next call the entire operation is repeated, save that the busy A trunk is "jumped" and the next one occupied, and so on.

The Pilot.—In this we find again the switchboard movement, clearing-out apparatus, and, in addition, a group-signal selector. The construction of the switchboard is identical with that of the originator, save that the drum is eliminated, and shuttle-actuat-

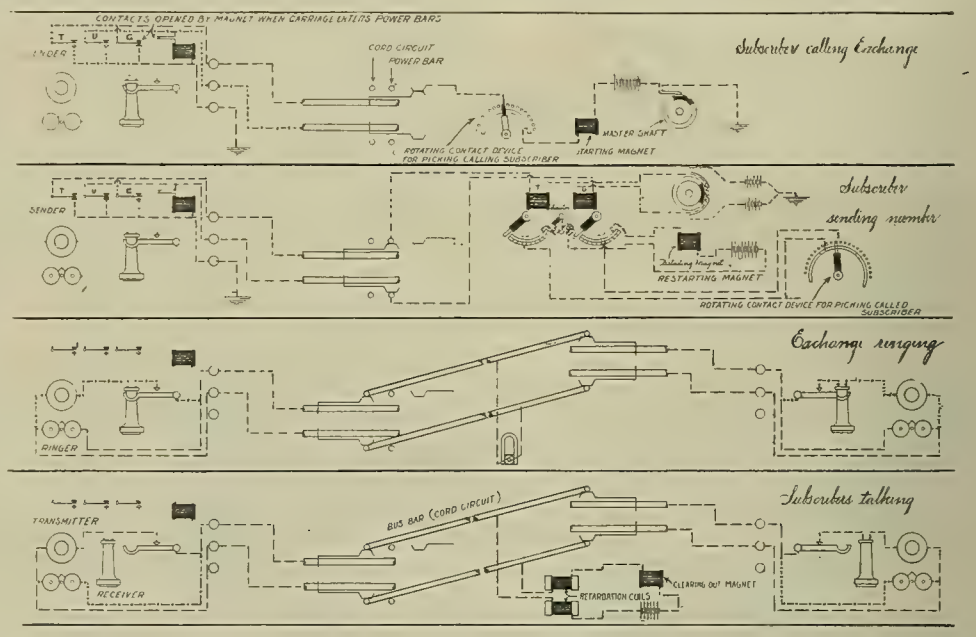


FIG. 3. FALLER AUTOMATIC TELEPHONE OPERATOR.—DIAGRAMS OF CIRCUITS.

ing rods pass directly from position of rest into second working position.

The A trunks from the originator again terminate in rods being provided with a branch circuit to the selector. These branch circuits are normally opened, and are opened during conversation over the trunks, being closed automatically part of the time during the switching act and during the transmission of the group signal.

The shuttles are here connected to rods in the various terminators, so that the particular shuttle which is selected decides into which groups the subscriber's line will be extended.

The electrical stop motion in the subscriber's sender permits only partial running down of the sender, but sufficient to transmit that part of the signal corresponding to the first two figures of the number desired. This is the group signal, and after its transmission the selector in the pilot causes the particular shuttle to drop into working position. But immediately the shuttle reaches such a position, the actuating movement is started, and, as already described, establishes connection between the shuttle and that one of the A trunks over which the signal came. Thus, the subscriber's line is continued into that one terminator in which the subscriber's line which is desired is located, and it now remains to show how the particular line wanted is selected out of the hundred lines in that group. This will be shown in the description of the terminator.

It is essential to mention here that the circuit, thus far built up, has in it a clearing-out magnet and

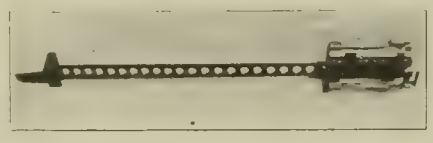


FIG. 5. FALLER AUTOMATIC TELEPHONE OPERATOR.—SUBSCRIBER'S UNIT (NEW FORM FOR TRUNKING).

parallel with that a non-inductive resistance, the province of the former being to maintain the established connection until the conversation is finished. A clearing out in the pilot effects a clearing out in the originator.

The Terminator.—Here we find again the switchboard-actuating mechanism, clearing-out mechanism, signal selector and the ringing apparatus.

The construction of the switchboard is identical with the ones already described, the 100 shuttles forming the terminals of the 100 lines of the group, and the metallic ends of the terminals of the B trunk, which meet here coming from the different pilots where they had their beginning in shuttles.

All these rods have open-branch circuits to the selector; but one of these branches at a time is closed temporarily the moment the pilot establishes connection between an A trunk and a B trunk. Now, the sender is again released, and the transmission is effected. When the signal has been transmitted, the selector at the terminator affects the dropping of that one shuttle which carries the number wanted, and if its corresponding shuttle in the originator is idle, it is thus connected with a B trunk, thereby establishing connection between two subscribers. In the other case the busy signal is given to the originator, and the connection so far established is taken down.

Next, the ringing machinery is actuated, causing the signal at the called subscriber's instrument, this signal being repeated usually four times. It may be any number. Should the subscriber not answer, the connection is cleared out again.

As soon as the subscriber answers, the ringing mechanism is cut out and the talking battery is thrown in, so that no time is lost. On completion of the conversation the clearing-out magnet with its parallel resistance clears the line.

It is self-evident to all electrical engineers who have had experience with electromechanical devices that it is far better to employ a well-designed mechanism, performing a definite cycle of operations and driven by some source of power.

This mechanical operator has been designed and constructed upon the following lines: i. e., an absolutely reliable, prompt, rapid and uniform service in telephone exchanges of any size; an embodiment of all essential features demanded by the exigencies of modern telephone practice; an elimination of the unreliable, flimsy and complex features inherent in systems heretofore presented to the public; and, finally, the effecting of large economies in construction and maintenance charges.

The author of this paper believes as a result of his investigations into this system, that these claims made for it will be borne out in actual practice, and he considers it a privilege to be able to present for your consideration what he believes to be one of the most important and interesting inventions ever brought before the American Institute of Electrical Engineers.

Interstate Standard-gauge Electric Railway.

With the completion of the Omaha and Des Moines railroad, Omaha will have, according to the World-Herald of that city, one of the first standard-gauge electric lines in the West. It is being built to compete with the steam lines in every particular, not only handling the passenger traffic, but freight and live-stock business of all kinds as well, using the standard size of cars and being able to interchange with any steam road. The line is being promoted by Lyman Waterman of Omaha, and will be 84 miles long, from Omaha to Spaulding, Iowa, and the cost of construction will be in the neighborhood of $2,000,000. The entire length of the road from Omaha to Des Moines will be 150 miles. In general the course of the line will be about midway between the Burlington and Rock Island main roads, and at Macedonia it will cross a spur of the Burlington. This connection, it is believed, will favor the shipment of live stock to St. Joseph, Mo., and Chicago from what has hitherto been regarded as Omaha territory.

The Fond du Lac and Oshkosh (Wis.) interurban electric railway was formally opened for business on January 28th, and the celebration constituted a social event for two cities. The mayor and city officials of Oshkosh went to Fond du Lac on the interurban, taking with them a band which gave a concert en route. At Fond du Lac the local officials entertained the visitors at luncheon, and there were congratulatory speeches. The new road is 19 miles long. T. F. Grover of Fond du Lac is the general manager.

Hewitt Mercury-vapor Lamp and Converter.

From accounts in the London electrical journals of the recent demonstration in that city of the mercury-vapor lamp and converter of Peter Cooper Hewitt of New York some interesting additional facts are gleaned. The Electrician notes that the lamp gives a steady, brilliant light, and the chief defect is its cold and almost ghastly color, the light being apparently devoid of any red rays. Objects which appear yellow by daylight were converted into a bright green tint under the influence of the Hewitt lamp, and the effect of the light on the faces of those present was anything but pleasing. A rather higher voltage than that at which the lamp is usually run is required to start it, and this is obtained by breaking the circuit of an induction coil, which is in series with the lamp, round which current is flowing, so that the difference of potential between the postive and negative electrodes is raised

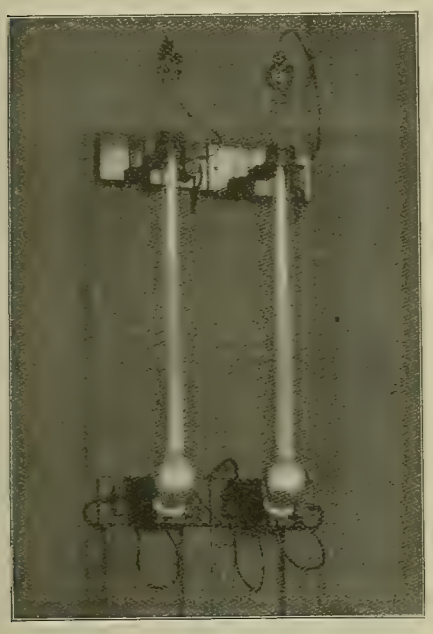


FIG. 1. HEWITT MERCURY-VAPOR LAMPS.

and the resistance of the lamp overcome. The connections necessary for this operation are the same as those required for a similar function when using the Hewitt rectifier, and may be seen on reference to Fig. 3.

The mercury-vapor lamp, as its name implies, derives its light from the gas or vapor of mercury, which is raised to a high state of incandescence. The vapor being under a vacuum, there is absolutely no consumption of the light-giving element, and the lamp, unlike all other illuminants of high power, requires no trimming or attention of any kind. It is said that lamps have been run continuously 200 days for 10 hours a day, and that the efficiency is very high.

Owing to the form in which the lamp is constructed and the extreme diffusion of light obtained, it may be employed to great advantage for purposes where a considerable illumination is required, and where, on account of its sharp and heavy shadow, the ordinary arc light is unsatisfactory. The candle-power per square inch is one-twentieth that of the incandescent, and one three-thousandth that of the arc. In addition to the advantages of diffusion, the absence of red—well known as the color most exciting and fatiguing to the eye—makes the light an almost ideal one for work where an absolute comparison of true color values is not required.

One of the greatest fields of application of the lamp is for all sorts of photographic purposes. The illumination being so diffused and the light composed almost entirely of the so-called "actinic" or chemical rays, it furnishes for this work, where there has never been a satisfactory illuminant, an almost perfect substitute for daylight.

Experiments now being conducted seem to show that as a germicide in certain skin diseases the light has properties similar to the so-called Finsen rays. The color of the light may be altered by the use of certain dyestuffs in reflectors or screens, but so far nothing practical appears to have been done in this direction.

It is said that the life of the lamp is "theoretically infinite." Lamps used over 2,000 hours show but a slight decrease in efficiency. It is usual, however, at the end of 1,200 or 1,400 hours to open the tube and wash and re-exhaust, by which simple process the lamp is made for all purposes as good as new. The lamp may be made in any shape or size desired, from one-eighth-inch diameter and three inches in length to three-inch diameter and 12 feet in length. A range of illumination may be obtained varying from 16 candles to several thousand, according to the size of the tube.

The lamps may be connected in series or parallel. They may be operated on any continuous-current voltage between 50 and 500 volts, and will allow a regulation of as much as 10 per cent. variation. The current consumed may be varied from 0.2 to 20 amperes. The efficiency of the light is about one-half watt per spherical candlepower, and under favorable circumstances as high as 0.3 watt per candlepower. The lamps reach their full candlepower almost immediately on starting, and give an absolutely steady light. There is almost no radiant heat, and the temperature of the glass is about that of an incandescent-lamp globe.

The Hewitt rectifier (or converter) is an imporant discovery in relation to the general distribution of electric current for light and power purposes. It was evolved by Mr. Peter Cooper Hewitt from his observations of certain phenomena in connection with his mercury-vapor lamp, upon which its principles of operation are based.

In its general construction Mr. Hewitt's rectifier somewhat resembles his vapor lamp, and it is even possible to combine the two, obtaining the brilliant mercury-vapor light and also continuous current for power. The invention may be described as follows: A vacuum tube or bulb is supplied with a positive electrode for each phase of the alternating current, which successively permits the positive alternations of the current to flow to a single negative electrode common to the several positives. Owing to the peculiar characteristics of the vapor column as a conductor, the current can pass in only one direction, and in consequence the alternations on one side of the zero line only will traverse between the electrodes. The alternations of opposite sign are cut off, and become inert in that they absorb no power. The particular converter (see Figs. 2 and 3) by means of which the demonstration was given consisted of a large glass bulb with a small quantity of mercury (E, Fig. 3) acting as the negative electrode. There were also four positive electrodes (E_1), (E_2), (E_3) and (E_4), one for a starting continuous current and three for the respective phases of the alternating current. When the continuous current was switched on a glow appeared at one of the positive electrodes, and the bulb acted precisely as though it were an ordinary mercury-vapor lamp. Then one phase of the alternating current was switched on and another electrode glowed, and when the switches controlling

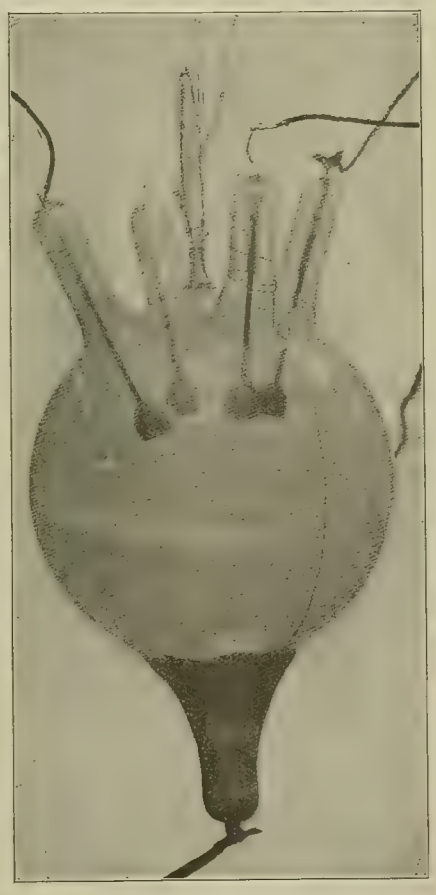


FIG. 2. HEWITT MERCURY-VAPOR CONVERTER.

the other two phases were closed it was seen that all four electrodes were working. The continuous current was switched off, and the converter continued to work with three-phase alternating current only. Immediately the voltage is allowed to fall below a "critical point," however, the rectifier ceases to work, and will not recommence until the necessary electromotive force has been applied at the terminals. For this reason it will not work on a single-phase system, as the pressure falls during the alternations and the initial resistance reasserts itself. With a polyphase system, the electromotive force never falls to the "critical point," and, therefore, the rectifier works continuously. The converter may be used on all voltages between 100 and 1,000, and can, without further development, be made for all capacities up to 100 amperes. Several converters, properly arranged, can be operated in parallel. The efficiency is very high, the only loss in power being due to a constant drop of 14 volts in the bulb. Consequently, at 140 volts the loss is 10 per cent., at 700 it is two per cent., and at 1,000 only 1.4 per cent.

Referring to Fig. 3, the references are: (A), three-phase alternator; (T), three-phase transformer (20,000 to 500 volts); (E), negative electrode; (E_1, E_2, E_3), alternating positive electrodes; (E_4), direct-current starting electrode.

The London Electrical Review makes this comment: "The Hewitt converter commands our admiration. Physicists have for years experimented on the flow of electricity through gases, and observed the laws which govern its operation; but it has been reserved to Mr. Cooper Hewitt to at one stroke bring this subject right into the midst of heavy electrical engineering, railway working and power transmission. At first sight it might seem a somewhat rash proposal to pass heavy currents through rarefied gases enclosed in glass bulbs—too much like treading on eggs; but second thoughts, and, still more, actual trials, will readily dissipate one's doubts. What will be the effect of the satisfactory develop-

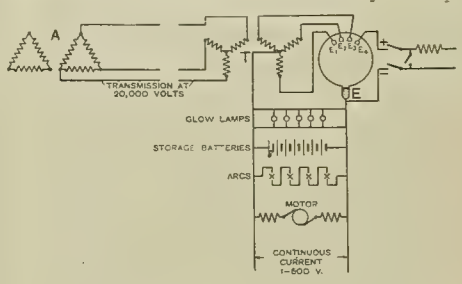


FIG. 3. CONNECTIONS FOR HEWITT MERCURY-VAPOR CONVERTER.

ment of this new stationary rectifier?—we refrain from using the word 'static' in this connection; of all misnomers, surely this is one of the worst. The fundamental change in sub-station equipment will be the supersession of rotary converters and motor-generators—no small gain. But half the waves of the alternating current are omitted; to make use of these we suggest that a second set of transformers be installed, utilizing the otherwise dropped waves, and perhaps both sets could be reduced in size, so that the total capital outlay would not greatly exceed that of the existing type of transformer equipment. If this were not done, it seems that only half the available output of the generators and cable lines would be utilized, a far more serious consideration than the cost of motor-generators. The direct-current voltage obtained, it appears, is about 14 volts lower than the virtual voltage of the alternating current, measured between the neutral and outers. The maximum safe pressure is 1,000 volts, which is about as high as it is likely to be used in direct-current railway working.

"It must not be forgotten that the device is as yet only in course of evolution, but it has great possibilities, and may become an important factor in electrical-power transmission, besides being of great use in many ways, such as the supply of direct-current motors from three-phase supply mains in works, charging batteries from the alternating-current mains, etc. Having seen it actually in operation, we were strongly impressed with its performance, and we shall look forward with interest to its further development."

Kenosha Power House Burns.

The power house of the Kenosha Gas and Electric Company in Kenosha, Wis., was nearly destroyed by fire on the morning of January 28th. The company supplies the city with electric light and power and operates in connection with its plant a Yaryan hot-water heating system. The hot-water plant was damaged but slightly and after a few hours' delay was continued in operation. Practically all of the electrical equipment was destroyed, entailing a loss of $10,000, covered by insurance. Included in the loss was a railway generator which B. J. Arnold of Chicago had placed in the power house to operate his local street-railway system. Mr. Arnold was required by franchise to begin operating his cars on February 1st, and only the night previous had tested the system and given orders to start the cars. The fire seemingly would have prevented his doing this, but by extraordinary efforts he obtained two generators from Chicago, rented steam power, and had his railway in operation on February 1st.

New High-potential Railway System.

The announcement is made and confirmed by Dr. F. A. C. Perrine, president, that the Stanley Electric Manufacturing Company is ready to put on the market a new high-potential railway system, employing electric locomotives. The new system will eliminate sub-stations, and no generating station will be needed within from 25 to 40 miles. The work has so far advanced that the company stands ready to equip any road and guarantee the machinery. The work has been done by C. C. Chesney, from patented systems which the Stanley company has bought.

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DATES AHEAD.

Northeastern Iowa Independent Telephone Association, Gedney Hotel, Independence, Iowa, February 10th and 11th.

Independent Telephone Association of Wisconsin, Hotel Pfister, Milwaukee, Wis., February 11th and 12th.

Chicago Automobile Show, Coliseum, Chicago, February 14th to 21st.

IN ORDER to present a statement of the value of the electrical exports of the United States in 1902 in its recent New Years number the Western Electrician was compelled to make an estimate of the figure for December, having official returns for the other 11 months. The estimate given was $750,000, which was remarkably close to the exact sum—$760,981—now reported by the Bureau of Statistics of the Treasury Department. With the year complete, the total value of electrical exports classified as such by the government is $9,997,195, of which $5,937,643 is the valuation of electrical machinery and $4,059,552 of electrical appliances, including telegraph and telephone instruments. In the fiscal year ended June 30, 1902, the electrical exports amounted in value to $9,011,505, and in the calendar year 1901 to about $9,300,000. Thus the country's electrical export trade is seen to be growing in volume, although not as rapidly as might be wished. A significant fact, pointed out in a statistical article on another page, is that about 75 per cent. of our electrical exports go to Great Britain or British colonies. Perhaps, when American electrical manufacturers take a greater interest in the electrical needs of other countries they will manifest a keener desire to make use of the metric system.

AS HAS been pointed out in previous issues of the Western Electrician, the subject of water storage, either to prevent floods or for purposes of irrigation, is seen to bear an increasingly important relation to the electrical transmission of power. The present scarcity of coal has also brought into greater prominence the possibility of utilizing waterpowers to a much greater extent than is now done. It seems to be evident that the time is coming when a careful and systematic effort will be made to conserve, by intelligent control and utilization, the vast resources of the United States in its watercourses. Electric power transmission is now successfully accomplished up to a distance of over 200 miles, and when this fact is considered in connection with the possible interruption or failure of the coal supply, with the need of irrigation for the arid regions of the West and with the great damage annually wrought by floods, it will be seen that the importance of the subject can hardly be overestimated.

President Roosevelt has directed the attention of Congress to the pressing need of irrigation in a large portion of the country and has strongly urged the law-making body to take up the work on a large scale as a project that can most fittingly be carried out by the general government. So far as the general subject is related to the control of flood waters, the Water Storage Commission of the state of New York has made an interesting contribution to the discussion. In its first annual report this body points out that the damage to property resulting from floods in New York state during 1902 was more than $3,000,000. Pecuniary loss is not the only injury sustained, for ofttimes loss of life results, and unsanitary conditions remaining cause sickness and serious inconvenience to public and private activity. The commission is of the opinion that most of the important streams can be regulated by storing their flood waters in reservoirs on the streams themselves or their tributaries, at moderate cost. This work, it thinks, should be intrusted to a permanent commission, with power to assess upon beneficiaries costs of remedial work. "The time has arrived in this state," the commission says, "when the continued denudation of forests has intensified freshet conditions, when electrical progress has rendered power in small units economically available long distances from interior sources of generation by waterpower, and when the sanitary requirements of increasing urban population, the demand for draining marshes and the increased development of internal water communication render mill acts in use in other states inadequate, and demand that we take an advanced position in this matter of river regulation." The commission believes that the policy of state control, if acquiesced in by the Legislature, "would more profoundly influence the progress and prosperity of the commonwealth than any public enterprise to which its attention can be directed."

This shows a conception of the importance of the problem which is gratifying. No scheme for the creation of irrigation or flood-storage reservoirs should be considered without a careful study of the existing or future power possibilities that it affords. We notice, as bearing on this problem, a disposition on the part of some daily newspapers to question the desirability of concentrating the source of power supply for a large area in one plant in view of the temporary interruption to the service of the Niagara Falls power plant last week. It may be pointed out, in answer to this, that the shutdown at Niagara was, according to all accounts, due to a stroke of lightning; the possibility of serious interference from this source is so slight that it should not be weighed against the great and obvious advantages of utilizing large waterpowers which are available, physically and commercially. Then, again, as our account of the Niagara breakdown shows, it is possible, by keeping a reserve of all necessary parts, to make repairs, even after such a serious accident as that of last week, in much quicker time than would have been deemed possibile before the occurrence. While on this subject it is proper to give cordial praise to the good, quick work of Superintendent Philip P. Barton and his assistants of the Niagara Falls Power Company in the recent emergency.

No one knows better than the electrical engineer the limitations of the electrical transmission of power in the present stage of the art and in competition with steam power from local units. But recent events, such as the coal strike, the growing recognition of the need of irrigation and the effort to further scientific water storage, show that the future of hydro-electric development in the United States is bound up with some of the most important projects now under consideration for the industrial betterment of the country.

IN no other line of mechanical industry, perhaps, has the last decade witnessed greater development in labor and time-saving machinery than in the newspaper-printing business. The mechanical equipment of a daily-newspaper establishment 10 years ago had seemingly reached a high state of perfection, but it was crude as compared with the plant of the metropolitan daily of to-day. An exceedingly interesting example of such an up-to-date installation is that of the Chicago Daily Tribune, which is given an extended illustrated description in this week's issue of the Western Electrician. In this printing plant are installed six of the largest and most improved perfecting presses, with an ingenious and effective system of control, an up-to-date perfecting press for printing in colors, an automatic machine for casting stereotype plates, no less than 43 linotype machines, improved electrotyping and etching apparatus and a quantity of auxiliary machinery—all electrically driven, every machine with its own independent motor. Much of the auxiliary apparatus that is necessary to the heating, ventilating and elevator service of the large Tribune Building is also operated by electric motors, and it is an interesting fact that absolute dependence is placed on electric current from outside central-station mains for all the power and light used in the extensive establishment.

MUNICIPAL conduits for electric wires possess many advantages, but progress toward them appears to be slow in several cities where the subject has been agitated. A rather discouraging note is sounded by Mr. Charles F. Hopewell, acting city electrician of Cambridge, Mass., in that part of his recent annual report devoted to this topic. "Municipal conduits have received the indorsement of the City Council of Cambridge for six different years," says Mr. Hopewell. "Pursuant to this idea, Cambridge representatives introduced into the Legislatures of 1893-4-7, 1900, 1901, 1902, bills to allow the cities and towns of this state, excepting Boston, the right to construct and maintain a system of municipal conduits. Two favorable committee reports have been received, and in 1900 and 1901 such measures have been passed by the House of Representatives by overwhelming majorities, but have failed so far of concurrent action in the Senate. This year [1902] your city solicitor and inspector of wires attended six hearings upon this measure at the State House, but received co-operation from only two other cities, although all the cities of this state were communicated with. These two cities were obtained through personal solicitation rather than by letter. While still favoring municipal conduits and believing that such would subserve the public interests the best, yet I would recommend that agitation for legislation be stopped until the City Council can extend to their own representatives the same co-operation, both financial and otherwise, as would be extended by the board of directors of any large corporation to their agents who seek or oppose legislation. This recommendation I feel obliged to make after a personal appearance at over 18 legislative hearings in four different years upon this subject." Inasmuch as this is a part of a report addressed to the City Council of Cambridge, the rebuke is a pointed one. The city electrician seems to have good cause for his annoyance, although it is to be remembered that Cambridge is not the only city in which municipal conduits have been talked of for years and still "nothing doing."

Lightning Causes Serious Interruption of Power Service at Niagara Falls.

[Special correspondence of the Western Electrician.]

Niagara Falls, N. Y., January 31.—The Niagara Falls Power Company, the electric lines between Niagara Falls, Buffalo and Lockport, and many industrial establishments in the cities mentioned, as well as in the Tonawandas, suffered severely from a fire that broke out on the bridge connecting power house No. 1 of the Niagara Falls Power Company with the transformer station on the opposite side of the inlet canal, at 10:45 p. m. on Thursday, January 29th. It is supposed that the fire was started by lightning that short-circuited the cables on the bridge.

The bridge in question is a stone structure with slate roof. It is substantial in every part, and on its interior on the night of the fire there were strung 52 1,000,000-circular-mil cables, carrying approximately the 50,000 horsepower generated in power house No. 1. The cables were strung along the walls on either side, having been supported on brackets. As soon as the fire started the current was shut off as quickly as possible, and an alarm rung in. There was prompt response on the part of the firemen, but the flames extended along the bridge into the transformer station. The firemen fought the flames both on the bridge and in the transformer station, and the water they threw among the big transformers necessarily damaged some of the apparatus. All of the cables on the bridge were destroyed, in all about 7,000 feet. The big generators in the power house were uninjured, the damage being confined to the bridge and transformer station and their equipment.

All the generators in both stations were shut down until an investigation was made after the flames had been extinguished. It was found that the damage would not interfere with the service of the Niagara Falls electric line, the Buffalo and Niagara Falls Electric Light and Power Company, which company lights Niagara Falls, nor with the power service of the Natural Food Company, these companies receiving power from the rotary service in power station No. 1. The sending of current to these companies was soon renewed.

Owing to the total destruction of the cable connections of the bridge and the thorough drenching of the transformer station, the electric power supply of Buffalo, the Tonawandas and Lockport was cut off. All the electrochemical plants and other factories on the lands of the Niagara Falls Power Company that received current from power house No. 1 were left without current and forced to cease operations. From the Falls to Buffalo on the south and from the Falls to Lockport to the east, a vast industrial area, the effect of the lightning bolt was felt. The street lights, also those in many business establishments of Buffalo went out. In Buffalo the International Railway Company was forced to cut down the number of cars operated, but following the fire there was an hour or more of idleness on all the Niagara-Buffalo lines affected. The storage battery of the railway company helped out in Buffalo, and the steam plant was put in operation. All the Buffalo plants that used Niagara power remained idle, including four large grain elevators. The Tonawanda factories operated by Niagara power were also out of business, and in Lockport 20 factories missed the energy of the cataract.

It was a startling condition, and its extent was startling. However, Superintendent Barton of the Niagara Falls Power Company recognized the necessity of immediate action, and the fire was hardly out before he was assembling his men to effect repairs. Carpenters were put to work repairing the bridge and transformer station. Electricians and their helpers set about establishing temporary cable connections. The Niagara Falls Power Company had a supply of cable on hand, and there was some cable available from the construction work in power house No. 2. In addition to this, the General Electric Company had some cable on the ground, and from these three sources of supply there was enough cable to repair the damage temporarily. Not a minute was lost after the fire was out, and throughout the remainder of Thursday night a large force of men was at work. On Friday, there was the same commendable activity. Vice-president William B. Rankine praised the progress made by Superintendent Barton's men. Mr. Rankine first learned of the fire on his arrival in Buffalo from New York Friday morning. When he reached the Falls and the power house he was surprised at the progress made in effecting the repairs.

It was hoped to have had 10,000 horsepower in Buffalo by noon Friday, but just as this current was about to be sent out a short-circuit delayed the transmission until about 4:30 p. m., at which hour Buffalo was again being fed Niagara current. This was sufficient for the full operation of the trolleys and the lighting of the city, but later Buffalo was in receipt of its full quota of power, as were also the Tonawandas and Lockport. Connections were made as rapidly as possible, and by Saturday afternoon affairs about the big power plants were nearly normal. Several of the factories on the lands of the Niagara Falls Power Company were already receiving current for their operation from power house No. 2 when the fire occurred, and as none of the cables from this power house crossed the burned bridge, they received current as usual Friday.

The transformers that had been wet by the streams thrown by the firemen were rendered useless until dried out, but, fortunately, the Niagara Falls Power Company had several transformers that were not damaged by the fire, and these were thrown into service on the transmission line. It can be readily conceived that no such disaster could occur to such a great plant as that at Niagara without causing more or less trouble for quite a time, but, considering the extent of the fire damage, the quick manner in which the Niagara Falls Power Company effected a temporary recovery was astonishing.

At Niagara Falls the accident was mainly felt in the non-operation of several large industries. On Thursday night the arc lights in the streets were out for about an hour, and the electric cars did not run for a similar period. However, this trouble was brief, and as the incandescent-light service of Niagara Falls comes from the canal power house, the fire effect did not extend into the homes and business places at the Falls. In Buffalo many of the large stores were without their usual light on Friday until the Niagara power was thrown on late in the afternoon. The Bell Telephone Company had provided for just such an emergency, both at the Falls and in Buffalo, and that company's service was uninterrupted.

The full loss resulting from the fire has not been estimated, but the cable loss will be about $25,000. In those factories at Niagara where continuous operation is necessary, there was loss. A review of the industrial idleness caused by the Niagara trouble serves to portray the enormous extent to which Niagara power has, within a few years, crept into the industrial life of the Niagara locality.

In the efficient manner in which the Niagara Falls Power Company recovered from a disaster of this kind there is a lesson for other companies in the electrical field. The Niagara Falls Power Company makes it a practice to keep on hand duplicates of all parts of its machinery liable to accident. For this reason it had on hand more than enough cable, even without that on the construction work of power station No. 2, to duplicate the cable lines burned. Here was the secret of its successfully surmounting a task so great as created by the lightning bolt. While Buffalo was inconvenienced for a few hours by the occurrence, it has much to be thankful for that this inconvenience was not extended through several days, if not weeks. Had the disaster of Thursday happened when the full installation of power station No. 2 was in operation, the people of that city would not have known, by experience, what had happened at Niagara Falls, and when the Canadian Niagara Power Company gets its new plant in operation, there will be still greater protection to an uninterrupted service between Niagara Falls and Buffalo. D.

Chicago Street-railway Situation.

The traction question continues to be the chief topic for discussion in Chicago. The Chicago City Railway Company has followed the plan of the Union Traction Company and appointed a protective committee of prominent citizens for the stockholders, consisting of James B. Forgan, Ernest A. Hamill, Byron L. Smith, Nelson Morris and Levi Z. Leiter. Both committees have expressed their willingness to meet with the local-transportation committee of the City Council and discuss the questions of franchise extension. It is stated that the Chicago City Railway Company stands ready to accept a 20-year franchise on the plan laid out in the Arnold report, and influential members of the Union Traction committee, it is said, have agreed that no more than a 20-year grant should be sought from the City Council.

George W. Jackson, engineer of the Illinois Telephone and Telegraph Company, has submitted to the council committee a plan of subways extending from curb to curb and only one story high. There would be seven loops under the downtown streets, and a passenger could be transferred underground from one to another. The subway would be 22 feet below grade, with a width of 48 feet on a 60-foot street. Mr. Jackson estimates the subway would be 4,400 feet long and would cost $350 a foot, or $15,400,000 for the entire construction. Provision is made for water, gas, electric and sewer utilities. The plan is commended by City Electrician Ellicott.

At the City Council meeting on February 2d a "blanket" ordinance for the construction of subways and operating of street-railway lines in any and all streets of the city was introduced. The ordinance, which was referred to the local-transportation committee, was introduced on behalf of Abijah O. Cooper and Arthur R. Wolfe, who are said to represent capitalists not at present identified with the local traction companies. The council passed an ordinance demanding an operating agreement between the Chicago City Railway and the Union Traction Company in Western Avenue. It referred to the local-transportation committee an order for four trunk lines—in Halsted Street, Ashland Avenue, Robey Street, and Western Avenue—and also an order that no franchise be granted in Halsted Street unless the line be a through route from one end of the street to the other. An ordinance repealing the grant to the West Chicago Street Railroad Company in Ashland Avenue between Blue Island Avenue and Thirty-first Street was passed.

Electrical Exports for December and the Year 1902.

Exports of electrical machinery and apparatus from the United States in the month of December, 1902, amounted in value to $760,981, as compared with $661,423 in December, 1901—an increase of $99,558, or 15 per cent. The figure for November, 1902, was $712,160.

Electrical exports are divided into two classes by the United States Treasury Department—electrical appliances (including telegraph and telephone instruments) and electrical machinery. The figures under each head are as follows: Electrical appliances—December, 1901, $302,943; December, 1902, $331,450. Electrical machinery—December, 1901, $358,480; December, 1902, $429,531. In each class an increase is shown.

With December, returns are at hand for all 12 months of the calendar year 1902. The figures are as follows:

Electrical Exports from the United States in 1902.

Electrical appliances	$4,059,552
Electrical machinery	5,937,643
Total	$9,997,195

For 1901 the electrical exports amounted in value to about $9,300,000. Comparing this with the $9,997,195 of 1901, it will be seen that the foreign electrical trade of this country exhibited a moderate increase last year.

Classifying the exports of electrical machinery for 1902 according to destination, the following interesting figures are obtained:

Name of country.	Value of Electrical Exports.
United Kingdom	$2,924,989
British North America	1,080,877
Mexico	410,623
Japan	341,743
British Australasia	239,953
Brazil	197,909
European countries not elsewhere specified	182,225
British Africa	117,909
British East Indies	75,451
Germany	50,688
Bermuda and West Indies not elsewhere specified	42,178
France	38,381
Colombia	37,857
Argentina	31,123
Cuba	26,736
South American countries not elsewhere specified	26,116
Philippine Islands	25,863
Central America and British Honduras	22,298
Hongkong	19,483
Asia and Oceanica not elsewhere specified	18,708
Chinese Empire	16,320
African countries not elsewhere specified	10,213
Total	$5,957,643

This table shows the striking fact that about 75 per cent. of the electrical machinery exported from the United States last year went to Great Britain or to British colonies. A similar classification in relation to electrical appliances would be interesting, but is not available.

Central-station Plans in Minneapolis.

The Minneapolis General Electric Company has plans in view for improvements to its city system, to cost $300,000. There will be constructed a new tile smokestack 175 feet high, seven feet in diameter. There will be a new 1,000-kilowatt, alternating-current generator, with switchboard, and additional rotary converters and motor-generators. The system of distribution throughout the city is to be entirely reorganized. This will involve the laying of 150,000 duct-feet of conduit. The work is to be begun at once, and is to be completed by September 1st. The improvements will improve the distribution throughout the city and insure a uniform service.

An electric-light and power combination has been formed by which the Lapeer (Mich.), Imlay City, Millville and Higley plants will pass under the control of one company. The Lapeer Light and Power Company has been organized with a capital stock of $75,000. J. Schlegel is president.

DEVELOPMENT OF THE TELEPHONE FIELD.

International Telephone Lines.

The prospective opening of the Paris-Rome telephone line has attracted attention to the international long-distance telephone systems in Europe. The new line consists of copper wires, four millimeters in diameter. The two countries served by it are divided into toll districts, the charge for a three-minute conversation between regulated by distance, the lowest rate being for the zone nearest the person talking, and so on. In Italy the first district includes the provinces which extend from the French boundary line to Massa and Brescia; the second district goes to the provinces of Rome and of Ancona. In France the first district ends at Lyons, and the second at Paris. Under these conditions, the ordinary cost of conversation between Rome and Paris is four francs (77 cents); between Rome and Lyons, 3½ francs, and between Genoa, Milan or Turin and Paris, 3½ francs.

The telephone line from Paris to Rome is 1,593 kilometers (990 miles) long, and is the longest of the telephone lines of Europe to be put in operation. An Italian contemporary has made the following table of the long-distance telephone lines of Europe, both national and international:

	Length in Kilometers.	Diameter of Copper Wire in mm.
Paris-Rome	1,593	4
Paris Berlin	1,118	4
Berlin-Budapest	979	4
Paris-Marseilles	863	5
Berlin-Prague-Vienna	662	4
Berlin-Vienna	661	4
Berlin-Monaco	660	4
London-Glasgow (two circuits)	647	5.5
London-Glasgow (two circuits)	647	4
Vienna-Trieste	590	4
Paris-London	470	5
Paris-London (three circuits)	470	4
Vienna-Prague	410	4

In the Paris-London lines the overhead construction is, of course, supplemented by submarine cables.

The line from Paris to Rome crosses 834 kilometers of Italian territory between Rome and Mont Cenis, and 759 kilometers in France from Mont Cenis to Paris, by way of Chambery and Lyons. In Italy the line, starting at Rome, passes through Viterbo, Siena, Florence, Bologna, Voghera, Vercelli, Turin, Susa and Mont Cenis. Four hundred and forty-four kilometers of it is built on railroad right-of-way and 390 kilometers on highways. For 437 kilometers of the distance it was necessary to string the line on posts set especially for the purpose; for the remaining 397 kilometers existing pole lines were utilized. In order to diminish the effects of induction the wires were crossed every kilometer.

The Paris-Rome telephone line enters not only the central office at Turin, but also that at Voghera, where two other important telephone lines end, one from Milan (65 kilometers) and the other from Genoa (157 kilometers). Under these conditions, the office at Voghera can put Milan and Genoa in communication with Paris, on one hand, and with Turin and Rome on the other. Besides Milan and Turin are joined directly by another special line 152 kilometers long, built with three-millimeter copper wire. Connection from Milan with the Paris-Rome circuit can be made equally well by means of this special line.

The international business promises to be very heavy, and it is easily foreseen that a single line with France will be insufficient, even at the start, especially at a time when Turin, Milan and Genoa will want, in their turn, to be put into communication with Lyons and Paris.

Italy has two other international telephone lines which were put into operation recently—the Milan-Lugano line, and the Como-Chiasso line—which assure communication with the principal cities of Switzerland.

EXTENSIONS AND IMPROVEMENTS.

The Co-operative Telephone Company of Detroit figures on establishing service with about 100 subscribers within two weeks. The first subscribers to be connected with the exchange will be business houses close to the Golden Building.

A bill has been introduced in the Missouri Legislature in relation to telephones which provides that for 25 words or less, to go a distance of 100 miles or less, there shall be paid by the sender 10 cents; for 25 words or more, to go a distance of 100 miles or more, the fee, to be paid by the sender, shall be one cent for each word or figure. The rental of instruments is placed at 75 cents a month. Any telephone company receiving greater charges than these shall be punished by a fine of not less than $25 nor more than $200.

C. W. Hinchcliffe, division manager of the Sunset Telegraph and Telephone Company at Los Angeles, Cal., gives the following statement of the company's business in Los Angeles on December 1, 1902: "On that date we had in Los Angeles 14,802 subscribers, or a little over 12 telephones per 100 inhabitants. We commenced in the summer of 1902 to erect new buildings in this city, since which time we have been working day and night, installing new express multiple switchboards, and are now attaching the subscribers' lines to the new system. We have imported 25 operators from San Francisco and 30 from the cities tributary to Los Angeles, Cal."

Expedients to Connect Competing Telephone Systems Surreptitiously.

The desire to "cross-telephone" sometimes exists where there are two competing telephone systems. This desire is fostered, perhaps, by the evident reluctance on the part of the companies interested to allow it to be done if it can be avoided. In Minneapolis, in the office of one of the city officials, there was an instrument of each company, the old company having the old wall instrument, while the new had the desk telephone. While in an experimental frame of mind, during a lull in business, one of the force found that it was quite possible to connect a wire from the line of the old instrument to the new one and by cutting out the other wire when a call came to use the same instrument in answering both lines. This could be done without arising from the desk, and thereby saved exertion, which all municipal officials and their employes seem prone to do. The telephone companies, however, learned of the scheme and vetoed the practice.

Somewhat in line with this experiment is another whereby a person on one exchange can talk to a man on the competing exchange through the medium of a friend who has both connections. The latter has to hold the receiver of one instrument to the transmitter of the other, and with a clear transmission a conversation can be carried on. It has been done repeatedly in the Twin Cities, where it is a custom of subscribers having both connections to place the instruments of each on a table or desk together. The connection is not always a success, as there are times when the voice is too muffled to be passed into the transmitter loud enough to be heard over the second line. The go-between is required to hold the two instruments together during the conversation and to listen in, in order to ascertain if it is completed. The scheme is quite possible, but it is not practicable, for the friend is likely to become weary of his part of the bargain. On this account the companies of the Twin Cities have taken no steps against the practice, although they know that it is carried on occasionally.

New Exchange in Washington, D. C.

A contract has been awarded to Richardson & Burgess, contractors of Washington, D. C., for the erection of a new telephone exchange in that city for the use of the Chesapeake and Potomac Telephone Company (Bell) at a cost of $200,000. The architects are C. L. W. Eidlitz and Andrew Mackenzie, who are the designers of the New York city telephone exchanges, and the central-office equipment, which is to be of the most modern common-battery type, will be installed by the Western Electric Company of Chicago. The new building will be located on Twelfth Street N. W., between G and H Streets, and will be a fireproof structure of stone and cream brick, 45 by 155 feet, and six stories in height. The main exchange will occupy the top floor, and will be equipped so as to provide a possible service of 15,000 telephone stations. The work is to be completed in nine months.

Kansas Independent Telephone Association.

A very successful meeting of the Kansas Independent Telephone Association was held at the Hotel Throop, Topeka, Kan., on January 28th and 29th. About 100 telephone operators and supply men were present. The principal subject discussed was the relation of the companies to the Bell company in signing contracts for long-distance service, and the new Kansas City Long-distance Telephone Company (Independent), which was represented by Messrs. Brailey and Hime, was quite successful in making contracts for long-distance service with a number of the companies represented. Among the manufacturers represented were the Kellogg, Stromberg-Carlson, American and Swedish-American companies of Chicago.

Southern New England Company.

The annual meeting of the Southern New England Telephone Company (Bell) was held in New Haven, Conn., on January 27th. President Morris F. Tyler's annual report stated that the company has 21,110 telephones in service, there having been a net increase of 3,546 during the last year. The following-named officers were re-elected: President, Morris F. Tyler; vice-president, James English; secretary, Victor N. Tyler; directors, Morris F. Tyler, Lyman B. Jewell, Thomas Sherwin, James English, Gen. Samuel E. Merwin, A. Heaton Robertson, John W. Alling, Max Adler and Frederick P. Fish. The gross earnings of 1902 were $919,556; net earnings, $172,744, which was an increase of $12,437 over 1901. Dividends at the rate of six per cent. were paid, and the total surplus is $73,576.

Indiana Telephone Items.

Several new telephone companies have filed articles of association with the secretary of state. The Independent Telephone and Telegraph Company of Corydon has a capital stock of $15,000, but reserves the right to increase this from time to time. The company will operate in Harrison, Floyd, Washington, Orange, Crawford and Perry Counties. O. S. Wright and E. D. Mitchell are officials of the company. The Eckerty, Branchville and Cannellton Telephone Company has headquarters at Doolittle's Mill, Perry County. It will operate a co-operative system in Perry and Crawford Counties. J. J. Esary, H. T. Lynch and T. H. Frakes, all of Branchville, are directors. The Salem Co-operative Telephone Company is organized for the Salem neighborhood near Lafayette. W. B. Pierce, F. M. Buskirk and M. F. Jeffres, all of Lafayette, are the promoters and incorporators.

The Home Telephone Company of Richmond, at its annual meeting last week re-elected its old officers. This company has over 1,700 telephones in use. A line will be built into Richmond from the east by the United States company, and Richmond will be the terminal for Ohio connections.

The Citizens' Telephone Company of Kokomo has commenced to make improvements and extensions. In order to carry out its expansion plan, the company increased its capital stock from $25,000 to $100,000.

The Putnam County Mutual Telephone Company has gained an independent connection into the heart of Greencastle.

Another telephone line is building from the north into the town of Cadiz, Henry County. Although Cadiz has less than 300 population, it is doubtless the greatest telephone center for its size in the country. The town is now the center for 22 co-operative rural telephone lines, none of which has less than 25 subscribers. Besides these, there are five long-distance lines connecting with all these co-operating lines. All Cadiz patrons have free connection with upward of a thousand telephones over Eastern Indiana. The patrons build the lines themselves, and get this service for a small charge, which goes to keep up the exchange. By giving free connection with companies of other towns they get free use of that town's service. Cadiz people and the farmers of the surrounding country boast of having the widest and best service at the cheapest rate of any community or town in Indiana. F.

Southern Telephone Developments.

The Standard Telephone Company of Atlanta was advertised to be sold on February 5th. The sale was made by Albert Boylston, upon the application of the City Trust and Safe Deposit Company of Philadelphia, the upset price being placed at $200,000. It was said that local capitalists would buy the plant.

E. N. Stephenson and others have entered suit to have the Texas Telephone Company of Waco, Texas, placed in the hands of a receiver to close up the business of the company. The plaintiff asks for $60,600 as a stockholder of the Electrical Construction Company. Also the officers and directors of the telephone company are sued for a bond issue of $150,000, the St. Louis Trust Company being made a party to the suit. Plaintiffs ask that the bond issue be canceled. It is asked that a receiver be named to take charge of the telephone company and of the Electrical Construction Company.

The Bell Telephone Company has begun work on the new underground system in Augusta, Ga. A new two-story building for the company will soon be built.

The Town Council of Newberry, S. C., has granted an unlimited franchise to the Bell company. It is understood that work will be started at once taking out the old telephones and putting in a new system complete. L.

Ohio Telephone Notes.

The proposition to increase the capital stock of the Cuyahoga Telephone Company by the issue of $2,000,000 more preferred stock has been declined by the bankers' committee having in charge the affairs of the Everett-Moore syndicate. It is probable that the bond issue of $2,233,000 will be increased to $3,000,000 instead, and the bankers have signified their willingness to take the bonds at 85.

At the annual meeting of the Columbiana County Telephone Company, held in Cleveland on Monday of last week, the following-named officers were chosen: President, F. S. Dickson; vice-president, Maxime Reber; secretary, R. F. Judd; secretary and general manager, W. R. Crossley. The company now has 13 exchanges in Columbiana County and 2,600 telephones in operation.

The Portage County Telephone Company of Ravenna has been incorporated with a capital stock of $100,000. F. E. Smith, Francis Seiberling, L. D. Brown, J. E. Bowman and W. E. Slabaugh are the incorporators. Mr. Smith and Mr. Seiberling, Akron men, are the moving spirits of this organization, which is formed to unite all the telephone plants in Portage County, as well as the toll lines connecting

them. The new company will have 1,500 telephones to start with.

The McComb Home Telephone Company of McComb has been incorporated with a capital stock of $20,000 by A. L. Frucha, J. C. Bright and others.

The North Baltimore Home Telephone Company of North Baltimore has been incorporated under the laws of West Virginia, with a capital stock of $2,000. C. B. Blose, F. M. Dotson and others are interested.

A company has been formed at Middleport to build a line from that place to Kyger, several miles out in the country. The officers of the company are as follows: President, W. E. Russell; secretary and treasurer, O. N. McElhenney; trustees, J. W. Wells, F. S. Johnson and Robert Fessler.

Miss Lulu Deiker, chief operator at the Wapakoneta telephone exchange, was married a few days ago to Howard Frazee, manager of the exchange at Orange, Texas, who formerly lived at Dunkirk, Ohio. It is said that the courtship was largely conducted over the long-distance lines. O. M. C.

Telephone News from the Northwest.

The Norwood-Young America Telephone Company has been formed to install an exchange to cover Norwood and Young America, Minn. Construction is to be begun as soon as the weather permits.

The Clearwater Telephone Company has been organized at Clearwater, Minn., with a capital stock of $10,000 to build lines through the vicinity. A line will be constructed to Silver Creek, 10 miles, as soon as the weather will allow.

The supervisors of Outagamie County, Wis., have let the contract for county telephone service for two years to the Fox River Telephone Company, at $126, the same price as last year. The Bell company bid $84 for the same service, but the board preferred to support the home company.

The Merrill Telephone Company of Merrill, Wis., will expend $15,000 to $20,000 in improving its plant.

The Northwestern Telephone Exchange Company announces that it will rebuild its exchange in Fargo, N. D., including the installation of conduits, modern switchboard, and other changes, and will reduce rates.

The Imperial Camera Company of La Crosse, Wis., will be reorganized and will engage in the manufacture of telephones.

The Dane County Telephone Company of Madison, Wis., will bring suit, it is said, against the Wisconsin Telephone Company for damages alleged to have been sustained by the publication of a statement at Kenosha, Wis., in which the company complained of announced, it is asserted, that Independent companies are unable to achieve success, and cited the opposition line at Madison. It is understood the Dane County company will have the backing of the Independent companies of the state.

J. W. Hill was selected as president of the Mutual Telephone Company of Des Moines, but was unable to serve. The company is considering plans for securing additional funds to make important changes and improvements. For the present there will be no president, but a superintendent will be selected to co-operate with the executive committee.

The Hancock County Rural Telephone Company of Garner, Iowa, has been incorporated with a capital stock of $100,000. The company proposes to establish local exchanges in the towns of the county and connect them with the best metallic system which can be secured.

The Iowa Telephone Company contemplates erecting a $200,000 central office and system at Sioux City. R.

GENERAL TELEPHONE NEWS.

The Britton Telephone Company of Britton, Mich., has filed articles of incorporation with a capital of $2,000.

A new telephone company has been organized at Wallace, Idaho. The incorporators are L. Prager, C. C. Landes, Jacob Lockman, P. F. Smith and John Morrison, all of Wallace. The capital stock is $25,000.

The Fairmont Telephone Company of Fairmont, W. Va., has been incorporated with a capital stock of $25,000, the incorporators being C. E. Michael, F. P. Kelley, M. M. Ogden, C. W. Arnett and S. B. Harr.

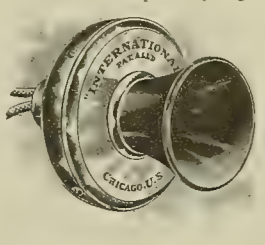
The Northeastern Iowa Independent Telephone Association will hold its regular meeting at the Gedney Hotel, Independence, Iowa, on February 10th and 11th. S. S. Lichty of Vinton, Iowa, is the secretary.

W. W. Dilworth of Beloit, Kan., has incorporated his telephone interests in Mitchell County. The new concern has an authorized capital of $35,000, and its officers are: President, W. W. Dilworth; secretary, A. T. Rodgers; treasurer, F. M. Daily.

The Chautauqua Telephone and Telegraph Company, which has headquarters in Jamestown, N. Y., has just completed the installation of an exchange at Kennedy, N. Y. This exchange has connection with Jamestown and the lines of the Interocean Telephone and Telegraph Company. The company has under construction a number of exchanges in other towns of Chautauqua County.

The International Transmitter.

A telephone transmitter that has many interesting new features, with parts carefully and durably constructed, is being put on the market by the International Telephone Manufacturing Company of Chicago. The accompanying cuts show an exterior view and an interior rear view of this instrument. The case is a little less than three inches in diameter. The front is a heavy, nickel-plated brass casting, on which are rigidly mounted all the working parts. The diaphragm is a flat metal disk, and is provided with a rubber band around its edge to insulate it from the frame. The diaphragm is firmly clamped by two fork shaped springs holding it



INTERNATIONAL TRANSMITTER.

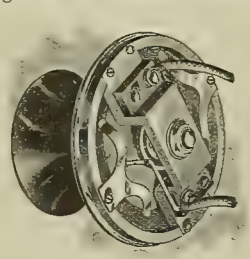
evenly at four points, to leave the diaphragm with the greatest possible freedom for vibrating.

The carbon chamber is a very light metal cup mounted on the center of the diaphragm. The front electrode is spun into the bottom of the cup, to leave no room for the granules to settle under its edge. The back electrode is mounted on a brass stud, which is provided with a washer and nut to clamp firmly a mica ring. The outside of the mica ring is clamped by the rim of the light metal carbon chamber, perfectly sealing the chamber.

The back-electrode stud is set into a clamping device that is made in the form of a spring collet, allowing the electrode to be moved the slightest degree for adjusting and so it can be firmly clamped without disturbing the adjustment.

This adjustment clamping device is so arranged that it holds the electrode perfectly central with the diaphragm, and obviates any indentation or side strain which usually occurs from the side set-screw. The adjusting device is set into a heavy, squarely formed brass bridge, from which it is properly insulated. It is constructed very rigidly, to avoid all possibility of throwing the instrument out of adjustment from heavy strains.

The circuit from the front electrode is taken from the diaphragm to an insulated block mounted on



INTERNATIONAL TRANSMITTER.—REAR VIEW.

one side of the bridge and the circuit from the back electrode is taken from the back-electrode stud to an insulated block on the other side of the bridge. These conductors are of light metal punchings, properly formed to make rigid and durable connections without being required to solder any joints of delicate wires.

Both sides of the circuit are taken from the two terminals by insulated cord, through the arm to the terminal or induction coil, avoiding the use of any exposed parts of the transmitter frame or arm for any part of the circuit.

The electrodes are of extra hard carbon, highly polished, and the granules are clean, hard, granular carbon. The diaphragm is placed under the proper tension and the cup vibrates with the diaphragm, which keeps the granules agitated and live at all times, which is said to prevent "packing" or the instrument becoming out of order.

MANUFACTURERS AND DEALERS.

The Kellogg Switchboard and Supply Company of Chicago has issued an attractive wall calendar. The feature of the calendar is a richly colored lithograph representing a laughing child teaching a pet puppy to appreciate the telephone. The Kellogg company says that for a small sum it will send this picture without calendar pad or printing.

George H. Morgenstern, formerly manager of the sales department of the American Toll Telephone Company and the Chicago Pay Station Company, is now acting in a similar capacity with the Vought-Berger Company, manufacturer of telephone apparatus at La Crosse, Wis. Mr. Morgenstern took up his new duties the latter part of January and confidently believes he has apparatus of the "finest" to exploit, and that there is a bright future in store for the company which he now represents. Mr. Morgenstern's work with the Chicago Pay Station Company fits him for his new position.

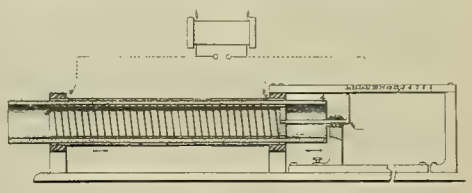
Tuning Device for Space Telegraphy.

A tuning device to be used in any space-telegraphy circuit in which is ordinarily contained a condenser and self-induction coils has been invented and recently patented by William S. Hogg of the United States Navy. The device is used to accomplish tuning by varying the capacity and self-induction of any circuit or circuits, according to the formula

$$T = \frac{2\pi\sqrt{LC}}{10}$$

C, the capacity, and L, the self-induction, being made so large that T, the period of oscillation, is also large, and only like instruments with a like large period will respond sympathetically. To attain this attuning, one or more stations must have like devices in every respect, with indices that throw the relative self-induction and capacity at the same marks on like arbitrary scales, all other parts of the wireless-telegraphy system being exactly similar.

Mr. Hogg's invention comprises, among other parts, an outer metal spiral surface, preferably fixed, and an inner metal spiral or continuous surface movable axially within the outer surface and separated therefrom by a proper dielectric. The capacity can be varied by moving the inner surface longitudinally within the outer and the self-induction varied by short-circuiting adjacent convolutions of the outer spiral by plugs or a sliding contact. The inner surface can be a spiral, a continuous metal



TUNING DEVICE FOR SPACE TELEGRAPHY.

tube or rod, a metal tube containing iron filings, or bundle of iron wires wound with insulated wire. The accompanying illustration represents in central vertical section, with parts in elevation, a form of condenser embodying the invention.

Government Test of De Forest-Smythe Wireless System.

In the official test of the De Forest-Smythe system of space telegraphy by the officers of the Navy Department, between Annapolis and Washington, already mentioned in the Western Electrician, no tuning was required. The De Forest anti-coherer, being a current-operated device, is best placed at a current loop or static node, that is, at the base of the antenna, which accounts for its operating where the coherer or potential-operative device is uninfluenced. Inasmuch as the attaching of an earth connection to one side of the receiver compels a static node there, it was found that signals continued to be received, even when a length of wire, inductive or non-inductive, was inserted between it and the base of the antenna, although this length amounted to that of the antenna, or more. At Annapolis and Washington the Navy Department has masts 180 feet in height. From these hung a fan of five wires, of an average length of 200 feet. The ground connections consisted of two copper plates, two by six feet each, buried six feet below the surface.

Sea tests of the system will be undertaken in March, upon the arrival of the cruiser Prairie from the Caribbean Sea. The De Forest company is now erecting at Cape Hatteras a 175-foot tower and a five-horsepower outfit for communicating with vessels, and with Block Island, 300 miles distant. At the latter point a similar plant is under construction by the Providence Journal for commercial purposes. Other stations are now under way in Porto Rico. Large orders have been placed by the De Forest company, representing a total of 180 kilowatts, for four stations for transpacific communication, to be located in Lower California, Hawaii, Philippines and China, and during the recent naval tests Dr. De Forest sent the following dispatch from Annapolis to President Roosevelt: "I have the honor to send you the first greetings by an American wireless-telegraph system from Annapolis Naval Academy to Washington, with the conviction that within 18 months we shall do the same from Manila, via Hawaii to California."

The twenty-fourth annual meeting of the Michigan Engineering Society was held in Battle Creek, Mich., on January 20th, 21st and 22d, and was attended by about 50 members. Twenty-seven papers were read, six of them by University of Michigan men. Mortimer E. Cooley, professor of mechanical engineering in the University of Michigan, the president of the association, presided. Among the papers read were "Results of Some Power Tests of Steam and Electric Railroads," by Professor John R. Allen of Ann Arbor, and "The Engineer and the Patent Office," by George B. Willcox of Bay City.

Lord Kelvin and Mr. Westinghouse.

As briefly announced in the Western Electrician of January 17th, Mr. George Westinghouse entertained at dinner a large company of British railway managers, financiers and scientists at Claridge's Hotel, London, on January 9th. Two speeches were made, of unique interest. One of these was by Lord Kelvin, the other by the host of the occasion.

Lord Kelvin said: "At this dinner of friends I would like to express a common sentiment which all must feel—our appreciation of the qualities of our charming and beloved host, Mr. Westinghouse. I am sure that Mr. Westinghouse's coming to England reminds us all of the advantages that England has derived from his genius and perseverance and grand skill in bringing out for the public good so many of the results of science and inventiveness. There are many railway men present at this table, and many passengers by railways—which means that every inhabitant of our country is represented here. When people belonging to these two classes—the railway men and the traveling public of Great Britain—are gathered together, as now, we can scarcely see Mr. Westinghouse without feeling how much we owe to him for the Westinghouse brake. (Applause.)

"But Mr. Westinghouse has not stopped with his brake; he has gone on, and on, and on in America, flashing over again on this side of the Atlantic, and bringing his energies here. The present development of the electric industry in the United Kingdom owes its growth largely to him.

"'Largely' is a small word to express how much we owe to him. I do not wish to enter into any comparisons or superlatives, but I do not think any man in the world of engineering could be named to whom more is due than to Mr. Westinghouse for his work in electric engineering.

"Other things besides mechanical engineering and electrical engineering we owe to Mr. Westinghouse. We owe to him the bringing to England, and causing to be appreciated in England, of American methods—American methods in a certain way which I may refer to without invidious comparison; American methods of industry, and resolution and determination—which are also English methods, because they have been inherited from England. (Applause.) Here they come back to us, with compound interest, in the shape of Mr. Westinghouse, and I am sure that we all feel that we are largely indebted to him for what he has done for us, what he is doing for us, and, in advance, for what he is planning to do for us in the future.

"We appreciate all this, and we appreciate him as a kind friend, a genial host and entertainer. I ask you to join me in drinking the health of Mr. George Westinghouse."

The toast having been honored with enthusiasm, Mr. Westinghouse rose to respond. He said: "I wish to thank our distinguished scientific friend, Lord Kelvin, for the complimentary language he has used about me. And I would like to say to all you railway men here present that my life has been very much associated with your calling. I invented the brake of which Lord Kelvni has spoken when I was scarcely 21 years old, and thus became acquainted with railway men when the railway industry was rather a poor one compared with what it is to-day. Since then I have closely followed railway operations, becoming acquainted with almost everything that is being done in them, and it is particularly my friendship with railway men which has prompted me to go forward in my work with an interest and keenness that probably would not have resulted from ordinary commercial motives.

"Lord Kelvin has been good enough to refer to my coming to this country. I came here 30 years ago, and for 10 years or so I was here about half the time. At that time it was very difficult to get any new thing done in England. I often wanted to sit down and cry, because I could not get anyone to believe in anything. (Laughter.) I wanted, in those early days, to try an iron brake shoe, because, on account of rapid wear, we couldn't keep the wooden one adjusted. I had to beg and beg to be permitted to put a set of metal brake shoes on one tender on the Caledonian Railway. Finally, I succeeded. You all know, that nowadays, all the railway shoes or blocks are made of cast iron or other metal, and are used upon all the wheels of the train.

"Lord Kelvin has alluded to 'American methods.' May I say that one of your English difficulties is inherent, I think, in an old-world, highly developed country. After a man (or a nation) has worked prosperously for a long time, he opposes improvement or suggestion, thinking: 'What I have is good enough; I won't try a new thing.' In America, however, the necessities have produced different results. Lord Kelvin speaks of England having sent many men to America. It has also sent to us many ideas. If you take up the American patent records, and follow the cases in litigation especially, you will find that among the references cited many are of English origin, some of them containing ideas so complete, the wonder is that the inventions disclosed were not established fully and completely in your own land. These records seem to show that Americans and Englishmen have invented the same thing many times.

"In America, however, we have always been shorthanded with regard to labor. We have been obliged to find methods whereby one man may accomplish the work of two or three men as compared with your practice here. We have had the best men from Europe—Englishmen, Germans, French, everybody—skilled men, highly trained men, as well as laboring men; we have combined their experiences with our own, coupled it with our necessities, and have thus accomplished results unattainable in a country like this, where you have more labor than you can well keep employed.

"As an illustration of what has been accomplished by the use of electricity in a great industry, I may cite the Homestead Mills of the Carnegie Company. Mr. Schwab, whose name is well known to you, is a genius in his way, particularly in the management of men; he is a master in organizing and directing men. Mr. Carnegie believed in him, and if Mr. Schwab made a suggestion in regard to the use of new appliances, even if it involved the tearing down of an old mill and putting up a new one, the new one was ordered. What Mr. Schwab thought should be done was done. As a result of such progressiveness we may see the splendid mills at Homestead, where they produce with about 4,000 men three times as much steel as the Krupp Works produce with 15,000 men. The results are simply wonderful. You can start there to-day, in a building containing steel-melting furnaces, and you will there see three men mounted on a car with the charging apparatus, which is moved and operated by electricity. With a few movements of this ingenious contrivance three men charge 20 furnaces, which, prior to the use of electricity, would have required the labor of over 200 men.

"You may go into the yard of the Homestead Mills, where they pile the metal in stock. This yard is covered by a system of overhead cranes, and the result is that not only there, but in the mill, and in every other place, you may see great weights lifted and many undertakings going on without a single man exerting himself a bit—working not half as hard as I am working now. (Laughter.)

"I took some English friends to Homestead. Mr. Schwab, after guiding us through several departments, said: 'I will now show you where we turn out 750 tons of plate girders a day.' The mill was in the shape of an 'L.' We went into the short end of the 'L,' where the furnaces were fed by natural gas, of course, requiring no stokers. The end at which we entered had a rather low roof, and there was in sight a contrivance like a battering ram in front of the furnaces; two workmen were sitting down eating their dinners near by; no one else was present. I thought: 'Mr. Schwab has made a mistake; he has asked us to see a mill that is not in operation.' But we went through the mill, which was about 200 feet long; and suddenly we heard a rattle and then saw a truck approaching loaded with a big ingot. No one touched the truck or the ingot. The load came to a platform, the crane overhead dropped a pair of tongs, and quickly put the ingot on the roller table, and as it moved along to the great rolls, it was automatically kept in place. The adjusting screws of the rolls were turned by little electric motors, and not a man in that house did a bit of work. It was just as easy as what you are doing now—looking on! (Laughter.) We went back to the furnaces. There was a 15-year-old boy seated in a little place called the 'pulpit.' He was able, merely by the movement of levers, to open at will any of the furnace doors and move the car along and we saw this car come in front of a furnace, and the charging machine approach and take out of the open furnace a hot ingot, which was dropped on the car and moved off to its work. There was this boy doing absolutely no hard work, and his mill was turning out 750 tons of steel plate each day. My English friends said: 'England has no chance in competition with such methods.'

"Now, all this sort of thing came about in America because of our necessities. We hadn't men enough to do our work. There was a premium in favor of those who could invent machines to work, and thus supply the deficiency.

"At the Carnegie Mills we went to see three blast furnaces. They were making 1,800 tons of pig iron in 24 hours. We saw only two or three men on a truck, which was moved automatically. These men were letting the ore run from shoots and mixing it in the required quantity, and when they had filled a truck, it was carried up and its contents dumped into a furnace, whence it returned for another load. They were running the metal into an immense receptacle into which the metal from all three furnaces was mixed. From this place the metal was taken as required, put into a special tank, mounted on a car and taken to Homestead, two or three miles away, to be poured into the furnaces; one heating only was required.

"I refer to all this simply to illustrate the immense advantages we have had in America, and the kind of experience I have been able to bring to this country, and to which Lord Kelvin so generously alluded, and which I hope will be not only useful and profitable, but will establish for the company I represent a name and a position which you will all regard as most satisfactory. (Applause.)

"I want to thank you very sincerely for the kind expressions with which you have greeted me, and especially for your acceptance of my invitation to inspect this evening a couple of inventions, one of which—the Hewitt mercury-vapor lamp—is a complete and accomplished thing. The rays of this light are not very pleasant, as yet, but the light is likely, however, to be of great value. The other invention—the Hewitt static converter—is quite new, and its object is to convert alternating currents into direct current at so low a cost in comparison with the sums which have heretofore been expended for equivalent results that it is likely, when fully perfected, to cause an immense stimulus in regard to the use of electricity in all parts of England, and particularly in the agricultural parts of the country, for farm work, and for moving all kinds of vehicles.

"I have taken advantage of these inventions to invite you to see them as my guests, and I thank you for having honored me with your presence tonight."

Chicago "L" Road Reports.

Earnings of the Northwestern Elevated Railroad Company of Chicago for the year ended December 31, 1902, were equal to 3.78 per cent. on the preferred stock of $5,000,000. The surplus for the year was $189,423. The year's business was the best since the road began operating in June, 1900. The annual meeting was held last week, and two retiring directors, John B. Dennis and W. W. Miller, were re-elected for a term of three years. It was decided at the meeting to proceed with the business of building an extension to Ravenswood. The total earnings for 1902 were $1,410,998, an increase of over $310,000 over 1901. The net earnings were $946,597, compared with $724,723 in 1901. The total assets are $26,301,225. The bond issue is $15,000,000. The ratio of operating expenses to earnings, including maintenance reserve, is 38.80 per cent., and, including also Union Loop account and taxes, is 55.77 per cent. The daily average number of passengers carried in 1902 was 63,986, compared with 55,690 in 1901.

Earnings of the South Side Elevated Railroad Company for the year 1902 were equal to 5.69 per cent. on the capital stock. The gross business of the road from passengers showed an increase of 8.95 per cent., compared with the previous year. The total earnings were $1,483,841 in 1902 and $1,362,231 in 1901. Net earnings were, respectively, $621,505 and $517,271. The sum of $409,125 was paid in dividends. The total assets are $12,158,522, with funded debt of only $750,000. The daily average number of passengers carried in 1902 was 78,566 and the percentage of expenses to earnings was 58.10. In his annual report President Leslie Carter says: "The chief new additions to your equipment are as follows: We have purchased and put into the service 20 new cars during the year. These cars cost $160,000. A new feed-water heater and pump have been added at the power house; 15 additional cells have been placed in the north storage battery; 41,372 feet of copper cable has been installed and the entire structure has been further bonded with copper bonds to improve the return circuit. The additional cables cost $37,226.21. The pay of every employe of the company except the general officers has been raised during the last 15 months, making an increase for the year of $20,552.83 in the pay-roll, which increase will be heavier during 1903, as some of the increases were made during the year 1902. We have made application to the Common Council of the city for the right to build a third track to Forty-third street, which, if granted, will be a great convenience to all our patrons in giving those south of Forty-third Street the opportunity to make their journey without stop between that street and Congress Street and in giving those north of Forty-third Street the comfort of seats in more crowded hours. Should the ordinance meet with the approval of the council and the mayor, we will also operate lines to the Union Stockyards and to Lake Avenue." Joseph Leiter and Byron L. Smith, retiring directors, were re-elected.

The Lake Street Elevated Railroad Company made a bad showing. It failed, by $26,915, to earn its expenses and bond interest, and has a floating debt of over $2,000,000 and outstanding bonds of $4,027,000. The Chicago Tribune says that nothing but the guaranty of the Northwestern Elevated has prevented the company from going into the hands of a receiver. The total earnings were: 1902, $815,284; 1901, $786,426. Net earnings were respectively $384,992 and $397,662. The percentage of operating expenses to total earnings was 52.78 in 1902 and 49.43 in 1901. The daily average number of passengers carried was 43,423. President Knight says that in order to meet the necessities of the company, $7,000,000 should be raised. A committee was selected for this purpose. Mr. Knight gave these facts: "On the first of July we increased the wages of the conductors from 17½ to 19½ cents an hour. This accounts for some of the increase in the labor account. The cost of electric current during 1902 over that of 1901 was $33,943, which more than offsets our deficit of $26,915. During the year we operated 4,346,505 car-miles, as against 4,078,880 in 1901. This is owing to the fact that we had in operation more trains." Several changes in the directory were made. Alfred Kohn succeeded Frank Hedley. J. C. Spry and W. V. Griffin resigned from the directorate and were replaced by James Boulton and Cory E. Robinson.

Preparations are being pushed for an electric railway to Mont Blanc's highest peak. The road will start at the village of Houches, Savoy, and will be about 11 miles long.

Woodward Friction Waterwheel Governor.

A new type of waterwheel governor, illustrated in the accompanying cuts, has been recently placed on the market by the Woodward Governor Company of Rockford, Ill. It is a horizontal compensating machine and is a radical departure from any previous type of governor, although the successful principles and most of the details used in the Woodward vertical-type governors are incorporated in this. The design is very strong and substantial, and the details have been carefully worked out to obtain simplicity, rigidity, easy removal of parts and good adjustments. It possesses every feature demanded in the regulation of the modern waterpower plant, and the manufacturer considers it a decided advance over any previous type of mechanical governor.

The power to operate this governor is supplied from the main shaft of the waterwheel installation and is delivered to the shaft of the governor by the large pulley seen in the rear of Fig. 1. On this shaft is mounted a compressed-paper friction. Supported by sleeves on this main shaft are two pans, which, when pressed against the friction, move the gates of the turbines in either direction by means of suitable gear friction to an intermediate shaft seen in the front of the cut, this intermediate shaft being connected in turn to the turbine-gate shaft.

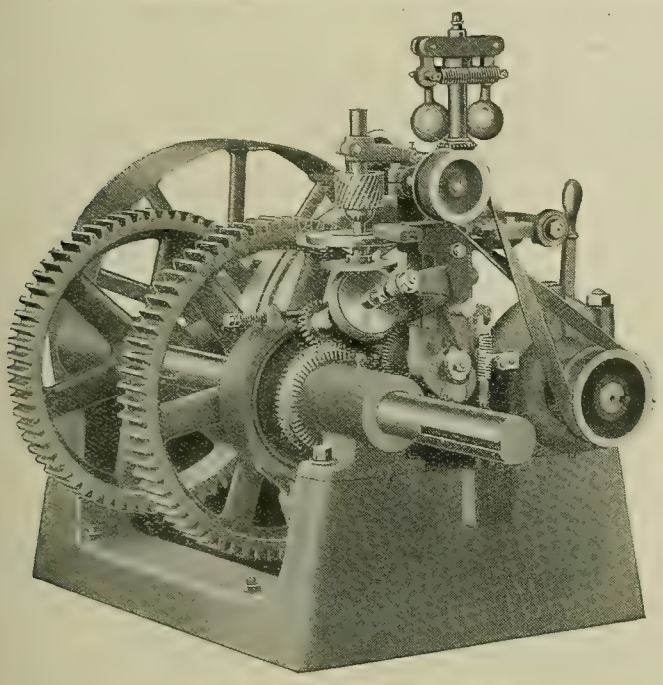


FIG. 1. WOODWARD FRICTION WATERWHEEL GOVERNOR.

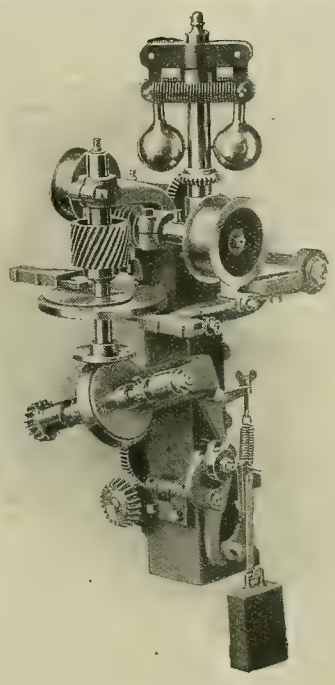


FIG. 2. CONTROLLING MECHANISM OF WOODWARD GOVERNOR

The speeder balls of the governor are separately driven from the main shaft of the installation. There is also a cam continuously revolved by means of the belt shown in the cut and a spiral gear, which can be plainly seen in the foreground. This cam will be noticed just below the spiral gear. As the speed changes the rod of the speeder raises and lowers, carrying with it the tappet arms and tappets. These tappets can be seen one above and one below the cam mentioned above. As soon as a change of speed occurs, either one or the other of the tappets, as the condition demands, is engaged by the cam and forced out from its center. The controlling mechanism is shown in detail in Fig. 2.

This motion is then conveyed through suitable crank shafts to the main shaft on which is mounted the friction, and as this shaft is forced back and forth the friction is brought to bear on either the opening or closing pan. When the speed is normal this cam revolves between the upper and lower tappets, without engaging either. The cam mechanism is capable of very close adjustment, enabling the governor to act on so small a change of speed that for the ordinary conditions of lighting service, no perceptible variation of speed will be allowed. At the same time, the governor will not act upon the gate when the speed and load are steady, and consequently there is much less wear on the gate mechanism than with a governor that keeps the gate in continuous motion, although so slight as not to affect the speed.

Just below the cam and fastened to the same shaft is a concave disk. Below this disk will be seen the compensating wheel which travels loosely upon an oblique shaft. This oblique shaft is geared to the intermediate shaft, so that it revolves only when there is a movement of the gates. It is further provided with a square thread, as is also the compensating wheel. The object of this device is to avoid racing of the governor. This device can be designed to compensate properly for any condition, as the time element can be varied, not only by varying the pitch of the screw, but also by varying the speed of the oblique shaft with a change of gears.

This governor is the largest and most powerful one the company manufactures. The friction wheel, 24 inches in diameter and 12 inches wide, is made with sufficient surface to transmit, if necessary, 5,000 foot-pounds per second to the turbine gates. All the parts are made to be interchangeable. For operating generators in parallel, the company has designed an equalizing device that will give perfect distribution of load when the proper adjustments have been made.

A severe test of this type of governor has been made at the three-phase power plant of the United States Arsenal at Rock Island, Ill., and proved highly satisfactory. Other installations have been made in this country and Canada.

Electric Railways in Massachusetts and New York.

In the thirty-fourth annual report of the Board of Railroad Commissioners of Massachusetts for 1902, the following is given on the question of the real or supposed public demand for legislation regarding electric and steam railroads: "Upon every hand it is apparent that agencies are at work to develop the application of electricity so as to permit more and more its substitution for steam in the general operation of railroads. No incitement to pushing forward these undertakings can be more effective than the stimulus of self-interest on the part of those anxious to install the electric in the place of the steam plant, and on the part of those eager in the handling of transportation to make use of every real advance in methods. It is idle to suppose that the end can be hastened by legislation in the effort to compel capital to follow experiment more closely than business prudence dictates."

The report shows that the length of street railway built in Massachusetts during 1902 was 207 miles, and the total length now owned by the 105 companies is 2,111 miles, of which 333 miles is double-track. In discussing accidents on street railways, the commissioners say that there is nowhere to be found any better management than in Massachusetts, but it is also true that inexcusable carelessness is manifest on some of the lines. The commissioners hold that all heavy cars operated at high speed should have a power brake.

From the statistics of street railways are obtained the following items: Total assets, $123,200,558, as compared with $107,250,656 for 1901; capital stock, $60,036,328, as compared with $54,069,933; gross earnings, $23,486,474; net earnings from operation, $7,573,622; net earnings per mile of main track, $3,099, as compared with $3,308, for last year; passengers carried 100,280,687, as against 93,005,225, in 1901.

Considerable attention is given to electric railways in the annual report of the Board of Railroad Commissioners of New York state for 1902. The inspection of street-surface railroads has been continued through the board's electrical expert, who reports generally on the building of new lines and reconstruction of old systems during the year. Improvement is noticed in the track construction, as well as in cars and equipment. Many power plants have been reconstructed, and an increase in the use of power-transmission systems is noted. The board renews to railway managers its general recommendations as to the operation of street-surface railways. Under statistics the following items are noted: Length of street railways on June 30, 1902, 1,746.015 miles, as compared with 739.291 miles in 1902; capital stock, $204,591,357.50; bonded debt, $218,508,474.10; cost of road and equipment, $420,888,704.51; gross earnings, $46,905,187.87; passengers carried (including elevated railroads), 1,209,510,539, as compared with 487,611,009, carried in 1892.

Third Canadian Niagara Power Company Authorized.

In accordance with a recommendation of the commissioners of Victoria Park, the Ontario government has issued an order in council granting a franchise to the Toronto Niagara Power Company, permitting it to develop power in Victoria Park on the Canadian side at Niagara Falls.

This is the third company to receive a franchise to develop a portion of the power of the Canadian or Horseshoe Fall. The development of the Toronto Niagara Power Company will be 125,000 electrical horsepower, and this will be accomplished by means of a wheel-pit and tunnel tailrace, the company's plan being almost identical with that of the Canadian Niagara Power Company. The wheel-pit of the Toronto Niagara Power Company will be located up the river from the wheel-pit of the Canadian Niagara Power Company, as will also be its inlet. This inlet, however, will be below the forebay of the Ontario Power Company. The pit of the Toronto Nigara Power Company will be larger than that of the Canadian Niagara Power Company, it is supposed, and to meet the demands of the development of 125,000 horsepower the tunnel should be of larger section. The route of the tunnel will be under the river bed to the gorge, the outlet or portal to be near the edge or behind the sheet of falling water. The expense of the new development will be about $5,000,000, and it will take three years to get it in operation. Prominently identified with the Toronto Niagara company are William McKenzie, Col. H. M. Pellat and Frederic Nichols of Toronto.

So that the intake of the Canadian Niagara Power Company shall be protected, the Ontario government has made the Toronto Niagara Power Company build weir dams, and has placed it under $25,000 bonds to do this. From these franchises the commissioners of Victoria Park get a large revenue, the Ontario Power Company paying $30,000 for its two rights, the Canadian Niagara Power Company $15,000, and the Toronto Niagara Power Company paying the same annual rental. In addition to this, payment is to be made at the rate of the sum of $1 per annum for each electrical horsepower generated and used and sold or disposed of over 10,000 electrical horsepower up to 20,000 electrical horsepower, and the further payment of the sum of 75 cents for each electrical horsepower generated and used and sold or disposed of over 20,000 electrical horsepower up to 30,000 electrical horsepower, and the further payment of the sum of 50 cents for each electrical horsepower generated and used and sold or disposed of over 30,000 electrical horsepower; that is to say, by way of example, that on generation and use and sale or disposal of 30,000 electrical horsepower, the gross rental shall be $32,500 per annum, payable half yearly, and so on, in case of further development as above provided, and that such rates shall apply to power supplied or used, either in Canada or the United States.

Waterpowers in France.

The railroads of France (25,000 miles in length) employ about 4,000,000 horsepower and the other industries about 2,500,000 horsepower—a total of 6,500,000 horsepower produced by steam. The hydraulic possibilities of France in her mountainous regions are estimated to be of 10,000,000 horsepower. The streams and cascades have been used to a certain extent for years, but not until recently has this water been "canalized"—conducted by pipes down the mountain sides—and with the aid of turbine wheels made to develop tens of thousands of horsepower and to distribute energy, heat and light in all directions.

It is a striking fact that the mighty energy cradled in the glaciers of the mountains, and lying dormant through the centuries, should be suddenly set free and made to turn the wheels of a hundred industries to meet the needs of man.

At Lancey, a few miles northeast of Grenoble, the water which gives power to mills of various kinds and to the electrical plant which lights the valley of the Graisivairdan and maintains its several tramway systems, is brought by three successive falls whose total is 6,560 feet. Light is furnished to the houses and farms of the vicinity at a very moderate cost.

Grenoble will soon be lighted by electricity from a plant 27 miles distant, and being thus illuminated as it were, by the melting snows, and furnished with a new motive force for turning its industrial wheels, it may well deserve the title of "the White Coal Capital."

The foregoing facts are gleaned from a recent report of C. H. P. Mason, American consul at Grenoble, France.

Carnegie Scientific-research Enterprises.

A meeting of the executive committee of the Carnegie Institution was held in Washington, D. C., recently, at which were allotted appropriations to encourage work in certain branches of science. The grants decided upon were not made public. The total grants so far made by the institution aggregate $200,000, which is the sum allotted by the trustees for this purpose for 1903. The research assistants have not yet been selected. The purpose of this work is to discover and develop, under competent scrutiny and under favorable conditions, such persons as have unusual ability, and work of a more advanced and special character is expected of all who receive these appointments. Among the appropriations that have been made to the several departments of science are $4,500 to engineering, $5,000 for investigation of project for physical and geophysical laboratory, $4,000 for physics, $25,000 for research assistants and $10,000 for student research work in Washington.

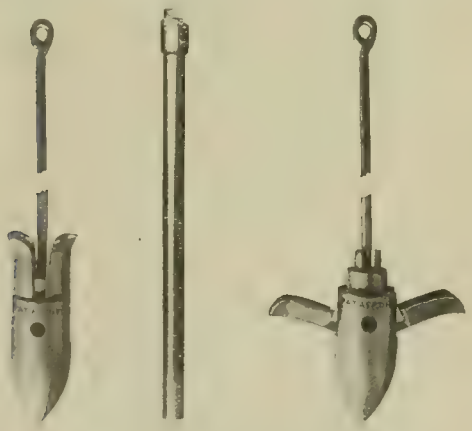
The year book, the first annual report of the institution, says of the plans: "The only organization outside of Washington to be provided for at present should be such advisers and advisory committees as may from time to time be found necessary in connection with the development of the research work of the institution. The executive committee defines research as original investigation in any field, whether in science, literature or art. In the field of research the function of the institution should be organization, the substitution of organized for unorganized effort wherever such combination of effort promises the best results, and the prevention of needless duplication of work."

In furtherance of his educational schemes for Scotland, Andrew Carnegie has decided to endow a trust for scientific research. The sum of $5,000,000 will be expended on the scheme. Mr. Carnegie, in his inaugural address as lord rector of St. Andrew's, Edinburgh, told his countrymen that, as they could never be a ruling commercial nation, they should endeavor to become the salt of the earth in an educational, scientific and historical sense. The scheme he now promulgates is an endowment trust for scientific research.

At a meeting of the Academy of Science in Paris last week Henri Poincaré announced that American and French scientists were co-operating in a series of experiments on the law of light and electricity. It is added that the Carnegie Institution of Washington, D. C., will defray the expenses of an American expert, who will arrive in France shortly to take part in the experiments.

Hector Land Anchor.

William Hector of Chicago makes the land anchor herewith illustrated. Of the three cuts, that on the left shows the device closed, ready for driving or putting down. The cut on the right shows the anchor open, demonstrating the gripping surface of the wings. In the center is shown a driving tube, adapted to slip over the rod and rest on the shoulders



HECTOR LAND ANCHOR.

of the anchor. This tube can be taken out easily, as it is much smaller than the point of the anchor. This anchor is easily driven in almost any soil, but if necessary a hole the size of the point may be drilled or bored. A 3½-inch hole will receive an anchor having a spread of wings of 12 inches. Any effort to pull up the anchor opens the wings, giving them a firm hold on the soil. The anchor is made in three sizes—nine, 12 and 15 inches, reference being made to the spread of wings.

The United Railways and Electric Company of Baltimore, Md., has signed a contract for the perpetual lease of the Baltimore, Sparrows Point and Chesapeake Railway, 43 miles of track, which now assures the United company complete control of every suburban line as well as the entire street-railway system of Baltimore City. The line will connect by trolley with the Maryland Steel Works at Sparrows Point, and will be extended to and along the Chesapeake Bay shore below North Point, where summer resorts will be established.

CORRESPONDENCE.

New York Notes.

New York, January 31.—The Manhattan Railway Company submitted to the State Board of Railroad Commissioners during the week a new schedule of train service devised on recommendation of the board to improve transit facilities on its lines. The schedule, after careful examination, was adopted by the board yesterday, and will go into effect tomorrow, February 1st. It provides for additional cars in both rush and non-rush hours and additional trains for the non-rush hours. A total seating capacity for 837,672 persons daily will be provided, or 175,516 more than at present. The company promises to make on its four lines 3,387 train-trips each 24 hours, with 17,439 cars.

On Thursday last the railroad commissioners handed down a report with regard to the complaints made by the Manufacturers' Association and others in Brooklyn, in which directions are given for the improvement of the service of the Brooklyn Heights Railroad Company, which is controlled by the Brooklyn Rapid Transit Company. The company is censured for not providing sufficient power to operate its lines properly. The commission directs it to get all possible power immediately and hasten the installation of power units now in progress. The full service of cars on surface lines, which was reduced in the latter half of 1902; heating of cars in cold weather; cleaning of cars once a day; lighting of elevated cars by electricity; reforms at the East New York "loop," and a duplicate power system are improvements demanded immediately. The board recommends that suitable ordinances be adopted in New York city providing for the proper regulation of vehicular traffic in the streets. Another statement is that additional switching and terminal facilities can and should be acquired on the Fulton Street side of the bridge terminus. The company's officers maintain that practically all of the reforms mentioned in the report have already been started.

At the annual meeting of the stockholders of the Brooklyn Rapid Transit Company yesterday President Greatsinger was dropped from the board of directors and succeeded by E. W. Winter. This is taken to mean that Mr. Winter will also succeed Mr. Greatsinger as president of the company. Mr. Winter, who formerly resided in St. Paul, where he was interested in the Twin City Rapid Transit Company, has been acting as adviser to the executive committee of the Brooklyn company for several months.

The engineering commission of the Pennsylvania, New York and Long Island Railroad Company's tunnel is preparing the plans and specifications on which bids will be made for the construction of the tunnels between New Jersey and Queens County, New York. Bids possibly will be advertised for within a few weeks, or it may be three months hence.

The Board of Estimate and Apportionment has granted a franchise to the New York Interborough Railway Company for the operation of a trolley road in the Bronx. The franchise is for a term of 50 years and gives the railroad company the right to run cars across Macomb's Dam Bridge and other Harlem River structures and contains the provision that at the expiration of the franchise the city can purchase the plant necessary for the operation of the road at a fair price, to be fixed by the Board of Estimate and Apportionment. O.

Canadian Intelligence.

Ottawa, Ont., January 31.—The big electrical works of the Winnipeg General Power Company, on the Winnipeg River, near Lac Du Bonnet, are now in course of construction. This company has commenced operations with a large force of men, and Winnipeg is now within measurable distance of obtaining electrical power by transmission over a distance of about 55 miles, which is the distance between the city and the works.

The Ontario government has passed an order-in-council granting a franchise for the development of power at Niagara Falls to a Toronto syndicate headed by William MacKenzie, H. M. Pellatt and Frederic Nicholls.

The organization of the Marconi Wireless Telegraph Company of Canada has been completed. The whole share capital of the company, amounting to 1,000,000 shares, has been subscribed, the par value being $5 a share, so as to correspond as near as possible to the one-pound shares of the English company, whose shares are now selling at about three times their par value, it is said. The Canadian company will control the business throughout Canada, as well as communication between foreign countries and Canada. The management will be located in the city of Montreal, Que., where offices are being opened. Arrangements are being completed for the manufacture of instruments and for the instruction of operators in the Dominion.

The St. John Street Railway Company of St. John, N. B., of which Sir William Van Horne and Mr. James Ross of Montreal are the principal shareholders, is preparing to improve and extend its street-car service in the city. The company carries on not only the street-railway, but also all gas and electric-lighting business of St. John, and has a very valuable franchise, including practically the free right to any streets on which it is deemed advisable to put down rails. It is not compelled to pay anything for the privileges, and practically the only obligation is to keep in repair the roadbed between the rails and 18 inches outside of them. This franchise runs for 40 years and was acquired, several years ago, by the purchase of the plant and rights of a defunct concern. Large improvements are to be made to the power houses, and heavy generators of the most modern type are to be installed. W.

New England News

Boston, Mass., January 30.—William A. Whittlesey, Alexander Kennedy and others have petitioned for the incorporation of the Huntington and Westfield River Railway Company, to build an electric railway in the towns of Huntington, Chester, Chesterfield, Worthington, Cummington, Windsor, Savoy, Goshen, Ashfield, Buckland and Conway, in Western Massachusetts. By the accompanying bill the company is to be allowed to sell electricity to any electric-light company, municipal lighting plant or corporation. The capital stock is to be $500,000 and the company is to be authorized to carry mail, express and freight, and to sell or lease any connecting railway. A portion of the road must be in operation within five years.

E. Moody Boynton has asked for a further extension of the time in which he must build the Boston, Quincy and Fall River Bicycle Railway, and he wants permission to carry freight. He now wants until December 31, 1905, in which to get 20 miles of the road in operation, the remainder to be built within the succeeding two years. The present law calls for the completion of 20 miles by December 31, 1903, and the remainder must be completed one year later.

Thomas B. Rounds has petitioned for legislation authorizing the purchase of electricity for lighting purposes, from electric-railway companies, by persons, firms, companies or associations in cities or towns in which no electric-lighting companies are located.

The New England Street Railway Club held its third annual reception and dinner at Hotel Somerset in Boston, a few evening ago. About 400 members and invited guests were present. President H. E. Farrington of Chelsea presided, and Frank Ridlon of Boston was toastmaster. Short after-dinner addresses were made by Hon. E. P. Shaw, Hon. B. F. Chadburn, F. C. Smith, R. M. Putney and others. At a business meeting the following-named were elected officers of the club: President, H. E. Farrington, master mechanic of the Boston and Northern Company, Chelsea, Mass.; first vice-president, E. E. Potter, general manager of the Union Street Railway Company, New Bedford, Mass.; state vice-presidents, W. G. Meloon, general manager of the Portsmouth, Kittery Point, and York Street Railway Company, Kittery, Maine; H. A. Albin, superintendent of the Concord and Concord and Manchester Street Railway Companies, Concord, N. H.; A. J. Crosby, superintendent of the Springfield Street Railway Company, Springfield, Mass.; H. M. Young, manager of the Woonsocket Street Railway Company, Woonsocket, R. I., and J. S. Thornton, superintendent of the People's Tramway Company, Putnam, Conn.; secretary and treasurer, J. H. Neal, chief of the Boston Elevated Railway Company's department of accounts; executive committee, H. E. Farrington of Chelsea, D. L. Prendergast of Boston, A. J. Purinton of Palmer, Mass., H. E. Reynolds of Quincy, Mass., and F. J. Stone, Franklin Huntress and J. C. Spring of Boston; finance committee, J. F. Wattles, Paul Winsor and P. W. Davis of Boston.

Nearly the entire city of Boston was in darkness from nine until after 10 p. m. one night last week, owing to the loosening of bolt screws holding the flange of a pipe connecting with one of the Edison Electric Light Company's boilers at its South Boston plant. The disconnecting of the pipe caused a vast amount of steam to escape, and before the trouble could be remedied there was such a reduction of steam pressure that there was not power enough to run the dynamos. As soon as the break was located the fire under that boiler was drawn and the other fires were started up. David Mansfield, a workman, was badly scalded by the steam, but will probably recover. Stores and halls of entertainment were deprived of light, and had to resort to gas or lamps until the current was restored.

The Boston Elevated Railway Company has voluntarily increased the wages of its blue-uniformed employes wearing service stripes, and placed learners under pay at $1 per day, and will pay a pension of not exceeding $25 a month to all incapacitated employes who have worked 25 years for the company and its predecessors or who are 60 years old and have worked 15 years for the company. The increased pay of the service-stripe men amounts to one-half cent an hour for men who have been in the service five years, one cent per hour for men who have been in the service 10 years, and 1½ cents per hour for men who have been in the service 15 years or longer. Extra men are to be guaranteed from $1.20 to $1.50 a day for each day they report for duty, whether or not they work. Guards and brakemen of elevated trains are to be given one cent more per hour, or 21 and 18½ cents, respectively. Starters are to be paid from $2.25 to $2.50 per day. Each blue-uniformed man who has been employed by the company for six months and who has ren-

dered meritorious service, will be given $15 at the end of the calendar year. Heretofore learners were paid nothing and extra men were paid only when at work. This will cost the company about $250,000 annually and will benefit 5,100 employes. B.

From the Buckeye State.

Cleveland, Ohio, January 31.—It would now appear that the Cincinnati and Columbus Traction Company means business and that its plans will be carried out. The capital stock has been increased from $10,000 to $2,500,000, and officers have been chosen as follows: President, H. H. Hoffman; vice-president, General Lewis Seasongood; secretary, C. H. Rowe; treasurer, Henry Burkhold; assistant secretary, Richard C. Swing. Judge Philip Swing and George B. Kerper, with the officers, make up the board of directors. Philip Swing has been named as general manager. A deposit has been made with the Hamilton county commissioners as a guaranty that the road will be completed there within the present year. It will be built to Washington Court House, where it will connect with the Appleyard road from Columbus, which is to be extended to that point.

It is said that Luther Allen, president of the Toledo and Western, and Judge Charles M. Stone of Cleveland will both be interested in the reorganization of the Lake Shore electric and that it will form a portion of the proposed system between Cleveland and Chicago. Mr. Allen is also president of the company operating lines between Cleveland and Painesville and Ashtabula, so that the extension toward Buffalo is pretty well along. The lines west of Ohio which are to be used in connection with the Toledo and Western have already been mentioned in the Western Electrician. T. C. Quayle of Cleveland is interested in the plan to connect Cleveland and the West by way of Chicago.

The Citizens' Light, Heat and Power Company of Springfield has been incorporated with a capital stock of $1,000. Hon. Walter L. Weaver, W. W. Keifer and other prominent men of that city are among the incorporators.

The Cleveland City Railway Company has filed notice with the secretary of state of an increase of capital stock from $8,000,000 to $9,000,000. The new stock will be offered to present stockholders at par. The old stock is now worth 110.

The United Water and Light Company of Wilmington has been incorporated in New Jersey with a capital stock of $200,000. S. C. Martin is the Ohio agent of the company at Wilmington.

The Mansfield, Crestline and Galion Railway Company has increased its capital stock from $10,000 to $250,000. Frank N. Wilcox is the president of the company.

The Warren Electric and Specialty Company, Warren, has purchased the Co-operative bicycle factory at St. Catherines, Ont., and will equip it for the manufacture of incandescent lamps. The new factory will probably be in operation by the first of May.

The Scioto Valley Traction Company is having specifications prepared for its power house, which will be located at Reese's Station.

The Ashtabula and Lake Shore Railway Company is a new company which is in process of formation at Ashtabula. L. A. Robinson, general passenger agent of the Pittsburg and Lake Erie Railroad Company, is said to be slated for president of the company, with W. S. McGeehan of Youngstown as secretary. A line from Ashtabula to Woodland Park and a line along the lake shore to Conneaut and Geneva are in contemplation. Pittsburg and Youngstown men are very largely interested in the new company.

The Canton and Dover Electric Railway Company, incorporated a few days ago, will build a line from Canton to Canal Dover, a distance of 23 miles, and a much more direct line than any of the other roads have.

The annual statement of the Toledo, Bowling Green and Southern shows gross earnings of $246,932.80; operating expenses, $138,089.17; net earnings, $108,843.63. After paying a dividend of three per cent. and all fixed charges, as well as other expenses, there is a surplus of $12,386. The road buys power for a portion of its line, and has been at expenses in other ways that were costly. Had it been situated as some other roads are, the surplus would have been very much larger or the dividend would have been increased materially.

It is stated on good authority that a million and a half dollars will be spent in improvements on the Cleveland city railway lines the coming year. For one thing, 70 new cars will be ordered for use as soon as they can be built and delivered. The Cleveland Electric Railway Company will tear up its track, from East Cleveland to Euclid, and put in a double track in its place. It will also complete the Erie Street cross-town line and will put in two large storage batteries. One of them is now being put in at the Windemere barns.

The Cincinnati and Columbus Traction Company will not use the third-rail system, as has been reported, but the overhead trolley instead.

The Leonard-Bundy Electric Company of Cleveland has been incorporated with a capital stock of $10,000. P. E. Hintz, L. B. Sparnier and others are interested.

The Miami and Erie Canal Transportation Company has all the tracks laid and the wires strung from Cincinnati to within two miles of Dayton, and the officers expect to be hauling freight between the two cities by April 1st.

It is said that an electric railway is being planned to run from Owensboro, Ky., to Hartford, striking the Green River Valley at Curdsville. This is a very fertile valley, and will be good territory to tap. The road will be 60 miles in length and will cost about a million and a half. Wade Cushing of Cincinnati and C. A. Hopkins of Loveland, Ohio, are at the head of the movement, and such men as J. C. Delker, F. T. Gunther, J. H. Parrish and R. S. Hughes of Owensboro, and Rowan Holbrook of Hartford, are associated with them.

Arrangements have been about concluded whereby an interurban passenger station will be established on Erie Street, opposite Vincent, at Cleveland. All the roads coming into the city will use the depot, but it will not be used by the city lines. This will relieve the congested condition about the square, as the cars from the east will stop at Erie Street and those from the west will likely use the St. Clair Street line. O. M. C.

Information from Indiana.

Indianapolis, February 2.—Two interurban railway lines were opened for business last week. The Michigan City and Laporte electric line, 14 miles in length, connecting the two cities, is one, and the Muncie, Hartford City and Fort Wayne Traction line is the other. A regular schedule has been established on both lines and the roads seem to be popular.

The Dublin City Council, after holding out for a long time for free city lighting, has granted a franchise to the Richmond Street and Interurban line and to the Indianapolis and Eastern Traction line to enter the city. These lines are both almost completed, one from the east, the other from the west, to the city of Dublin, and when the gap is completed a continuous line from Indianapolis to Dayton, Ohio, with many connections, will be formed.

The Indiana Coal Belt Electric Railway Company was incorporated on January 28th. This company proposes to construct and operate extensive electric lines in Sullivan, Green, Clay and Vigo Counties, in and connecting the cities and towns of Sullivan, Terre Haute, Linton, Dugger, Jasonville, Hymera, Shelburn, Farmersburg and Merom. The promoters of this enterprise say that they propose to do an extensive freight business in the matter of hauling coal, and will furnish light and power to the towns and cities named. The company is capitalized at $100,000. C. L. Davis, W. H. Crowder and C. J. Sherman are the chief officials. The company's headquarters are in Sullivan.

The strike situation at Elkhart and Goshen remains about the same. The Indiana Railway Company is running cars, but it remains to be seen how long it can afford to operate patronless cars, or how long the public will submit to the edict of the strikers, and refrain from patronizing the cars. Spotters watch every car, and business men are immediately informed that they will be boycotted in case any of their employes or members of their families board the cars. Traveling men coming into town on the interurban are followed from store to store, and the proprietor warned not to patronize the salesman under penalty, and this suffices to stop any transactions with traveling men. The business men do not dare patronize the company under existing conditions.

The Indiana and Eastern Traction Company—Greenfield line—has installed half a dozen elegant and commodious new cars in service on its line. The prominent features of the new cars to attract favorable comment are the wide parlor windows and the low or depressed center aisle. The cars are well finished and very comfortable. On April 1st the company will establish a new fast limited service, and has ordered some high-speed cars for that purpose.

The Logansport-Wabash Traction Company, after long delay and wrangling, effected a crossing over the Wabash railroad near Peru last week, and cars will now be run the entire length of the road, which is 34 miles.

South Bend is about to despair in getting cheap electric power from Chapin's Dam power plant, in the St. Joseph River, at Buchanan, Mich. That town has brought injunction proceedings on the ground that it has a contract with Mr. Chapin which forbids transmitting the power elsewhere. The poles for the wires have been placed in South Bend. Mr. Chapin says, in case of an adverse decision, he will appeal to the highest court.

Proprietors of grist mills and warehouses along the line of the Fort Wayne-Southwestern Traction Company at Huntington and other places are securing power for running their plants by electricity from that company.

Great preparation is being made in Indianapolis for the annual automobile show, to be held the first week in April. Interesting events are being arranged and the entries promise to exceed any previous show. F.

Southern Developments.

Charlotte, N. C., January 31.—It is reported that the plant of the Rock Hill (S. C.) Water, Light and Power Company has been sold to George MacDonald of New York city and others for approximately $70,000.

The Thornton Electric Light Company of Hickory, N. C. (previously mentioned), has been chartered with a capital stock of $8,000.

The Virginia Passenger and Power Company of Richmond, Va., intends to rehabilitate the Seven Pines electric line to this famous battlefield.

A movement is on foot at Trenton, Tenn., for the purchasing by the city of the local lighting plant for $6,000. Bonds may be issued for the purpose.

Colonel G. T. Graham has bought Ranch Shoals, on Saluda River, near Lexington, S. C., and a large power house will be erected. It is presumed that the purchase was made for the proposed Lexington-Columbia electric line.

It is said that plans are nearly completed for the erection of a $1,000,000 plant at Richmond, Va., to build railway and electric cars. Northern capital is interested, but no names are made public in connection with the enterprise. L.

Detroit, Mich.

Detroit, January 31.—The route for the Detroit and Toledo Shore Line, from where the road now ends at Trenton to Detroit, has been selected. The line will leave Trenton and come up the Rouge River on the north and west of the Lake Shore and Michigan Central steam roads, paralleling these lines; it takes a wide detour to the west before it reaches the Rouge and joins the Wabash tracks at the Rouge bridge.

Alex Dow, acting for the new Edison Electric Company, has purchased of the Solvay Process Company eight acres on the Detroit River for $30,000. This, with the land already purchased, will give the Edison company about 35 acres for the site of its new power plant.

The Detroit Trolley Wheel and Electrical Equipment Company has just been incorporated; capital, $100,000.

It is reported at Lansing that the Detroit United Railway is negotiating with Hawks and Angus for the purchase of the Detroit-Jackson railroad, and that it is understood the negotiations also cover the Lansing street-railway property owned by Hawks and Angus. It is also stated that the Detroit United is desirous of purchasing the right-of-way between Lansing and Jackson procured by Hawks and Angus. The Hawks and Angus street-railway franchise in Lansing has been declared forfeited by the Common Council, and the action was accompanied by instructions to the superintendent of public works to tear up the tracks. Opportunity was given the company, however, to take out an injunction, that its side might be presented in court. The street railway has asked and obtained an injunction restraining the Common Council from carrying out its intentions to tear up the tracks, and the courts will decide if the service rendered by the street-railway company is up to the standard set by the franchise.

In addition to extensive improvements made by the Muskegon Traction and Lighting Company in the recent construction of a new power house and barns, $100,000 more will be spent in improving and enlarging the gas plant which it operates, and in the purchase of new rolling stock for the street-railway line. Extensive improvements are planned at Lake Michigan Park, Muskegon's summer resort, located on the shore of Lake Michigan. The earnings of the street-railway department in 1901 were double those of 1895, and 1902 showed a marked improvement over the year 1901.

At the recent meeting of the Grand Rapids Edison Company it was decided to build an extensive power plant on the Flat River, six miles above Lowell. Since the company acquired the power rights a few weeks ago it has had engineers at work in the vicinity making estimates as to the cost of the plant that will generate the 1,000 horsepower. Work will be commenced at once, and it will probably take about a year to complete it.

M. C. Patterson and G. M. Clarkson of Ann Arbor have secured franchises for an electric road to run from Hillsdale, Mich., to towns in Northern Indiana. It is stated that Detroit capital is also interested in the road.

The car barn of the Bay Cities street railways was almost wholly destroyed by fire on the night of January 28th. The barn was 100 by 150 feet, and was built last year at an expense of $15,000. At the time of the fire it contained a snow plow, street sweeper, wrecking car, six special double cars, 20 open cars, and one closed car, all of which were destroyed. The company is in sore straits, as it does not know where it will get cars for the coming summer service. Recent inquiries of builders brought information that no cars could be delivered within nine months. C. G. W.

Northwestern Notations.

Minneapolis, January 31.—E. P. Burch, the electrical engineer of Minneapolis, entertained the Engineers' Club last week with a history of the construction of the dam at Tenth Avenue South, Minneapolis, illustrated by stereopticon. The series included views of the various stages of the work and also of the machinery and the inside workings of the power house. Mr. Burch was elected vice-president of the club, at the annual meeting, just held.

The Interurban Railway Company of Des Moines has begun locating the line of its extension from Colfax to Newton. A line is also projected from Colfax to Prairie City. The company expects to build a total of 80 miles of road this year. A line

is to be constructed to Indianola and Winterset by way of Norwalk. The Legislature has enacted a law giving electric railways the same rights as steam roads in the securing of rights-of-way.

The council of Winona, Minn., awarded the contract last week for the construction of an electric-lighting plant to W. I. Gray & Co. of Minneapolis. The mayor vetoed the award on the ground that the contract called for more money than was available, and returned it to the council, which promptly passed it over the veto. A competing bidder has now enjoined the contract on the ground of being entitled to the work because of offering the lowest bid.

The St. Croix Falls (Minn.) Improvement Company has been formed in Minneapolis with $50,000 capital stock. A similar company will be formed in Wisconsin, the title being the St. Croix Falls (Wis.) Improvement Company. The two will be under the same control and will develop electrical power from the St. Croix River at the falls between Taylors' Falls, Minn., and St. Croix Falls, Wis. A bill has been offered in Congress to permit the construction of the dam. It is intended to induce the location of industries at Taylors' Falls and St. Croix Falls, by the attraction of cheap power. The surplus power will be transmitted to St. Paul and Minneapolis.

The Twin City Rapid Transit Company, operating the street-car systems of Minneapolis, St. Paul and Stillwater, had an increase in total expenses for the past year of 15.17 per cent., but nevertheless, earned 6.4 per cent. on common stock. The common-stock surplus for the year preceding was 5.3 per cent. The increased expense was caused mainly by claims for injuries and damages. The gross increase in earnings was $438,235, as against $334,620 for the preceding year and $216,562 for 1900.

The Twin City Rapid Transit Company is still experimenting with the magnetic brake and car heater of the Westinghouse company, on the interurban line between St. Paul and Minneapolis.

Collins & Co. of Chicago have been awarded the contract for the construction of a trolley line from La Crosse to Viroqua, Wis., for the La Crosse and Eastern Railway Company.

Sisseton, S. D., seeks to induce some capitalist to invest in an electric-light plant for that town.

The Wisconsin River Railway and Power Company has been incorporated to build an electric line from Plover, Portage County, Wis., to Merrill. The capital stock is $100,000.

Owing to a shortage of fuel at Blue Earth, Minn., the street lights have been cut out, and if the scarcity continues all electric lights will be dispensed with.

The Butte Street Railway Company of Butte, Mont., will shut down its power plant in the spring and will secure power from the Missouri River Power Company. It is understood that the company will save $8,000 a year by the change. The South Butte plant will be held ready for any emergency.

The Seattle and Renton Railway Company, operating an electric line from Seattle to Renton, Wash., has been reorganized as the Seattle, Renton and Southern Railway Company, with a capital stock of $1,500,000. New rolling stock has been purchased and the line will be double-tracked and ultimately extended.

Hord & Keator of Chicago have filed an acceptance of the franchise granted last November for a street-railway system in Mankato, Minn. They propose an electric line to St. Peter, Minn., and ultimately on to St. Paul and Minneapolis. R.

PERSONAL.

Sir Oliver Lodge has been appointed the Romanes lecturer at the University of Oxford for the present year.

W. H. Bentley of Jamestown, N. Y., has been appointed general manager of the Marconi Wireless Telegraph Company, with headquarters in New York.

Clarence L. Fulmer, son of D. M. Fulmer, president of the D. M. Fulmer Lumber Company, died at his home in Florence, Wis., January 29th of typhoid fever.

Samuel G. Neiler of the firm of Pierce, Richardson & Neiler of Chicago, consulting engineers, is recovering from a recent severe illness, to the gratification of his friends. He is expected at his office in a day or so.

A. A. Anderson, formerly general manager of the Pennsylvania and Mahoning Valley electric-railway lines at Youngstown, Ohio, has been chosen as general manager of the Union Traction Company's lines, with headquarters at Anderson, Ind.

William E. Athearn of New York, assistant electrical engineer of the Western Union Telegraph Company, has resigned to accept a position on the engineering staff of the American Telephone and Telegraph Company. He is succeeded by Frank Kitton of Buffalo.

William J. Wilgus, formerly chief engineer of the New York Central Railroad Company, has been appointed fifth vice-president of the company, with offices in New York city. He will have, under the direction of the president, general charge and supervision of all construction work and will assist the third vice-president in matters pertaining to maintenance of way and structures. The new electrical work at the Park Row terminal of the New York Central will come under the immediate supervision of Mr. Wilgus.

A Pittsburg press dispatch of January 31st says: "C. B. Allison, a well-known electrical contractor, was called to the door of his house in Sheraden, at two o'clock this morning and shot down by a mysterious assailant, who has not yet been identified. Mr. Allison is seriously wounded."

Arthur Holloway of Salisbury, Md., was killed on January 30th by an electric shock while working in the testing department of the General Electric Company in Schenectady, N. Y. He received the full current of a 2,300-volt circuit. He was a graduate of Pennsylvania State College and was 23 years old.

The many friends of George B. Foster, Chicago manager for the Wagner and Bullock Electric Manufacturing Companies, will learn with regret that he has been confined to his home for over three weeks by a severe case of rheumatism. His condition is now improving, and he soon expects to be at his office again.

Jacob Levin, assistant district superintendent of the Western Union Telegraph Company at Minneapolis, has been appointed inspector of the eastern division of that company, with headquarters in New York. Mr. Levin succeeds E. P. Griffith, resigned, who has become telegraph superintendent of the Erie Railroad.

George H. Gibson has resigned his position with the Westinghouse Companies' Publishing Department of Pittsburg, Pa., to accept a position with the B. F. Sturtevant Company of Jamaica Plain Station, Boston, Mass. Mr. Gibson was formerly a member of the editorial staff of the Engineering News of New York city, and is a graduate of the engineering department of the University of Michigan.

David Philipps Jones, a well-known civil, mechanical and naval engineer, died at his home in Pittsburg on January 30th. Mr. Jones had served several years with the navy and was connected with the Bureau of Steam Engineering. He was president of the West Kansas Constructing Company, and from 1885 to 1888 was professor of mechanical engineering in the Kansas Normal College. He was one of the consulting engineers of the Louisiana Purchase Exposition, and at the time of his death was actively engaged in that work.

A New York wedding in which a number of electrical people were interested was that of Mr. Hiram Edward Manville of Milwaukee and Miss Henrietta Estelle Romaine, daughter of Frank Hall Romaine, on January 28th. Rev. Dr. D. Parker Morgan performed the ceremony in the Church of the Heavenly Rest. Mrs. Clarence Levey was the matron of honor; there were no bridesmaids. Frederick W. Rockwell was the best man, and Frank Hall Romaine, Jr., a brother of the bride, David C. Pye, Robert C. Caldwell and William Mayne were ushers. A reception and wedding breakfast at Sherry's followed the ceremony.

ELECTRIC LIGHTING.

Bayne, La., is to build a waterworks and electric-light plant.

It is stated that an electric-light plant will be erected soon in Bangor, Mich.

The City Council of Trenton, Tenn., has decided to buy the electric-light plant owned by Wade & Keenan.

A syndicate of New York capitalists is said to be planning a combination of a number of electric-light plants in New England cities.

J. H. Staedtler has been granted a franchise by the village authorities to construct and operate an electric-light plant in Monticello, Ill.

The City Council of Harrodsburg, Ky., has decided to take definite steps at once in the matter of establishing an electric-light plant. The plant is to cost about $20,000.

The business men of Centralia, Ill., who contend that the prices of electric light and gas are too high, have held a meeting, and will take steps to see if it will be possible to lower the price; if not, a company may be formed and a business men's light plant installed.

The United Water and Light Company has purchased the electric-light plant of the village of Wilmington, Ohio. It will rebuild the plant during the summer and will install in it two 200-kilowatt units and two 20 by 42-inch automatic engines, in connection with a complete waterworks system. E. D. Hurst is the superintendent.

Owing to scarcity of coal, the trustees of the village of Freeport, N. Y., were obliged to discontinue the street arc-lighting service recently. The police value of well-lighted streets is shown by the following extract from a newspaper writer's account of Freeport's predicament: "Since the village has become shrouded in darkness nightly the male population has resorted to lanterns and armed themselves to be protected against possible hold-ups, and the fair sex are living in continuous fear of 'Jack the Hugger' and other annoying characters. It is reported that last week, while on her way home, a well-known married woman was hugged by a stranger in going along the Merrick Road. It proved, however, a case of accident, occasioned by the intense darkness, so the hugger said, as he collided with the woman and had to put his arms about her to save her from falling."

The city of Sioux City, Iowa, received on January 27th a very agreeable addition to its finances in the form of a deposit of $2,067.77, given to the city treasurer by L. L. Kellogg, manager of the Sioux City Gas and Electric Company. This money is two per cent. of the gross receipts of the company for the last six months and is given to the city according to the company's agreement to turn over that percentage of its gross earnings.

The Milwaukee Electric Railway and Light Company is to have a rival in the newly organized Milwaukee Gas and Coke Company, according to a statement attributed to Ferdinand Schlesinger, who, with Mark Hanna, Charles Ray and others, is interested in the new company. Mr. Schlesinger says the company has plans under consideration for the conversion of gas which it produces into electricity. This would be done, he explained, by using the gas as fuel to operate electric generating machinery. "Our plans are still in somewhat indefinite shape, but this is one of the things we have seriously under consideration," said Mr. Schlesinger. "We shall have a large amount of gas on hand, of which we propose to make use, and this is one of the uses to which it can be satisfactorily put. We shall, if the idea works out as we expect, furnish electricity for all purposes for which it is generally used."

ELECTRIC RAILWAYS.

It is said that Murray A. Verner of Pittsburg, backed by New York capital, has secured the contract for the extensive electric-railway improvements in St. Petersburg, Russia, mentioned in the last issue of the Western Electrician.

John I. Beggs of Milwaukee denies that the Milwaukee Electric Railway and Light Company and the interurban interests with which he is connected are to be consolidated with the electric-railway and light properties of the Emerson McMillin syndicate in Southern Wisconsin.

The Wisconsin River Railway and Power Company of Plover, Wis., has been incorporated with a capital of $100,000. The company may construct and operate a street railway from the village of Plover, Portage County, through the cities of Stevens Point and Wausau and intervening towns and villages. The company may also conduct the business of electric lighting and heating and operate grist and flour mills and other plants which may be run by electricity.

Hauling cotton will be one of the principal sources of revenue of the Fort Worth-Springtown (Texas) electric railway, if it is built. The farmers are anxious to have the road built, provided it will be able to haul freight, for the simple reason that they are now practically isolated in this respect, being compelled to haul their cotton, grains, fruit, etc., a distance of 17 to 20 miles, to Weatherford. It now costs them about $1 a bale to get cotton to the railroad. One farmer in the vicinity of Springtown has agreed to give to the company $1 a bale for a term of five years, provided it will build the road. The people of Springtown also agree to give a bonus of $10,000 and the right-of-way through the town. Other equally as valuable offers are made from other towns along the proposed road.

AUTOMOBILES.

It is stated that the General Electric Company proposes to enter the automobile trade. According to report, the company has been experimenting with a gasoline machine for which it controls the patents and which is said to be one of the best machines on the market. The machine may be manufactured at the Lynn works.

Arthur Brisbane, the able editor of the New York Evening Journal, says that in less than 50 years from now the working man, the mechanic and the laborer will go to their work from their cottages in the country in automobiles. He says that the history of the bicycle, first the fad of the rich and afterward the useful conveyance of the poor, will be repeated in the case of the automobile.

POWER TRANSMISSION.

A Pittsburg account says that the Phipps power plant is to be erected at an estimated cost of $425,000, on Duquesne Way. When completed it will have a capacity of 7,200 horsepower, which is to be used for lighting, heating, operating elevators and other purposes.

Senator Nelson has favorably reported to the United States Senate the bill of Senator Clapp permitting the building of a dam across the St. Croix River at St. Croix Falls, Wisconsin, by the St. Croix Improvement Company of Minnesota. The bill was amended in committee to leave a channel open for navigation and to protect other public interests. The company proposes to generate electricity. Martin B. Koon is its president.

SOCIETIES AND SCHOOLS.

The Chicago Steam Engineers' Club has been recently organized in Chicago for the "social and intellectual advancement and improvement of the conditions surrounding its members." Resident members of the club shall be engineers and others who may be interested in or connected with the profession of steam engineering.

There is hope of a technical school at the University of Rochester some time in the future. Many additions have recently been made to the instruments and apparatus of the physical laboratory, including a 10-ohm Reichsanstalt resistance standard correct to one one-hundredth of one per cent. The students have been making a 20-cell storage battery, and castings for a one-kilowatt alternator of the revolving-field type have been ordered.

The anuual dinner of the American Institute of Electrical Engineers will be held at Sherry's, New York city, on Monday, February 9th, and will be specifically a "library" dinner. Mr. Andrew Carnegie, who has made a generous donation to the library fund, is to be the guest of honor upon this interesting occasion. The list of speakers will not be long, but will include some very well-known men. The dinner is to be attended by ladies as well as gentlemen. Tickets will be $5 a plate, without wine, and orders should be sent in at once to the secretary at 95 Liberty Street, New York.

SPACE TELEGRAPHY.

Recent experiments on the military railroad between berlin and Zossen, in connection with keeping a moving train in continuous wireless communication with the signal station, are said to have been completely successful. The Braun system was used.

Professor Braun of Strasburg University announces to the Strasburg Scientific Society, according to a Berlin dispatch, that he has discovered a method of producing electric energy of unlimited volume and projecting it into space in the form of electric waves to any desired distance. He thinks he has substantially reached a method of transmitting exclusively to one point of the compass, thus avoiding interference by ether waves.

The American De Forest Wireless Telegraph Company was incorporated on January 5th at Kittery, Maine, with a capitalization of $5,000,000. The company is to operate under the patents of the De Forest Wireless Telegraph Company throughout the United States and Porto Rico. The following is a list of the names of the directors: Lee De Forest of New York, A. White of New York, Ferdinand W. Peck of Chicago, Henry Doscher, C. C. Galbraith, W. N. Harte, and M. M. MacRae of Philadelphia, Clarence G. Tompkins and Dr. Samuel V. Abel of New York.

Last week witnessed the first attempt to supply incoming steamers at Queenstown with news service by space telegraphy. The Reuter's Telegram Company sent 100 words of news through the Marconi Wireless Telegraph Company to the Cunard liner Lucania. The Marconi company at first will only engage to attempt to transmit messages 20 to 30 miles from Brow Head, so the news will only reach the steamer a few hours before her arrival at Queenstown. The company will have a better chance with the Atlantic Transport Line steamers, which pass 20 miles from the Scilly Islands, but reach London 48 hours later.

PUBLICATIONS.

Pass & Seymour of Solvay, N. Y., are distributing their latest illustrated catalogue of electrical specialties. It illustrates porcelain cleats, tubes, knobs, insulators, cut-outs, rosettes, sockets, etc. The illustrations are of a high order of merit.

The Ohio Brass Company of Mansfield, Ohio, is sending out "A Short Story Taken from Life" to show the fine insulating quality of a Dirigo hanger as demonstrated by a recent short-circuit of 1,500 amperes on the Millcreek Valley (Ohio) street railroad.

The Sterling Electrical Manufacturing Company of Warren, Ohio, has just issued a revised copy of its Midnight Sun catalogue, in which it has included many special features which render this booklet a desirable acquisition for any central-station plant, as the pamphlet contains much of interest to lamp users.

Several "flyers" recently issued by the Crocker-Wheeler Company of Ampere, N. J., for insertion in its bulletin files, treat of increased cutting speeds, the company's type-D machine, motor-driven linotype machine, motors for elevator duty, countershaft motors and motor-driven rotary planer, printing presses, grinder and compressor.

The Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., is distributing a 20-page bulletin, No. 1061, which is descriptive of its new line of automobile-charging outfits, including switchboards, motor-generators, and engine-driven sets, etc. Westinghouse, Church, Kerr & Co. have reprinted in pamphlet form, for general distribution, E. H. Sniffin's paper upon "The Steam Turbine," which was read before the American Street Railway Association at Detroit. The booklet may be obtained from any office of Westinghouse, Church, Kerr & Co.

The 1903 catalogue of J. H. Williams & Co., Brooklyn, N. Y., treats of the firm's iron, steel, copper, bronze and aluminum drop-forgings. Several excellent half-tone cuts illustrate special forgings not in stock or for sale, but used to show character of work done only. The catalogue has an artistic colored cover and views of the factory.

A souvenir of an inspection trip made by the American Society of Civil Engineers to the new terminal of the North German Lloyd Steamship Company at Hoboken, N. J., has been issued by the Joseph Dixon Crucible Company of Jersey City, N. J. Several construction views are shown of the structural steel and metal work of the bulkhead buildings and piers, all of which is protected with Dixon's silica-graphite paint.

MISCELLANEOUS.

In the hope of settling the strike of electrical workers against the Robertson Electrical Company of Buffalo, it has been agreed by the union men and employers to settle the differences by means of arbitration.

The Spanish government is installing Westinghouse motors in its gun shops at Trubia, and the Spanish arsenal at Ferrol is also shortly to be equipped with a number of motors and other electrical machinery.

A number of United States letters patent for electrical devices and also the inventions described in several pending applications will be offered by sale by public auction at the Real Estate Exchange, Baltimore, Md., on March 3d. The persons selling the patents are George Whitelock and Arthur Steuart of Baltimore, who have been appointed special masters in the case of Albert H. Henderson against Elias E. Ries, pending in the United States Circuit Court, District of Maryland. The patents and applications are 65 in number and are divided into 13 groups, as follows: Automatic signaling device for railroads, electric welding and tempering, electric riveting, electric soldering, electric heating, induction coils, dynamo-electric machines and motors, overhead conductors for electric railways, brake and traction systems, conduits for electric and cable railways, electric-railway systems, transformer railway systems, induction railway, and apparatus for removing ice and snow from railway tracks.

TRADE NEWS.

The Eastern Electric Contract Company has been incorporated in New Jersey with a capital of $100,000 by Le Grand Bouker, W. Mondo Greene and Charles N. King.

M. P. Kelly of Gainesville, Texas, is said to be in the market for dynamos, incandescent lamps, switchboard, wire, steam engines, pumps, boilers, heater, etc. Immediate shipment is desired.

The Sundh Electric Company of New York city, capitalized at $100,000, was recently incorporated by W. E. Quimby of New York, Austin Colgate of Orange, N. J., and W. J. Tuigue of Greenwich, Conn.

The Cable Joint Company of America of New York city has been incorporated to manufacture cable joints and electrical appliances. Its capital is $12,500, and the directors are J. D. Maguire and W. M. Murphy, New York, and G. F. Valentine, Larchmont, N. Y.

Edward P. Burch, the well-known electrical engineer of Minneapolis, has recently been retained on several exceptionally large electrical installations. Mr. Burch is one of the best-known engineers in the West, and although his headquarters are in Minneapolis, he is called to all parts of the country for his professional services.

The General Electrical Repair Company, Chicago, has been reorganized and changed the name to the Peerless Electric Company. In addition to the general repair work that this company has done for some years, it is building improved motors, ranging from one-fourth to 15 horsepower. Mr. Poelma is manager of the Peerless company.

The International Steam Pump Company states that the growth of the business has so far exceeded expectations, that it has become necessary to enlarge and concentrate existing plants and build new factories to meet changed conditions. The net profits for three years have averaged 6.95 per cent. on the common stock over and above all fixed charges. A tract of land has been purchased, and work begun on a plant at Harrison, N. J., which, it is asserted, will be by far the largest pump works in the world. To provide for these purposes and furnish funds for improvements already made, for which the company has already borrowed $700,000, the directors have authorized an issue of $3,500,000 debentures.

According to La Energia Eléctrica of Madrid, the Hispano-American Electrical Society has been formed by a syndicate of American firms in different branches of the electrical trade, each of which has, for many years past, made a specialty of constructing a certain kind of articles. The journal named (organ of the association "La Industria Eléctrica en Espana") expresses the hope that this may lead to the recent advances of American industry becoming known in Spain, thus giving rise to a powerful development of the industry of that country.

The Allis-Chalmers Company of Chicago is sending to its friends a souvenir that will be valued and preserved. It is a paper-weight made of metal run in the first heat at the new West Allis foundry at Milwaukee. The casting is nickel-plated and neatly lettered, and in it two bronze medallions are inserted, one showing the head of Edwin Reynolds, chief engineer of the company, and the other a view of the West Allis works, designed by Mr. Reynolds.

The Northern Electrical Manufacturing Company, Madison, Wis., is now occupying two wings just added to its works. The wings are occupied by the new power plant, the paint shop, brass-working department, pattern department and boxing department. The power plant occupies the major portion of the large addition and is a new departure; heretofore power and lighting required have been purchased from the local central station. Direct-current motors are used throughout the shops in driving machines and machine tools. Two generating units supply the current. The larger is used for the day load and is a 200-kilowatt Northern dynamo, direct-connected to a 225-horsepower Vilter-Corliss engine. A 50-kilowatt Northern dynamo, direct-connected to a 75-horsepower Ball engine, furnishes power for the night shift. A motor-generator supplies an alternating current for the lighting system.

BUSINESS.

Delivouk & George, Chicago, manufacturers of multipolar dynamos and motors, are distributing to the trade a circular descriptive of their 10-horsepower, direct-current, multipolar motors, for which they lay claim to the greatest efficiency and durability.

E. R. Crolius & Son, 6421 Parnell Avenue, Chicago, report that the demand for their solder is rapidly increasing. The Chicago Edison Company is an extensive user of this solder, and the makers have lately received a large number of orders from the East.

George L. Lindsley, president the Lindsley Brothers Company, Chicago, producer of cedar poles, has left on his annual trip to Washington, Oregon and Idaho, to look after the interests of his company, and to attend the annual meeting of the Lindsley brothers.

The Electric Appliance Company of Chicago, selling agent for Packard incandescent lamps, makes the claim for its factory that, while it is large enough to handle quickly any sized order, it is at the same time small enough to give each order its careful and personal attention.

W. N. Matthews & Bros., St. Louis, announce that they have purchased a large lot of globes of various styles and shapes for Helios, G. I., A.-B. and Wood arc lamps on which attractive prices will be quoted. These globes are said to be as good as new. The firm also has on hand a choice stock of Sterling enclosed-arc lamps.

The Standard Pole and Tie Company of 135 Front Street, New York city, has completed work on its cross-arm mill at Brooksville, Fla., which is situated in Hernando County, in the center of the Florida heart-pine belt. The mill has a capacity of 40,000 feet a day and is equipped to turn out arms of any dimension and bore. Shipments have already been made, and the company is in excellent position to fill all orders and make prompt shipment to any point. All arms turned out are subjected to careful inspection before shipment, and, upon request, samples will gladly be furnished.

The Electric Storage Battery Company of Philadelphia has recently adopted a policy concerning the renewals of plates in Exide batteries which promises to attract the favorable attention of users of electric vehicles in that it reduces to a minimum the cost of these new parts. Information regarding this departure may be secured from any of the sales offices of the company or from the Exide battery depots at Philadelphia, New York, Chicago, St. Louis, Buffalo, Rochester and Detroit. A significant feature of the recent automobile show at Madison Square Garden, New York, was the fact that of the eight manufacturers of electric vehicles exhibiting, six used the Exide batteries.

The Electric Machinery Company of Minneapolis, Minn., manufacturer of direct and alternating-current machinery for lighting and power transmission, reports a flourishing business. The company recently increased its capital stock to $125,000 and has added about $10,000 worth of new machinery. It is now thoroughly equipped to make anything in its line in the shortest possible time and has found it necessary to work its force overtime in order to meet the demand for its products. The company makes machines from one to 500-kilowatt capacity and states that it has nearly 10,000-kilowatt capacity in successful operation. It has received many letters from customers who speak in the highest terms of its machines. The company was established in 1891, and although located in the Northwest, it is filling orders from all parts of the country.

ILLUSTRATED ELECTRICAL PATENT RECORD.

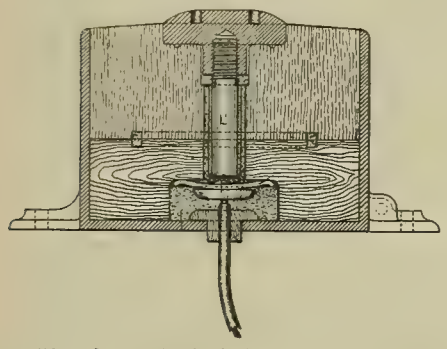
Issued (United States Patent Office) January 27, 1903.

719,003. Surface-contact Structure. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed October 20, 1897. Divided and this application filed March 27, 1901. Renewed April 23, 1902.

A structure for electric railways is described which consists of an insulating block having an upper recess and a vertical groove communicating therewith, a metal bolt in the groove, a metal stud screwed to the upper end of the bolt and resting in the upper recess of the support, and a spring between the head of the bolt and the lower part of the insulating support. (See cut.)

719,005. Tuning Device for Wireless Telegraphy. William S. Hogg, U. S. Navy, assignor of one-half to the Greater New York Security Company, New York, N. Y. Application filed March 4, 1902.

See page 117.



NO. 719,003.—SURFACE CONTACT STRUCTURE.

719,006. Trolley. Andrew J. Johnson, Cleveland, Ohio. Application filed April 14, 1902.

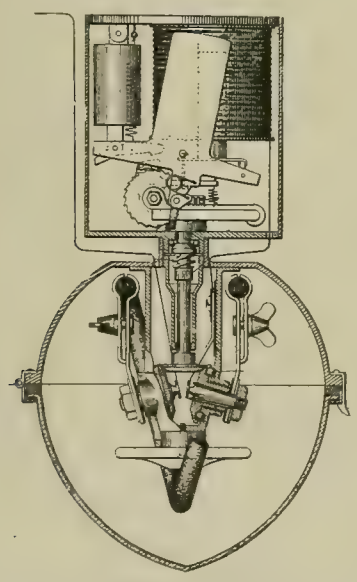
The leverage of the operating arm upon the trolley pole is inversely and proportionately changed by the corresponding movement of the free end of the operating arm along the trolley pole.

719,016. Electric Railway. Martin T. A. Kubierschky, Berlin, Germany. Application filed March 22, 1902.

In a sectional electric railway, combined with the feeder, are sectional conductors, electromagnetic switches for connecting the conductor sections and feeder, and a circuit controlled at each switch, which has two branches, one leading through the car motor to return, and the other leading through the coil of an advance switch and a resistance to return.

719,018. Automatic Electric-circuit Controller. Harry W. Leonard, New York, N. Y. Application filed May 7, 1901.

The circuit controller has a resistance-adjusting switch, an electromagnetic circuit-breaker arm in series therewith, and a hammer-blow arm which upon failure of the supply electromotive force delivers a blow upon the resistance-adjusting arm and moves it so as to insert resistance or to open the circuit.



NO. 719,149.—ARC LAMP.

719,020. Railway Electric Motor-cooling System. Cyprien O. Mailloux and William C. Gotshall, New York, N. Y. Application filed October 6, 1902.

The combination with an electric-railway motor and a source of compressed air carried by a car propelled thereby, of a valve adapted to release and discharge the air from the source into or upon the motor to keep the temperature of the same down, and means for controlling the action of the valve operating periodically and independently of any variations of pressure in the source of compressed air. (See cut.)

719,024. Alternate-current Traction System. William M. Mordey, Westminster, London, England. Application filed November 14, 1902.

719,025. Electric Fuse or Cut-out. Harry L. Morse, Boston, Mass., assignor to the Chase-Shawmut Company, Boston, Mass. Application filed February 24, 1902.

The fuse consists of a shell or case provided with a hole, a fuse-wire contained within it, refractory material contained in the shell or case between the fuse-wire and hole and a removable indicating plug normally held in the hole and adapted to be ejected by an increase of pressure in the shell or case and a foraminous covering for the hole.

719,026. Electric Fuse or Cut-out. Harry L. Morse, Boston, Mass., assignor to the Chase-Shawmut Company, Boston, Mass. Application filed July 25, 1902.

An indicating device at the hole in the shell consists of a piece of flexible material covering the hole and adapted to be protruded therefrom by an increase of pressure in the shell.

719,055. Switch-controlling Apparatus. Charles W. Squires and James B. Squires, Springfield, Mass. Application filed July 2, 1902.

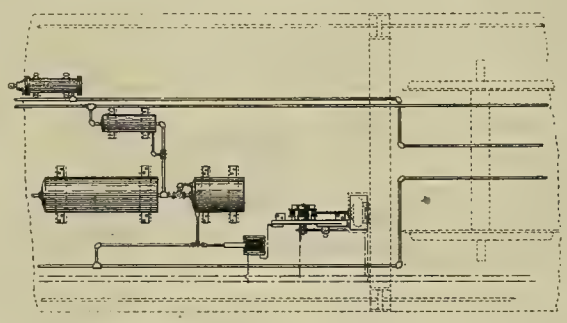
Combined in a railway switch-tongue are an electromagnetic device for throwing the tongue, an electric-circuit conductor leading from a feed-wire to a return wire and comprising in its circuit the coils of the electromagnetic tongue-operating device and also comprising in the circuit an electric-circuit switch, and an electromagnet device for operating the circuit switch.

719,092. Electric Self-playing Piano. George H. Davis, New York, N. Y. Application filed March 22, 1899.

One claim reads: In an electrical self-playing instrument, the combination with a plurality of contacts, of a music-roll holder movable to and from the contacts and carrying a contact-roller adapted to contact with the contacts, and mechanism for feeding the music sheet over the roller, electrically operated mechanism controlled by the music sheet for actuating the key-operating mechanism, and a circuit-breaker operating when the music-roll holder is moved out of operative position to break the circuit controlling the electrically operated mechanism.

719,093. Electrical Self-playing Musical Instrument. George H. Davis, Brooklyn, N. Y. Application filed November 26, 1900.

Electromagnets are used in the operation of the instrument.



NO. 179,020.—RAILWAY MOTOR-COOLING SYSTEM.

719,095. Line-tapping Device for Telegraph or Telephone Circuits. Christian Dietz, Munich, Germany. Application filed August 2, 1902.

Combined with a telescopic tube are a hook secured at the upper end of the same for engagement with the corresponding line-wire, a casing at the lower end of the tube, of a reel within the casing, a flexible conductor arranged to be wound on the reel, and a connecting hook secured to the free end of the flexible conductor and arranged to rest, when not in use, at the upper end of the telescopic tube, the hook being arranged to engage the corresponding line-wire.

719,112. Trolley-wire Support. Ebenezer Hill, South Norwalk, Conn. Application filed May 7, 1902.

A trolley-wire support of uniform cross-section and having a longitudinal enlargement has a hanger with a continuous longitudinal recess and a reduced neck, the recess being adapted to receive the enlargement, the support being continuous to extend between a number of such hangers.

719,114. Elevator. Nelson Hiss, New York, N. Y. Application filed May 22, 1902.

The apparatus consists of hoisting means operated by an electric motor, an electrodynamic brake for the hoisting means, main controllers for the motor and brake, electromagnetic means for operating each of the controllers and a switch adapted to establish operative electric circuits in the main controllers successively.

719,122. Automatic Electric Switch. Walter Lasar, St. Louis, Mo. Application filed February 11, 1902.

The switch comprises a rotatable switchboard, a worm-gear thereon, and a worm operatively connected to the driving mechanism to be actuated thereby. The switchboard has a number of contact plates electrically connected to the several motor circuits, and a pivotally mounted arm having brushes is arranged to co-operate with the plates. Means independent of the driving mechanism are provided for moving the arm independently of the switchboard. The means for moving the arm are arranged to operate several indicators simultaneously.

719,149. Electric Arc Lamp. Albert F. Shore, New York, N. Y., assignor of two-thirds to Daniel N. Hurlbut, New York, N. Y. Application filed January 29, 1900. Renewed July 19, 1902.

Arc-feeding mechanism consists of a solenoid, a plunger working in the solenoid, a weighted rock-lever, a circularly rotating frame attached to the main feeding shaft, and means for rotating the frame by the motion of the rock lever. (See cut.)

719,167. Magneto-electric Machine. James M. Wilson, Battle Creek, Mich. Application filed April 14, 1902.

In the machine combined with an armature adapted to be rotatably oscillated are a spring adapted to rotate the armature in a given direction, a counteracting spring adapted to rotate the armature in the opposite direction, and means for oscillating the armature.

719,180. Electric Car Sign. Irving B. Brower, Philadelphia, Pa. Application filed April 4, 1902.

The sign has a frame adapted to be illuminated, a bracket adapted to support the frame and having a chamber therein, and a resilient piece occupying the chamber and adapted to contact with a conductor on the frame, the piece and the illuminator of the frame being in an electric circuit.

719,182. Hoisting Apparatus. Earl H. Browning and Victor R. Browning, Cleveland, Ohio. Application filed October 4, 1901.

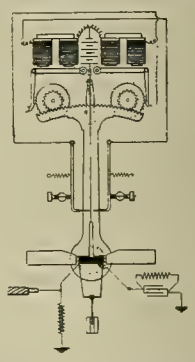
In the apparatus are a drum, a motor, a shaft driven by the motor, a gear-wheel loosely mounted on the shaft, an electric clutch for securing the gear to the shaft, driving connections between the gear and drum, and electric connections for passing a current through the motor and the clutch to start the shaft and simultaneously to clutch the gear thereto.

719,207. Process of Treating Argillaceous and Alkaline Ores. Charles H. Gage, Denver, Colo., assignor to Jesse E. Krepps, Pittsburg, Pa. Application filed October 29, 1901.

The process described consists in subjecting the ores to a bath of hydrocyanic acid, agitating the mixture, then adding a solution of potassium cyanide and agitating until all chemical action ceases, and then separating the precious metals by electrodeposition.

719,219. Telephone System. Wilhelm Höhne, Schöneberg, Germany. Application filed April 17, 1902.

The system has a switch spring-actuated normally into open position, so as to prevent the station at which it is located being connected in parallel with other communicating stations, notwithstanding the switch plug of the station remains in connection with a socket of the switch box.



NO. 719,355.—TELEGRAPH RELAY.

719,265. Electric Socket. Albert P. Seymour, Syracuse, N. Y. Application filed February 10, 1902.

An incandescent-lamp socket is described.

719,315. Storage Battery. Claude H. Everett, Atlanta, Ga. Application filed July 8, 1901.

A positive storage-battery plate consists of the combination of a vertical support, arms extending horizontally therefrom, and corrugated sheet-lead strips, such strips having openings therein in which the arms are adapted to be received, and such strips being secured upon the arms.

719,325. Electromechanical Governor. Elisha Gray, Highland Park, Ill., assignor to the Gray Telephone Company, Waterville, Maine, and Boston, Mass. Application filed November 6, 1899.

719,355. Electric Telegraphy. Alexander Muirhead, Shortlands, England. Application filed August 11, 1902.

Combined in a telegraphic relay are a receiving coil energized by message impulses, an index actuated by the coil, means applied directly to the index independently of the coil to give directive force thereto and further means serving to turn a part of the first-named means to give directive force to the index and thereby correct the "zero" thereof. (See cut.)

719,388. Electric Danger and Safety Signal for Railways. Henry F. Spurr, Jr., Boston, Mass. Application filed April 24, 1902.

Brushes carried by the trains make contact with the block rails. A pair of electric lamps of diverse colors is arranged in the engineer's cab. There are conductors from the lamps through the brushes to the rails, and conductors completing the circuit from the lamps through the body of the engine to the traffic rails of the railway, the danger-signal being given to the engineer when a train is on the next block ahead, two engines never being in the same circuit.

719,390. Electric Time Switch. James J. Stockall, Jr., London, England. Application filed August 2, 1902.

Combined with a switch are two arms, one of which operates the switch one way and the other the other way, a spring for operating the arms when released and cam means controlling the arms, the cam means comprising a pair of cams, two separate spindles therefor upon which the cams are set and a dial and setting-hand for each cam, whereby each may be adjusted to cause the actuation of the arms at the proper moment.

719,405. Appliance for Electrically Operating Vessels and Torpedoes from a Distance. Lida Wilson, Brooklyn, N. Y. Application filed April 21, 1902.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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Electrification of New York Central Railroad Lines in and Near New York City.

By an official bulletin posted February 3d the New York Central and Hudson River Railroad Company gave notice of what will be one of the most important electric-railway conversions ever undertaken by a steam-railroad company. The notice is to the effect that the electrification of the New York Central lines in the city of New York and vicinity will be in charge of a commission consisting of W. J. Wilgus, fifth vice-president of the company, Bion J. Arnold, electrical engineer, of Chicago, Frank J. Sprague, electrical engineer, of New York, George Gibbs, electrical engineer, of New York, and A. M. Waitt, superintendent of motive power of the company. The electrical and mechanical engineering force for carrying on the work will be in charge of Mr. Edwin B. Katté, electrical engineer of the company.

W. J. Wilgus, Fifth Vice-president, New York Central.

Bion J. Arnold, Member of Commission.

Frank J. Sprague, Member of Commission.

The commission for this important work is thus composed of five members—two officers of the railroad company and three consulting engineers, with Mr. Katté associated in the manner indicated. It is composed of strong men, and the best possible solution of the problem presented, in the present state of the art of electric railroading, should be arrived at. The work in hand consists in providing for the electrical operation of trains from the Grand Central Station to Croton Landing, 35 miles out on the Hudson division; from the Grand Central Station to North White Plains, 29 miles out on the Harlem division, and the complete electrification of the Yonkers division (from One-hundred-and-fifty-fifth Street to Yonkers). It will consume several years and must be carried on, of course, without interruption to the enormous volume of traffic daily going and coming into the Grand Central Station (Forty-second Street and Fourth Avenue). When it is completed the passenger service of the New York Central in and near New York will be very greatly improved, and the smoke nuisance in the Fourth Avenue tunnel, which has been a source of public outcry for years, will be entirely done away with. No engineering data of the plant and equipment contemplated are now ready for publication, if, indeed, they have been formulated.

A. M. Waitt, Superintendent of Motive Power, New York Central.

Edwin B. Katté, Electrical Engineer, New York Central.

ELECTRIFICATION OF NEW YORK CENTRAL RAILROAD LINES.

This extensive improvement is undertaken largely on the advice of Mr. B. J. Arnold, who, in August, 1901, was commissioned by the railroad company to study the conditions governing the operation of trains between Mott Haven Junction and Grand Central Station and to report on the feasibility of operating them by electricity. This part of the system is entirely in New York city and only between five and six miles long; it forms the main artery through which the trains from the three divisions of the New York Central and the main line of the New York, New Haven and Hartford railroads enter the city of New York. Nearly 600 train movements are made daily on these congested tracks, which are laid partly on an elevated structure and partly in the tunnel referred to. The electrification which his been decided upon extends to a much greater distance from Grand Central Station, but the most difficult engineering of the problem is to be met with in operating trains in the yards and tracks between Mott Haven and Forty-second Street. In an elaborate and valuable report (Western Electrician of June 28, 1902, pp. 458-460) Mr. Arnold found that while there would be a slight annual saving in operating expenses in favor of electricity, it would not be sufficient to warrant its adoption on the ground of economy alone, although its adoption is justified on other grounds. He recommended, for the section of road under consideration, the direct-current system in combination with the third rail for the main line and overhead construction for the yards.

In addition to the electrical equipments, many other improvements are planned to be carried out at the same time. These include changes and additions in Grand Central Station and its immediate vicinity, elimination of grade crossings in The Bronx, etc. In all, probably over $20,000,000 will be expended on the new work. The agreement by the city is conditioned upon the railroad companies' procuring and aiding the city to procure all legislation necessary to permit the change of motive power from steam to electricity in the Park Avenue tunnel. There is a proviso that in case of an emergency or breakdown through trains only may be temporarily operated by steam, the emergency in each case to be determined by the mayor of the city of New York. In case of a breakdown steam may be used for three days, and after that the railroad company must pay the city $500 a day penalty unless a certificate is obtained from the mayor that the use of steam is further justified. The agreement declares that no power house shall be situated on Manhattan Island more than two blocks from the water front, except with the consent of the Board of Estimate.

William J. Wilgus, recently appointed fifth vice-president of the New York Central and Hudson River Railroad Company, is a native of Buffalo, where he was born in 1865. He is an engineer, and his railroad service dates from 1885, beginning with western roads. In 1891 he was resident engineer of the Chicago Union Transfer Railway Company. Mr. Wilgus' connection with the New York Central dates from 1893, when he began as assistant engineer of maintenance of way on the Rome, Watertown and Ogdensburg (New York Central system). He has held the positions of chief engineer of the Terminal Railway of Buffalo, resident engineer of the eastern division, chief assistant engineer all lines, engineer of maintenance of way and chief engineer. Mr. Wilgus is a member of the American Society of Civil Engineers, and is an engineer of high professional attainments.

Bion J. Arnold, second on the list of commissioners, needs no introduction to the readers of an electrical journal like the Western Electrician. He is one of the most prominent electrical engineers of the country, having paid especial attention to electrical railroading. He was born in Grand Rapids, Mich., in 1861, but spent his boyhood in Nebraska, whence his parents removed when he was a small child. He obtained his education in the schools

of Ashland, Neb., the University of Nebraska, Hillsdale College and Cornell University. The degree of E. E. was conferred upon him by the University of Nebraska in 1897. Mr. Arnold has had a truly varied experience. With natural ability of a high order, he has raised himself to his present position in his profession by the thoroughness of his work and the manliness of his character. Since 1891 he has been a resident of Chicago. He designed the power house of the Intramural elevated electric railway at the Chicago World's Fair. He has invented a power-station system, a magnetic clutch and an electro-pneumatic railway system of great promise. In this very brief sketch space is not available for a list of Mr. Arnold's achievements. He was retained by the New York Central, as related above, and his remarkable work as consulting traction engineer for the city of Chicago, culminating in a very comprehensive and valuable report, is still fresh in the minds of all readers of this journal. Mr. Arnold is a member of several technical societies, among others the American Institute of Electrical Engineers, of which he is a vice-president. In 1900 Mr. Arnold, with others, represented the Institute at the International Electrical Congress at the Paris Exposition.

Frank J. Sprague has gained well-earned distinction by his work in developing the electric railway. He is one of the best-known electrical engineers in the country, and in 1892-93 was president of the American Institute of Electrical Engineers. He was in earlier life an officer in the United States Navy, but about 1884 resigned to engage in electrical work. It has been truly said that "no man in the electrical field has worked harder and accomplished more in the face of what at times appeared to be insurmountable obstacles than Lieutenant Sprague." He was born in Milford, Conn., in 1857, and graduated from Annapolis in 1878. He became famous by his work in designing and operating the pioneer electric railway in Richmond, Va., in 1887. By Mr. Sprague's ability, zeal and energy all obstacles were finally overcome, and the first electric railway in the United States became a success. It was followed by a great boom in electric-railway building, and Mr. Sprague's fortune was made. Since those days the inventor has not been idle. He has made a study of the application of electric power to traction conditions in New York city, where he lives, and has designed and perfected the well-known multiple-unit system of train control bearing his name.

George Gibbs is the first vice-president of Westinghouse, Church, Kerr & Co. of New York. He is an able engineer and is well known in the West through his connection with the old Gibbs Electric Company of Milwaukee, of which he was president. For several years, however, Mr. Gibbs has been connected with the Westinghouse interests, by which the Gibbs company was absorbed. Mr. Gibbs has had valuable railroad experience. He was at one time electrical and mechanical engineer of the Chicago, Milwaukee and St. Paul Railway Company, has been connected with the Baldwin-Westinghouse electric-locomotive work, and is in charge of mechanical engineering, electric locomotives and traction for the Pennsylvania Railroad Company's great tunnel and terminal project in New York city. An effort was made to secure Mr. Gibbs' portrait, to make the accompanying group complete, but without success.

Arthur M. Waitt, superintendent of motive power of the New York Central, was born in 1858 in Boston. He graduated from the Massachusetts Institute of Technology with the degree of mechanical engineer. He has been engaged in railroad work since 1879. In 1899 he went to the New York Central as superintendent of motive power and rolling stock, having been previously general master car builder of the Lake Shore and Michigan Southern. In 1901-1902 Mr. Waitt was president of the American Railway Master Mechanics' Association.

Edwin B. Katté, the recently appointed electrical engineer of the New York Central, is a young man who bears a patronymic well known to engineers. He was formerly assistant engineer under Mr. Wilgus. He will have charge of the electrical and mechanical engineering force for carrying on the work of electrification.

An estimate of the waterpower used for generating electricity recently made by a German engineer shows that Germany and Austria utilize 180,000 horsepower; Switzerland, about 160,000; Sweden, 200,000, and the United States, 400,000. The total available power in Sweden is placed at 2,000,000 horsepower; that of France at 10,000,000; that of Germany, Austria, Switzerland and Italy together at 10,000,000; while in the United States Niagara alone could furnish 10,000,000.

Power Required to Drive Machine Tools in Locomotive Shops at Du Bois, Pa.

Some interesting tests were recently made in the locomotive shops of the Buffalo, Rochester and Pittsburg Railway at Du Bois, Pa., with the purpose of ascertaining the amount of power used by various machine tools when operating in regular routine work, and at the same time the power lost in shafting and belting in a group-driven system. The plant consists of five buildings, viz., the power house, a building containing the locomotive-erecting, boiler and machine shops, the roundhouse, the blacksmith house and the storehouse and offices. These buildings are located on a plat of ground 32 acres in extent, and the equipment is intended to handle the repairs of about 150 locomotives, with provision for an increase of 75 engines, which is expected to cover about five years, making an estimated ultimate total of 17 engines per month.

The power plant, which is located in a separate building, is designed for the transmission of power by electricity and compressed air, and furnishes all power needed for driving the machinery, lighting the shops, grounds, a large car-building plant and neighboring stations, and the further supply of steam for heating the buildings. All pipes and wires pass from the power house to the several buildings through underground galleries. The boiler equipment comprises four 200-horsepower water-tube boilers, the furnaces of which are hand-fired.

The engine room (Fig. 1) contains three generating units. A 200-horsepower compound engine direct-connected to a 125-kilowatt, direct-current, compound-wound generator, operating at 250 volts and 280 revolutions per minute, carries the day load and supplies power for machine tools, cranes, lighting, etc. A 100-horsepower simple engine, belt-connected to a 75-kilowatt, direct-current, compound-wound generator, operating at 250 volts and 750 revolutions per minute, carries the night load and supplies power for lighting, motor driving for special night work and the turntable. The night and day-load generators are interchangeable at the switchboard. A 100-horsepower, simple engine, belt-connected to a 60-kilowatt, two-phase, alternating-current generator, operating at 2,200 volts, 7,200 alternations and 900 revolutions per minute, furnishes power for lighting the yards, the Falls Creek station, the passenger and freight stations at Du Bois and the Du Bois car shops. A 2½-horsepower exciter operating at 125 volts and 180 revolutions per minute, supplies the alternator. These engines and generators are of the Westinghouse make. A standard marble switchboard (Fig. 2) is installed, and an Ingersoll-Sergeant, steam-driven compressor furnishes compressed air for the plant.

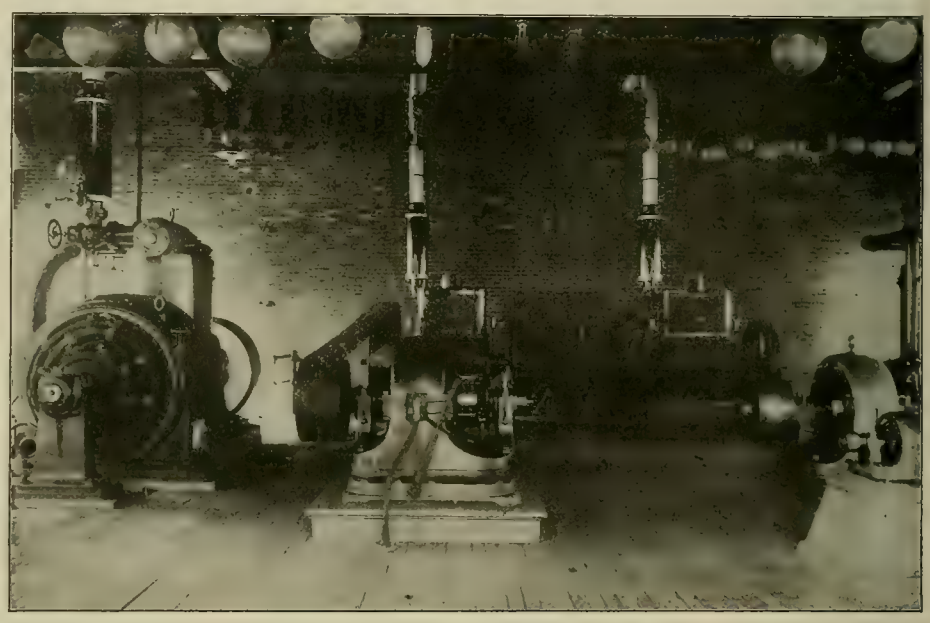


FIG. 1. POWER PLANT OF LOCOMOTIVE SHOPS AT DU BOIS, PA.

The results of the tests are given below, the net power consumed by each tool or group of tools being stated. It is to be noted in reading these results that the net power consumed by the several tools and by the line shafting was not obtained directly, but by subtraction. All measurements were made by means of a voltmeter and an ammeter in the motor circuit. These indicated the electrical horsepower delivered to the motor. The brake horsepower delivered by the motor at any given load was then determined by means of the motor-efficiency curve. The tests were made while the shops were in full daily operation, and it was for that reason impossible in many cases to make as direct measurements as might seem desirable.

These tests, in addition to furnishing accurate data relating to the power required for various tools when starting, running light and cutting, also make possible some estimation of the merits of roller bearings for shaft hangers. The line shafts are cold-rolled steel and are carried on Hyatt roller bearings, and a shaft 200 feet long without belts could be turned by hand. But in spite of the unusual efficiency of the bearings, it will be noted that the power consumed by the tool is often less than that lost in transmission. Nevertheless, the capacity in motors required for the group drive is two to 2½ times smaller than it would have been had each tool been provided with an individual motor.

The locomotive-erecting, boiler and machine shop consists of a middle aisle for erecting and two shed bays equipped with shafting for driving the machine tools. Two 50-ton, electric traveling cranes have a runway in the middle aisle. There are five lines of shafting driven by five shunt motors in the shed bays, and the sections are designated as wheel section and boiler section in one bay, and lathe, tool and flue sections in the opposite bays.

Wheel Section (Fig. 3).—Shafting driven by a 40-horsepower, shunt-wound motor and operating boring mills, lathes, etc. The line shaft is 200 feet long, 2½ inches in diameter, and has 26 hangers. It was inconvenient in this instance to obtain a test of the line shaft alone. A test of the line shaft and counters only gave 1.5 horsepower.

A 15-minute test was made of a group of machines comprising a 72-inch and a 66-inch wheel lathe, each with two cuts, a wheel press operated at 50 tons, and an 84-inch Niles boring mill, a band-saw belt, an emery wheel, a Pond radial drill, and a 60-inch planer with one tooth cutting cast iron, with an average result of 4.6 horsepower, a minimum of 0.88 horsepower and a maximum of 10.43 horsepower. The speed of the line shaft was 160 revolutions per minute.

Tests of single machines were made; that is, of the power consumed by the one machine tool thrown in at a time. A 42-inch wheel lathe, with one tool cutting, took on starting up 4.6 horsepower, and on steady running 0.5 horsepower; an emery wheel took 0.7 horsepower; a 79-inch wheel lathe, with two tools making roughing cuts on a pair of drivers, took four horsepower; an 84-inch boring mill, boring an eight-inch cylinder, took two horsepower; a 60-inch planer, cutting a cast-iron cylinder, took two horsepower, and a maximum at reversal of 8.5 horsepower; an 18-inch slotter, with tools of three-fourths-inch face, cutting steel, took 0.3 horsepower, and a maximum at reversal of 1.2 horsepower; a band saw starting up took 6.3 horsepower and running light or cutting four inches took four horsepower; a group run of an 84-inch boring mill, a 79-inch wheel lathe, a six-foot radial drill, a 60-inch planer and an 18-inch slotter gave at steady running 6.9 horsepower, and with the planer at reversal took 14 horsepower.

Boiler Section.—Shafting driven by a 30-horsepower shunt-wound motor and operating bending rolls, punches, etc. All the counter-belts were

thrown off and the line shaft tested alone, with a result of 0.3 horsepower. This line shaft is 170 feet long, 2½ inches in diameter and has 19 hangers. The speed of the line shaft was 158 revolutions per minute. A test of the line shaft and countershafts only gave an average of two horsepower.

The machines comprising the first group tested were a stay-bolt cutter and a bolt cutter, a No. 4 Hilles & Jones punch and shear. The No. 4 punch and shear was punching thirteen thirty-seconds-inch

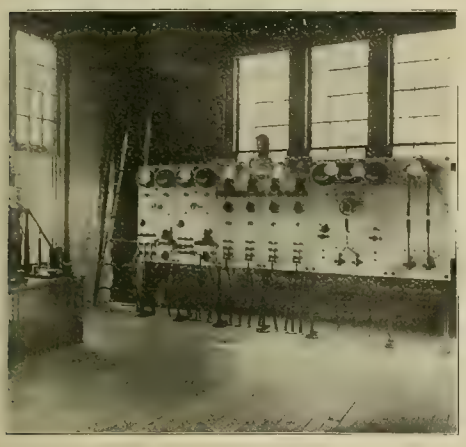


FIG. 2. SWITCHBOARD OF POWER PLANT AT DU BOIS LOCOMOTIVE SHOPS.

holes in three-sixteenths-inch steel plate. A 15-minute test showed an average of one horsepower, with a minimum of 0.2 horsepower and a maximum of 3.5 horsepower. A single tool, a No. 4 Hilles & Jones 48-inch punch and shear was then thrown in, and starting up light took 6.9 horsepower, settling down to 0.4 horsepower. Shearing five-sixteenths-inch steel plate, it required three horsepower. A six-foot radial drill was then added, and at starting up light took 3.6 horsepower, settling down to 1.1 horsepower. A 1½-inch drill cutting in steel gave 1.5 horsepower. A six-foot radial drill and bolt cutter required 1.1 horsepower.

The 12-foot bending rolls were then added and starting up light showed 7.3 horsepower, settling down to 4.75 horsepower. Rolling steel plates, one-half by eight inches, required 5.3 horsepower. A test of line shaft and counters with the six-foot radial drill cutting steel with 1½-inch drill, and a punch and shear running light showed two horsepower. A one-inch stay-bolt cutter added to the above took on starting up 4.5 horsepower, and cutting 12 threads per inch gave 2.1 horsepower.

Lathe Section (Fig. 4).—Shafting driven by a 30-horsepower, shunt-wound motor and operating miscellaneous machinery. The line shaft and counters gave 4.1 horsepower. A test of the line shaft with counterbelts off gave 0.7 horsepower. The speed of the line shaft was 155 revolutions per minute. The line shaft is 180 feet long, 2½ inches in diameter and has 22 hangers.

A 15-minute test was made of a group of machines comprising two 26-inch planers and one 36-inch

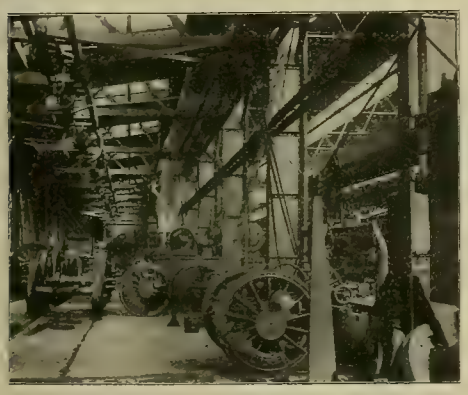


FIG. 3. WHEEL SECTION OF DU BOIS LOCOMOTIVE SHOPS.

planer, cutting steel with one tool each, a turret lathe, an emery wheel, three 16-inch lathes, two 22-inch lathes, a 36-inch boring mill, drill press and a shaper, all in operation. The readings gave an average result of 6.9 horsepower, a minimum of 4.74 horsepower and a maximum of 15 horsepower.

A single 26-inch planer cutting cast-iron took one horsepower, and at reversal 3.5 horsepower. A 16-inch shaper cutting one thirty-second-inch steel at 12-inch stroke took 0.9 horsepower, with a minimum of 0.2 horsepower and a maximum of 1.4 horsepower. A 24-inch turret-lathe cutting required 0.3 horsepower. A 24-inch lathe boring brass took 0.03 horsepower.

Tool Section.—Shafting driven by a 20-horsepower, shunt-wound motor and operating machine tools. The line shaft and counters required 2.8 horsepower. The line shaft is 140 feet long, 2½ inches in diameter, and has 20 hangers. It was not convenient to obtain a test of the line shaft alone. The speed of the line shaft was 155 revolutions per minute. The line shafts of the lathe and tool sections can be connected by a clutch coupling, and the whole operated from either motor.

A group test was made of a 16-inch lathe, a drill press and a grinder, all in operation, with a result of 1.9 horsepower. A single grinder took in starting up 9.7 horsepower, and grinding, 1.95 horsepower. A 28-inch lathe took on starting 4.7 horsepower, and cutting steel 2.5 horsepower. A group run of two 16-inch lathes, a shaper, and two grinders in operation showed 2.5 horsepower.

Flue Section.—Shafting driven by 10-horsepower, shunt-wound motor. A test of the line shaft with all counters gave 0.6 horsepower. A test of the line shaft gave 0.035 horsepower. The line shaft is 90 feet long, 2½ inches in diameter, and has 12 hangers. A single flue welder with blowing fan attached required on starting up 7.1 horsepower. Running light it took 3.4 horsepower. The pipe cutter, cutting 2½-inch pipe, took 0.06 horsepower. The auto-flue cleaner, cleaning two-inch flue, took 0.2 horsepower.

Blacksmith Shop.—The blacksmith shop is driven by a 40-horsepower, shunt-wound motor, which is belted to 75 feet of 2½-inch line shafting with 12 hangers. A test of the line shaft and counters with grindstone and two blowers constantly in operation gave 14.5 horsepower. The bolt header, added to the above, gave on starting 7.8 horsepower, running light 0.5 horsepower, and heading one-inch bolts 3.5 horsepower. A No. 2 Hilles & Jones punch and

FIG. 4. LATHE SECTION OF DU BOIS LOCOMOTIVE SHOPS.

shear added to the above, first condition, gave on starting up 5.5 horsepower, running light 0.5 horsepower, and shearing 1½-inch round bar 4.3 horsepower.

Turntable.—The turntable is 70 feet long and is operated by a 10-horsepower, direct-current motor of the street-railway type, geared to an independent traction wheel, the driving combination being supported in a pivoted frame, or "donkey," which rests with all its weight upon the turntable track, even when the table is tipped by a locomotive. The power is led to the motor through a sliding contact placed on the bridge above the center of the turntable. With the table running light and the controller on full, a test gave 4.45 horsepower. In throwing on the controller and accelerating up to full speed five horsepower was attained, which dropped to a constant of 4.45 horsepower. With a class S-2 locomotive on the table, weighing with tender approximately 286,000 pounds, a test gave 7.35 horsepower when accelerating to full speed. When full speed was attained, the test showed 5.43 horsepower.

Power House.—Switchboard readings of the ammeter and voltmeter were taken every five minutes from 1 p. m. to 5:30 p. m., with averages of 220 volts and 250.7 amperes, or 73.8 horsepower. The minimum current was 200 amperes, or 59 horsepower, and maximum current 300 amperes, or 88.5 horsepower, the average of which is 250 amperes, or 73.75 horsepower.

These tests were carried out by H. M. Palmer and George H. Gibson of the Westinghouse Electric and Manufacturing Company, and were made possible by the courtesy and permission of F. T. Hyndman, master mechanic, and the kind assistance of C. D. McArthur, chief draftsman of the Buffalo, Rochester and Pittsburg Railway Company.

Mr. Carnegie the Guest of the Institute.

[Special dispatch to the Western Electrician.]

New York, February 10.—Andrew Carnegie, who apparently enjoys, among his other distinctions, that of being the only old-time telegrapher who trembles at the thought of dying rich, was the guest of honor last night at the "Library" dinner of the American Institute of Electrical Engineers at Sherry's. Mr. Carnegie was in reminiscent vein, and in his speech indulged in some interesting recollections of his experiences in telegraphy, with Edison and Barclay, who were present, "before there were any electrical engineers," as he expressed it. The dinner was well attended and fully as successful as last year's affair in honor of Marconi. More than 250 members and guests, men and women, were present. The large ballroom was brilliantly decorated with festooned strings of vari-colored lights, while above the speaker's table was the "kite" emblem of the Institute, outlined in incandescents and flanked by the figures "73," the telegraphic "glad hand," to refresh Mr. Carnegie's memory.

Dr. S. S. Wheeler, the donor to the Institute of the Latimer Clark library, for the housing and cataloguing of which Mr. Carnegie gave $7,000, was seated at the left of President Scott, who had Mr. Carnegie at his right. The covers of the menus were facsimiles of the cover of the oldest book in the collection—that of Albertus Magnus, dated 1494.

Mr. Scott opened the speechmaking. His address was mainly a plea for co-operation on the part of the engineering societies. In part he said: "We are looking forward to the time when we may have a building which will be suited to the dignity and the demands of our society. I am among those who constitute, I believe, a large and growing number among the engineers in the national societies whose ideal is a magnificent engineering building, giving adequate accommodations to many societies, where each may have the individual facilities which will enable it to carry on its own particular work most advantageously, with those common facilities such as a large assembly hall and reception room, and a general library which will be of the greatest common advantage and benefit. It is of inestimable consequence that every means should be afforded for increasing the effectiveness and the efficiency of the engineering profession. As electricity has been a unifying element in modern affairs, so likewise may not the electrical engineer be a unifying agent among the engineering professions? Let the spirit of the American Institute of Electrical Engineers be not isolation, but co-operation."

Mr. Carnegie was warmly greeted by the engineers when he arose to speak on his pet subject, "Libraries." Like all good after-dinner speakers he avoided his text and fell to giving reminiscences with pleasure alike to himself and his hearers. He spoke of his transfer from the steam engine to the telegraph key as his first glimpse of Paradise. "When I first became able to touch that instrument," he said, "and, pounding the key, call up New Orleans—I had been practicing surreptitiously before the operator came in the morning, receiving the princely salary of $25 a month—I said to myself: 'This is what Swedenborg said about heaven; space was annihilated.' So when I see Mr. Edison and others, then I think, 'Why, boys, you're a new generation, but, knowing what you do, no fond father was ever prouder of his boys than we are—Edison, Barclay and I.'

"The American in my experience is the most co-operative man that exists to-day. There is this about an American, of all men, that he's fair-minded; he doesn't want to overreach himself; he's not implacable. I think he's placable. He doesn't want to make enemies. It is institutions like this that do so much for him."

The other speakers were Dr. S. S. Wheeler, R. R. Bowker, Dr. John S. Billings, Theodore L. De Vinne and Dr. J. C. Bayles.

Among those seated at the various tables were F. R. Anson, Mrs. F. R. Anson, Henry Abbott, Miss Abbott, Sidney W. Ashe, Miss Imogene Ashe, G. F. Archer, W. C. Andrews, Sydney Aylmer-Small, W. Hand Browne, W. S. Barstow, Mrs. W. S. Barstow, F. C. Bates, E. V. Baillard, Douglas Burnett, H. H. Barnes, Jr., Alonzo C. Bell, Charles T. Bell, Joseph Bijur, T. E. Crossman, Mrs. T. E. Crossman, Alexander Churchward, Fred Darlington, Mrs. Fred Darlington, Charles Day, Kern Dodge, Patrick B. Delaney, Mrs. Patrick B. Delany, Theodore Dwight, C. A. Dresser, Thomas A. Edison, Mrs. Thomas A. Edison, C. V. Edwards, Mrs. C. V. Edwards, C. J. Field, Henry W. Fisher, R. A. Flies, W. E. Goldsborough, Mrs. W. E. Goldsborough, George H. Gay, Wilson S. Howell, Miss Howell, J. C. Hatzel, F. B. Herzog, George A. Hamilton, H. C. Hall, W. J. Hammer, Mrs. W. J. Hammer, T. W. Henry, George L. Hoxie, F. V. Henshaw, George Hays, R. H. Johnston, Francis E.

Jackson, W. H. Kenyon, Mrs. Kerr, A. A. Knudson, Mrs. A. A. Knudson, Max Loewenthal, Mrs. Max Loewenthal, Henry A. Lardner, Mrs. Henry A. Lardner, F. P. Lupke, R. W. Lohman, Miss Levy, E. L. Morley, T. C. Martin, Mrs. T. C. Martin, W. A. M. McClurg, Mrs. W. A. M. McClurg, J. J. Mahony, C. O. Mailloux, E. H. Mullin, Mrs. E. H. Mullin, L. B. Marks, Walter H. Miller, Max Osterberg, E. E. Olcott, L. A. Phillips, Louis M. Potts, F. D. W. Paine, Charles W. Price, Frank A. Pattison, E. L. Phillips, R. W. Pope, Mrs. R. W. Pope, A. Parshall, N. M. Ryerson,, David B. Rushmore, Robert Rafu, G. A. Rogers, Dr. Rees, Edward F. Schmuck, Samuel Sheldon, Mrs. Samuel Sheldon, Jesse M. Smith, Fred. A. Scheffler, Mrs. Fred. A. Scheffler, William Stanley, Lambert Schmidt, Philip K. Stern, Angus Sinclair, Albert Taylor, Calvert Townley, Charles A. Terry, Mrs. Charles A. Terry, H. W. Weller, Merle J. Wightman, Mrs. Merle J. Wightman, Alfred K. Warren, Mrs. Alfred K. Warren, Stuart Wilder, Joseph Wetzler, Mrs. Joseph Wetzler, Miss J. E. Young, C. G. Young, E. L. Zalinsky. P.

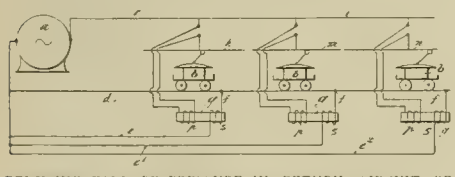
Reducing Fall of Pressure in Return Circuit of Alternating-current Railways.

A method for diverting the return current of alternating-current railway lines from the return rail or conductor into return feeder conductors, thus reducing or avoiding fall of pressure in the return circuit is the object of a patent recently taken out in the United States by William M. Mordey of Westminster, London, England. For this purpose the current in the outgoing conductor is passed through a winding of a transformer, the return current passing in the opposite direction through another winding on the same transformer. By this means fall of pressure in the return main or feeder is reduced without practically affecting the pressure of the motors or of the circuit as a whole. The transformer may be placed at the generating or transforming station or at any convenient point on the line. By suitably arranging the windings, any desired transfer of pressure to the return circuit may be obtained.

The invention is applicable to single or multiphase systems of electric railways or tramways, and in the accompanying illustrative drawing is shown diagrammatically one way of applying the invention to a single-phase electric railway for long lines.

Referring to the drawing, (a) is a single-phase alternator supplying alternating current to a car or train (b), or it may be to two or more cars or trains. The outgoing current is conveyed by a trolley line or other insulated conductor (c), from which it passes to the car (b), on which it passes through the motor or motors used for propelling purposes or through static or rotary converters or motor-generators or other apparatus in which the alternating current is utilized or transformed, the current then passing to the return conductor (d), which may be the uninsulated rails or any other conductor wholly or partly insulated.

An insulated return feeder (e) is led from a point (f) of the return rail or other conductor (d) back to the alternator (a). A transformer (g) has a laminated iron core, provided with two windings (p) and (s), that are connected up in the circuit in the manner shown, the outgoing current passing from one pole of the generator (a) through winding (p) to the trolley line (c), and the current returning to the other terminal of the generator (a),



REDUCING FALL OF PRESSURE IN RETURN CIRCUIT OF ALTERNATING-CURRENT RAILWAYS.

partly by the return conductor (d) and partly by the return feeder (e) and the winding (s).

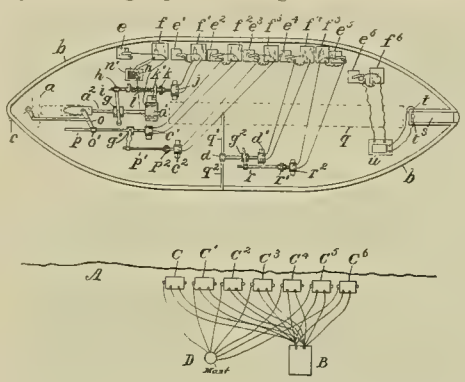
It will be seen that the current traverses the windings (p) and (s) in opposite directions and that the current in winding (p) is larger than that in winding (s) by the amount which directly returns to the terminal by way of return conductor (d). The effect of this arrangement is that the return current, or a large proportion of the return current, is withdrawn from the return conductor (d) at the point (f) by reason of the volts impressed on the winding (s). Thus, the difference in pressure between (f) and the generator terminal will be reduced. The assisting electromotive force thus impressed on the return feeder circuit (e) by the winding (s) is transferred from the other end of the circuit, a corresponding back electromotive force being set up in winding (p). The total pressure of the circuit, and also the pressure applied to the motors or other electric translating devices on the car or train, is not affected by this arrangement except to the small extent due to the loss in the transformer (g). The effect is only to alter the distribution of the fall of pressure, removing it from the return circuit, where it is objectionable, to the outgoing circuit, where it it is much less objectionable. The amount of this transfer of pressure may be adjusted by suitable construction of the transformer (g) to reduce the difference of pressure between (f) and the generator terminal to any desired extent.

The arrangement is said to be practically self-regulating—that is to say, the electromotive force added to the return feeder (e) by the winding (s) tends to be proportional to the current. For long lines the trolley or distributing line may be in several sections, as shown in the drawing, where the main outgoing line (c) is tapped off at intervals to supply the sectional lines (k) (m) (n), which are connected to the line (c) through separate transformers (g), constructed with two windings (p) (s), the winding (p) being inserted between (c) and (k), (m) or (n), and the winding (s) being connected in the return feeder circuit (e), (e′), or (e^2), as shown.

Torpedo Boat Controlled by Wireless Transmission.

An ingenious use of space telegraphy is made in an invention recently patented by Lida Wilson of Brooklyn, N. Y. The invention is entitled an "Appliance for Electrically Operating Vessels and Torpedoes from a Distance," and is said to be especially useful in its application to the operation of torpedoes and marine vessels, whether for surface or submarine navigation.

"The mechanical operations," says the inventor, "may be of various kinds—as, for instance, the operation of machinery upon a vessel for the purpose of propelling and directing such vessel and to perform various other functions, also mechanism for closing an electric circuit to ignite a torpedo or explosive charge upon a floating vessel or in a sub-



TORPEDO BOAT CONTROLLED BY WIRELESS TRANSMISSION.

aqueous or subterraneous mine. The impulse transmitted to a wireless receiver of electricity would in such case be used to initiate the operation of the electric circuit required to produce the igniting spark. The wireless transmitter, attuned to operate in unison with such wireless receiver, may be upon a floating vessel or upon land.

"Where a number of mechanical operations are to be performed, a series of the wireless receivers may be employed to initiate the movements of the several mechanisms, and a corresponding series of wireless transmitters, each synchronized and attuned in unison with one of the wireless receivers, would be used to initiate such mechanical operations independently, so that each receiver can only be influenced by a transmitter attuned in sympathy with it. In many cases the various mechanisms may be advantageously actuated each by an electric motor and storage battery carried upon the vessel, and the movement of each motor and the resulting operation is initiated by means connected with the wireless receiver of electricity upon the vessel. The ignition of an explosive charge, whether upon a craft, torpedo, or in a mine, is correspondingly effected by the use of a wireless receiver to close an electric circuit and direct a spark into the charge to explode the same. A series of motors to perform different functions upon the same craft may be set in operation by a series of wireless receivers constructed or attuned differently one from another, but each adapted to operate sympathetically synchronously in unison with a special one of a corresponding series of wireless transmitters located at the same or at different distance stations, so that each receiver can only be influenced by a transmitter attuned in sympathy with it. The transmitters may be connected electrically with a kite or mast, which may be placed vertically, inclined, or horizontally."

The invention is illustrated in a diagrammatic form in the annexed drawing, which represents a sectional plan of a submarine boat resting upon the water, and a portion of the adjacent shore fitted with apparatus for a transmitting station. The transmitting station is designated by (A). (B) is a generator connected with a series of wireless-electricity transmitters, designated (C) (C′) (C^2) (C^3) (C^4) (C^5) (C^6), and each of the transmitters is connected with a mast (D). The submarine boat (b) is shown provided with propeller (a), driven by electric motor (a′), a rudder (c), moved by motor (c′) and a ballast-shifter (d), actuated by the motor (d′). A series of wireless-electricity receivers (e) (e′) (e^2) (e^3) (e^4) (e^5) (e^6) is shown upon the boat and a series of storage batteries (f) (f′) (f^2) (f^3) (f^4) (f^5) (f^6).

The motor (a′) is connected with the storage battery (f) by circuit wires and a switch (n), the latter being normally open and closed by an electromagnet (n′), which magnet is in circuit with the battery (f) with a switch upon the wireless receiver (e). The wireless transmitter (C) and the wireless receiver (e) may be sympathetically synchronized, so that the one may actuate the other, and an impulse sent by the transmitter (C) may therefore operate the receiver (e) and close the switch in the circuit of the magnet (n′). This switch may be made of delicate construction and operate to close the switch (n), which may be made of larger parts and contacting surfaces adapted to carry a heavy current to operate the motor (a′), and thus rotate the propeller wheel (a) when desired.

A reversing gear represented by a casing (g) is driven by a reversing motor (j). The reversing motor (j) is shown in circuit with the battery (f′) and a switch actuated by the wireless receiver (e′), and such receiver (e′) may be constructed to operate sympathetically synchronously with the transmitter (C′), so that the reversing motor (j) may be started by operating such transmitter (C′).

The rudder (c) is similarly actuated by a steering motor (c′) and a reversing gear (g′) connected to a reversing motor (c^2). The steering motor (c′) is in circuit with the battery (f^2) and the wireless receiver (e^2), and a switch actuated by the wireless receiver (e^2), which would be sympathetically synchronized with the transmitter (C^2), operates to connect the steering motor (c′) with the battery and to rotate the screw (p). The reversing motor (c^2) for the steering gear is shown in circuit with the battery (f^3) and the wireless receiver (e^3), and a switch actuated by such wireless receiver serves to start the motor (c^2) when required to move the lever of the rudder-reversing gear (g′).

The drawing represents a submarine boat, and the means for shifting the ballast is represented diagrammatically by a water tank (q) and a rotary pump (d) (as of the double rotary-piston type), adapted to propel the water in either direction in which its pistons are rotated. A motor (d′) to rotate the pump pistons is shown in circuit with the battery (f^4) and a switch upon the wireless receiver (e^4), and the actuation of the switch by the wireless receiver when influenced by the wireless transmitter (C^4) serves to connect the ballast motor with the battery, and is reversed by (C^5).

A charge (s) of explosive material in a tube in the bow of the boat and spark wires (t) conducted from an induction coil (u) to the base of the charge, to ignite and explode the same, are operated by (f^6), (e^6) and (C^6).

"The vessel thus equipped," says the inventor, "constitutes a wirelessly electrically controlled torpedo, which may be directed and controlled from the wireless-electric-transmitting station by a knowledge of the range, accurate timing of the transmission for each part and function of the run, an accurate knowledge of the speed, steering, raising and sinking effects produced by the several motors during the different periods of time during which the corresponding electric impulses are transmitted wirelessly. By carefully recording or charting these during a run the position of the vessel from time to time may be known throughout the run by the operators at the transmitting station or stations."

Another Municipal-ownership Setback.

Sealed proposals will be received until 6 p. m. on February 16th, by the city clerk of the city of Dexter, Mo., for the sale of the electric-light plant now operated by that city. Bids will also be taken for furnishing the city with from six to 12 arc lights and 15 clusters (three to a cluster) of 32-candlepower incandescent lamps. A liberal 20-year franchise will be given to a purchaser of the plant. B. F. Metz is the city clerk.

A royal commission has been appointed in England to inquire into the question of location and transport needs of London and the desirability of establishing some authority or tribunal to which all schemes of railway and street-car line construction should be referred. Sir David Balfour is appointed chairman of the commission, which includes among its members Earl Cawdor, Sir John Wolfe-Barry and a dozen other prominent men.

Gray Electromechanical Governor.

A United States patent has recently been issued for an electromechanical steam governor, invented by the late Elisha Gray, which is a valuable application of the governor device described in another patent for transmission of sound. The invention in question, as shown in Fig. 1, is adapted to regulate automatically the flow of steam or other power through a pipe by means of a valve in the pipe, which is operated by the governor to maintain a practically uniform or constant flow of steam through the pipe at the pressure required for actuating uniformly an engine or motor.

In the drawings (L) is a steam valve of ordinary construction, arranged so that it is balanced when under steam or other pressure. It may be the main operative valve or it may be an auxiliary or supplemental valve. It is represented as provided with movements which open and close or partially open and close the passage in the valve by the solenoids (P) (P′), which are adapted to be electrically energized, and are alternately operated upon the valve stem or rod (M) through the lever (N). The solenoids are arranged one on each side of the lever at or near its outer end, sufficient space being provided between them for the movement of the lever. The lever has mounted upon it two soft-iron cores (R) and (R′), one for each solenoid. These solenoids are preferably curved as shown. The energizing of one solenoid will cause the valve (L) to be moved in one direction and the energizing of the other solenoid in the opposite direction. The governor controls the energizing of the solenoids, and in the following manner:

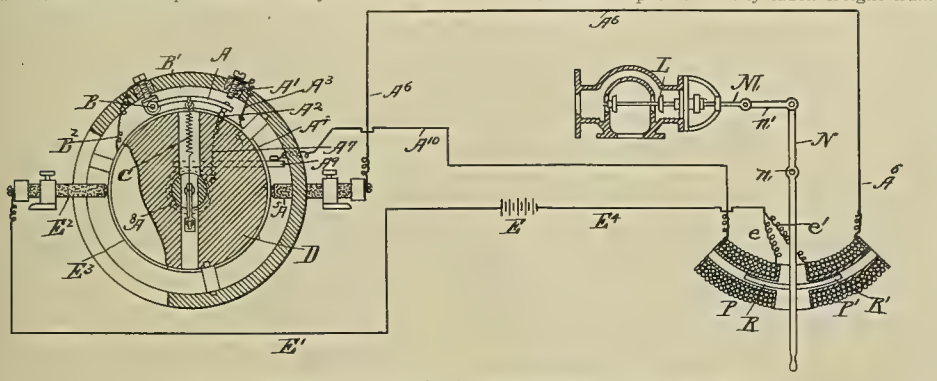


FIG. 1. GRAY ELECTROMECHANICAL GOVERNOR.—DIAGRAM OF CONNECTIONS

The governing lever is shown at (A). It preferably is exceedingly light and not over an inch in length. It is pivoted at (B) by an insulated connection to the ring (B′). This ring is mounted on a rotating disk or drum (D), from which it is insulated, and between which and the ring is a space within which the lever (A) may have a slight movement. The outer end of the lever plays or moves between the outer contact point (A′) and the inner contact point (A^2), and when in contact with either it forms a part of an electric line or circuit, the current reaching it from the line (B^2). The lever is moved in an outward direction to make contact with the point (A′) by centrifugal force and in the inward direction to make contact with the point (A^2) by the light spring (C). The tension of this spring may be varied at any time, either by hand or automatically. The latter way is represented in Fig. 2 of the drawings.

The lever (A) is rotated generally at a high rate of speed. It is set to operate after a certain speed has been reached, when it immediately becomes as sensitive to an increase as any highly organized or sensitive instrument, like, for instance, a barometer or thermometer can be, responding instantly to any variation in centrifugal force at a high rate of rotation. This sensitiveness of the lever insures an almost, if not quite, absolutely perfect automatic control of the valve, for when the rate of rotation has arisen which causes it to become mobile it then may be said to be traveling in the air between the points, or to be making a rapid contact with one or the other of them, of such exceeding quickness and fineness as is best adapted for the use and control of the electric current in producing instantaneous results. The contacts thus established through the contact point (A′) permit the current to pass from the lever through the contact point, line (A^3), ring (A^4), brush (A^5), line (A^6) to the solenoid (P′). The contacts establish with the contact point (A^2) a line (A^7), extending to the insulated ring (A^8) in the drum (D), brush (A^9), line (A^{10}) to the solenoid (P).

(E) is the battery or other source of electric energy. It is connected by line (E), branching at (e) (e′), with the solenoid (P) (P′). It is connected by line (E′) with the lever (A), through brush (E^2) and ring (E^3), which ring is connected with the lever by the line (B^2).

The ordinary action of the governor and solenoid upon the valve lever will be such as to keep the valve lever and the valve at the time when automatic regulation or control of the motor is desired upon what might be called "a more or less continuous rapid vibratory action."

In Fig. 2 the governor is represented as automatically regulated to effect the variation in the action of the valve which it governs. In his patent specification Professor Gray describes it as applied to locomotive engines for the purpose of preventing the driving wheels from slipping on the track when a train is started up or a heavily laden freight train is running up a grade. The governor is of the construction already described, and it operates to control the electric current energizing the controlling magnet in the same way. The magnet is lettered (F) and is adapted to be energized to actuate the valve of the locomotive, as above described. It may operate in opposition to a spring (F′), as represented in Fig. 2, upon an armature (F^2), connected with the valve, or, in lieu of the spring, another magnet may be employed, in which case practically the magnet construction of Fig. 1 would be used. The governor is mounted upon a shaft (G), which may be turned by any rotating or moving part of the locomotive, and may have continuous connection therewith or may be connected therewith when it is desired that the governor be used. When the latter construction is desired, the connection between the shaft and one of the driving wheels or other part of the locomotive may be established by a lever and intermediate connections. The shaft (G) carries, in addition to the governor, which is called the "primary" governor, a secondary governor (H), and this is of any usual type of centrifugal governors.

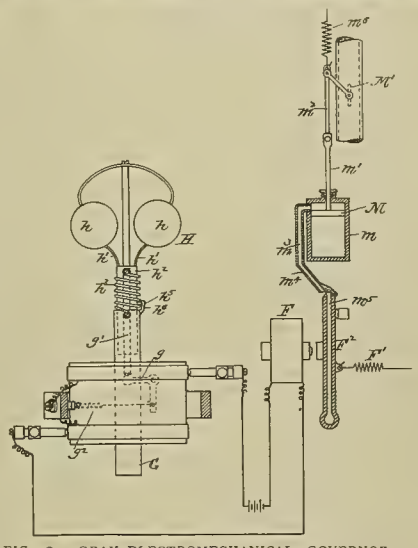


FIG. 2. GRAY ELECTROMECHANICAL GOVERNOR. — ADAPTATION FOR LOCOMOTIVES.

The one represented has the balls (h), which are mounted upon the spring arms (h′). It is carried by the section (h^2) of the governor shaft, which, however, is not fastened to the shaft, but is free to have limited rotation thereon, the extent of the rotation being controlled and limited by a spring (h^3), fastened at one end to the shaft section (h^2) and at the other end to the shaft (G). Stops (h^5) (h^6) prevent the primary governor from running slower than the secondary governor. If, however, the revolutions of the shaft (G) are suddenly increased, the primary governor will instantly respond to the increase, while the secondary governor, because of its construction and weight and because of the manner in which it is connected with the shaft (G), will be slower to respond.

The operation is as follows: When a locomotive engine is started up and no slip occurs between the driving wheels and the track, it will gradually move faster and faster, until the maximum speed has been reached. Under these conditions the governor lever will not be thrown against the outer contact point as its centrifugal power increases, because the balls of the secondary governor will cause the pin (g′) of the primary governor to be moved inward against lever (g), and thus gradually increase the tension of the governor spring and its stress upon the governor lever. If, however, the wheels at any point should slip upon the track, causing a sudden acceleration of speed, the primary governor will then run ahead of the secondary governor and unwind the spring (h^3). This sudden acceleration of speed of the primary governor will cause its centrifugal lever to be thrown out for a short time, because the secondary governor controlled by the balls will not then immediately act to increase the tension of the governor spring. It will be seen, then, that whenever a slip occurs between the driving wheels and the track the steam will be suddenly shut off by means of the operation of the magnet (F) or its equivalent; but immediately the driving wheels slack or as soon as the secondary governor overtakes the primary governor the circuit will be opened and the steam turned on. These parts may be so related as to allow the steam to be turned off from a very small fraction of a second to a whole second, or even longer, as circumstances may demand.

"This attachment to a locomotive," says Professor Gray, "will not only save work for the engineer, but will save the wear and tear of the engine and track due to friction when the engine races, and, what is more important, it will save the expenditure of energy in loss of steam whenever a slip between driving wheel and track occurs. The slip will be practically prevented, because the steam is shut off before the driving wheel has moved many inches at the accelerated speed due to slip."

Death of A. T. Weightman.

A cablegram received at Niagara Falls, N. Y., announced the death of Alfred T. Weightman in London, England, on Tuesday, February 3d. Mr. Weightman was the electrochemist of the Electrical Lead Reduction Company of Niagara Falls. It will be recalled that at the second general meeting of the American Electrochemical Society, held in Niagara Falls last September, he read a very able paper on "Cathodic Reduction." He attended the banquet given by that society. About four o'clock on the morning after the banquet he was taken ill, being found in an unconscious state on the floor of his room at his boarding place. Doctors, whom he consulted, advised his return to his home in Surrey, England, for a rest and an operation. He left Niagara Falls for England on November 17th. Word came later that he would undergo an operation in a London hospital, but his friends at Niagara had received no news until the sad message informing them of his death. Overstudy and research contributed to his early demise. He was about 33 years old. His parents, three sisters and three brothers survive, one brother being Captain Weightman of the English army. Alfred T. Weightman was a young man of great promise, and his death has removed one of the eager, enthusiastic laboratory workers of Niagara Falls.

A. T. WEIGHTMAN.

Electrical Production of Sleep.

S. Leduc has pursued his researches on the anesthetic use of an electric current (see Western Electrician of August 30, 1902), and extended them to the human subject, having the necessary experiments performed upon himself. The voltage was 50 at a maximum, and the current was introduced through cotton electrodes moistened with salt solution, and placed, one on the forehead and another over the kidneys. The potential is reached gradually in the course of five minutes. The faculty of speech is first inhibited, and then the rest of the motor system. There is a gradual inhibition of sensation, beginning with a numbing of the limbs. The only disagreeable sensation is the gradual loss of the faculties, which gives the sensation of a nightmare. The heart is entirely unaffected, but the breathing is somewhat obstructed, probably, the author thinks, by the strength of the current through the neck, which should be shunted. On breaking the current the awakening is instantaneous, and the feeling is one of invigoration. All danger to life may be avoided by switching off the current as soon as the breathing shows a sign of stopping.

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DATES AHEAD.

Chicago Automobile Show, Coliseum, Chicago, February 14th to 21st.

Central Missouri Telephone Association, Huckins Hotel, Sedalia, Mo., February 27th.

ETHIOPIA is about the last region in the world in which one would look for telephone activity. In the telephone we have, perhaps, the highest product of the inventive faculty of the human intellect; Ethiopia stands, for most of us, for remoteness from civilization and for barbarism. And yet we have the authority of a foreign contemporary for the statement that the use of the telephone is gradually becoming more extensive in Ethiopia. "The Addis-Abeba-Harrar line has already rendered immense service, but has become insufficient, and a new line to Holota is to be opened to the public." We must confess to a little haziness as to the exact location of the places mentioned. Are they thriving emporiums of commerce, where the shrewd Arab traders keep the cowrie in brisk circulation, or are they mere collections of huts? And what languages or dialects, from thick lips and uncouth visages, undulate over these far-off lines? Did the subscribers on the Addis-Abeba-Harrar line ever hear of the Berliner case?

Ethiopia and the telephone! Truly, civilization is marching forward with majestic strides.

DR. FREDERICK BEDELL'S paper on "The Joint Transmission of Differing Currents," read before the Electrical Society of Cornell University a few days ago, and presented in abstract elsewhere, deserves the thoughtful attention of electrical engineers. The subject is one to which the author of the paper has given careful study; and, in moderate phrase, he points out his belief that the joint transmission (that is, over the same system of conducting wires) of differing currents (either alternating or direct), for electric light and power, has signal advantages, such as simplicity, copper economy and independence of lamp and motor regulation. He believes that a system may be devised for the joint transmission and separate utilization of differing currents. The last requirement is, of course, very essential, and Dr. Bedell briefly outlines systems by which, he thinks, the results desired may be obtained. For this purpose he favors what he styles the "differential" and the "common-conductor" systems of transmission in various combinations, briefly elucidated in the paper. In conclusion the writer affirms his belief in the utility of the joint-transmission system. The subject is a very interesting one and is fraught with great possibilities. Theoretically, it would seem that important economies should result from joint transmission, but in practice it may be that, under those conditions where differing currents might be made use of over one set of wires, the complications introduced by the devices for utilizing the differing currents would more than offset the advantages. Still, this is only a tentative objection, which the test of practice may remove.

BY glancing over a list of the past-presidents of the American Institute of Electrical Engineers, and noting the places of residence of the former presidents, it will be seen that New York city has had six, Philadelphia three, Massachusetts (Great Barrington and Swampscott) two, Newark, N. J., one, Washington, D. C., one and Schenectady, N. Y., one. The present incumbent of the office lives in Pittsburg, and represents the most western point which the Institute has as yet honored in selecting its presiding officer. We call attention to this fact because it seems to us that the society may well continue the good work begun in the selection of Mr. Scott and go farther west whenever the time shall come that a successor is to be elected to the president now in office. This may not be at this year's election, of course, but we deem the time opportune to direct attention to the matter, owing to the St. Louis Exposition, with very likely an International Electrical Congress, of next year. It is probable that St. Louis will have the last of the great expositions at which electricity will be emphasized as a separate and distinct feature; in future expositions it is likely that there will be no more an Electricity Building than a Steam or Hydraulic Building; electrically accomplished work of all kinds will be accepted as a matter of course. Therefore, in view of this great exposition in the West, paying marked attention to electricity and electrical development, it seems to us that it would be graceful and appropriate if the chief electrical society of the country should elect a western man as its president at a time coincident with the exposition.

There are many worthy members of the Institute in the West; the organization is growing rapidly in this part of the country, and we are sure that the western members will be greatly pleased if one of their number is selected for the chief honor which the Institute has to bestow. As we have pointed out, former presidents have been very largely taken from New York city and its vicinity; but the association is national in its scope, and should limit its favors to no one section of the country. We take it that the American Institute of Electrical Engineers will broaden its influence, please a large section of the membership hitherto passed over in presidential elections and pay a graceful compliment to the electrical importance of the St. Louis Exposition by selecting a western man for its highest office.

THE addresses of Mr. Charles F. Scott as president of the American Institute of Electrical Engineers are felicitous. On several recent occasions he has pointed out the opportunities, duties and responsibilities of the electrical-engineering profession in a luminous and convincing manner. His speech in New York at the "Library" dinner of last Monday, at which Mr. Carnegie was the guest of honor, was characteristic of this valuable faculty. "Electricity enters into so many departments of our modern civilization," said he, "that its function is difficult to describe. If I were called upon to state the effect of electricity in briefest terms, I should reply, 'Electricity increases efficiency.' By its use the world's work may be done more quickly and at less cost. The telephone is an instantaneous messenger; it doubles the work a man can do. The railway motor, the motor in the mine, the crane motor, the motor in the machine shop, bring results more quickly and more cheaply. Electrochemical processes produce cheaper products. The electric light adds to the hours of efficient activity. Electricity has given to the whole world a new method of doing things—of doing them more efficiently in time and in cost. The work of the electrical engineer is not separate and apart, but it is interwoven with every branch of engineering, with every industry, with commerce, and in a score of ways with the conveniences and necessities of everyday life." This is certainly well said, and may serve as a good epitome of what electricity stands for. Mr. Scott urged a continuation of the efforts for the growth of the membership of the Institute and reverted to a favorite topic of his—the co-operation of engineering societies. He closed an excellent address by an appropriate reference to the great ironmaster who was the guest of the evening.

UNLESS space telegraphy should remedy the difficulty, it seems to be clear that underground wires will have to be resorted to before long to prevent the occasional interruption of telegraphic communication by severe storms between Chicago and New York. To lay a telegraph cable between the two cities, 950 miles apart, would be an expensive proceeding, of course; but it would give relief and security to the commercial world that would be invaluable. The storm of last week, referred to on another page, points anew the moral that more stable service should be provided.

In Great Britain the heavy damage to overhead telegraph lines in England and Scotland, caused by severe storms during the last few years, has caused the British Postoffice authorities to lay considerable underground cable. This underground construction, which is now approaching completion, includes a number of separate circuits from London to Liverpool, Glasgow and Edinburgh. Some of the sections are now in working order, and the cast-iron pipes are laid practically over the whole route. The completion of these sections will, it is hoped, make the total severance of telegraph communication between England and Scotland in the case of a breakdown of the overhead wires almost an impossibility. The sections do not form a continuous line, but they are the most exposed sections on the route between London and Glasgow and Edinburgh. A dry-core cable consisting of bare copper wires loosely wrapped with manila paper so as to insulate one from the other and encased in a lead sheath is used. It is not contemplated at present to rely upon underground cables for anything but emergency working, i. e., when overhead lines are down. They are not suitable for long-distance telephone work, owing to their high capacity compared with an aerial line, nor are they suitable for high-speed telegraph transmission, which in England is usually done by the Wheatstone automatic. An installation is also being made of a 38-wire dry-core cable for the London and Southwestern Railway from Waterloo Station toward Clapham Junction, where it is practically impossible to erect poles.

The Joint Transmission of Differing Currents.[1]

By Frederick Bedell.

This is an era of combination. The particular combination to which I invite your attention is a combination between the one-time rivals, direct and alternating currents. In fact, the combination is far more reaching, for alternating currents of different frequencies may be combined, and so, too, may power-transmission currents and currents for the transmission of intelligence. The same system of conductors may supply our alternating lamps and our direct-current motor. We may remove an incandescent lamp, attach a telephone and talk over the incandescent circuit with our neighbor.

This method of telephoning or telegraphing over electric-light and power circuits let us pass with this casual mention and proceed to consider the joint transmission of differing currents for electric light and power.

An important characteristic of differing currents is their non-interference. Assigning personality to the currents, we may say that Current A when traversing a wire does not know that Current B is there, the two being of different character. Neither current recognizes the existence of the other, and is in no wise affected by its presence or absence. To illustrate the extreme to which this is true, we may refer to the experiment which some of you have tried and others may try in the laboratory, of telephoning over a power circuit from which motors are operated. The starting and stopping of the motors does not affect the telephone.

For power transmission this non-interference leads to two important results—a great economy of copper and a lamp regulation not affected by motor load.

Copper Economy.—In the joint transmission of differing currents each current has the entire benefit of the whole conductor as though that current were transmitted alone. This means that for the transmission of two currents the same amount of copper is required as for the transmission of one alone; that is, twice as much power may be transmitted with a given amount of copper. Hence there is a copper saving of 50 per cent.[2]

Consider the case of one incandescent lamp furnished with a direct current of one ampere over a conductor with a resistance of one ohm. The line loss for one lamp is one watt. Let a second incandescent lamp be supplied with one ampere of alternating current. In the line conductor, the one ampere of direct and one ampere of alternating current combine to make a resultant current of only 1.414 amperes. The line loss is now two watts for two lamps, or one watt per lamp, as before. Each current has a loss of one watt, the same as though the other current was not there.

If the two lamps were supplied with like current, one ampere each, the total current would be two amperes with a line loss of four watts. To reduce the line loss to two watts (its value with differing currents), the line resistance would have to be reduced to one-half; to accomplish this twice as much copper would be necessary. Single-current transmission requires twice as much copper as double-current transmission.

Independence of Lamp and Motor Regulation.—We have just seen that line losses[3] for differing currents transmitted jointly are independent of each other; whereas this independence is not found for like currents. What is true for line losses is equally true for line drop. The line drop for each current is equal to the line loss for that current divided by the value of that current. The regulations for each of two differing currents is accordingly independent of the regulation of the other.

In all systems employing but one kind of current the lamp regulation is affected by the motor load. With differing currents, the lamp and motor regulation may be made entirely independent. The motor service may be increased far beyond that originally contemplated, each motor overloaded as much as it can stand, the line drop for the motors increased to any amount you will, and the regulation of the lamps will remain unaffected. This feature, aside from its general utility, is of particular value in service furnished to outlying districts.

General Advantages.—The fundamental advantages in joint transmission are those just discussed—simplicity, copper economy and independence of lamp and motor regulation. These lead to the further advantages:

General Economy.—In addition to economy in first cost, the reduction of 50 per cent. in the copper employed in feeders and mains of a distribution system reduces the cost of maintenance, inasmuch as it simplifies the system and reduces subway construction, poles, lines, switching devices, etc.

Extension of Kind of Service.—Motors and lights may be offered to consumers, where otherwise only one kind of service could be satisfactorily and profitably maintained.

Improvement in quality of service on account of independence of lamp regulation.

Extension of Economical Area of Distribution.—This is rendered possible on account of the copper economy. In some cases the area may be extended on account of the income from the added motor service, which otherwise would not be possible.

Different Voltages for Lamps and Motors.—The voltage of incandescent lamps is lower than is generally desirable for motor operation. With the two classes of service supplied by joint transmission, each class may be supplied with current at the pressure and with the degree of regulation best suited for it under the conditions. Thus the motors may be operated for 440 volts and the lamps at 110 volts.

Systems of Transmission.—To obtain the benefits recited above it is required that a system be employed for the joint transmission and separate utilization of differing currents. The separation of the currents for their utilization is as necessary as the combination of the currents in transmission. The systems[1] by which these results may be obtained may be classified as follows:

(a) Selective.
(b) Differential.
(c) Common conductor.

(a) Selective System.—In solving the problem it is natural to consider first the employment of selective devices or traps permitting the passage of one form of current and restraining the other. This system can be worked to a limited extent. Try it and you are likely soon to conclude that its commercial applicability is questionable. When direct and alternating currents are transmitted by this system a serious problem arises in preventing the saturation of the iron cores of alternating-current coils by the passage of direct current. But even with all difficulties overcome, the need of special devices is a serious objection. For commercial success the separation of the currents must be obtained as an inherent characteristic of the system.

(b) Differential System.—In this system one form of current (e. g., direct) flows differentially through the coils of apparatus utilized by the other current (e. g., transformer coils), so that no magnetizing action is obtained. This method many of you have used in the dynamo laboratory in performing the experiment entitled[2] "Starting a Rotary Converter by Means of Direct Current Transmitted Over the Alternating Line." The complete separation of the two currents by this system is illustrated by the telephone experiment referred to above.

For primary transmission, the differential system is the proper one to use. By means of this system direct current may be transmitted for special purposes over alternating-current transmission lines, either single-phase or polyphase. An interesting field lies in the joint primary transmission by this system of alternating currents of different frequencies, one for light and one for power; these may be single-phase or polyphase. The lamp regulation is thus independent of motor load.

For secondary distribution it is preferable to employ the differential system only in connection with the common-conductor system.

(c) Common-conductor System.—This system is adapted to secondary distribution, for which it is especially suited on account of its simplicity, as well as the copper saving and improved lamp regulation already discussed. Four main wires, 1, 2, 3, 4, are employed, only two of which need enter any consumer's premises, or need be employed in any particular street or district. The separate pairs of wires are used as follows:

Lines 1 and 2 supply direct-current devices.
Lines 2 and 3 supply alternating-current devices.
Lines 3 and 4 supply direct-current devices.
Lines 4 and 1 supply alternating-current devices

All receiving devices are directly connected, and no special apparatus is required.

Existing systems may be utilized without change to obtain the advantage of joint transmission. Consider lines 1, 2 to be the main conductors of an existing Edison system supplying 100 lamps. The addition of lines 3, 4 permits the wiring of 300 additional lamps (instead of 100 additional lamps, as at present). Doubling the copper increases the lamps supplied fourfold without disturbing the existing system.

The three-wire system may be used. The addition of a neutral wire for each pair makes it possible to employ the three-wire system, together with the common-conductor system. The two systems are not alternative.

For isolated plants and office buildings the common-conductor system should be used for connecting receiving devices. At the generating plant a combination with the differential system may be employed, so that only one double-current generator need be employed. The alternating-current brushes connect with the primary of a transformer with two equal secondaries. The four secondary terminals form the four wires of the common-conductor system. The two leads from the direct-current brushes are connected respectively to the middle points of the two secondaries. From this it is not to be understood that the use of a double-current generator is necessary; separate sources for direct and alternating currents may be employed when desired.

For sub-station work one rotary converter may be connected in a somewhat similar manner.

Voltage in Primary Distribution.—By the differential system of connection, in any usual case, direct current transmitted over primary lines will not increase the line voltage.[1]

In the joint transmission of high-potential currents of different frequencies, the line voltage is raised. Hence on the basis of a limiting voltage between conductors, the copper saving is reduced from a saving of 50 per cent. to a lesser amount, according to the particular way in which the differential method is applied. Thus in one case, on the basis of a definite potential between conductors, the copper required[2] in transmitting currents of different frequencies is nine-tenths of that required for the transmission of three-phase current of one frequency. The advantage of copper saving is accordingly not so great. The advantage of independent lamp regulation is fully obtained.

Voltage in Secondary Distribution.—Referring to the paragraph on the common-conductor system, if the receiving devices be for 100 volts, the lines brought into each consumer's premises will be at a pressure of 100 volts. In the distributing system lines 1, 2, lines 2, 3, lines 3, 4 and lines 4, 1 will have a difference of potential of 100 volts. There will be a difference in pressure of 141 volts between lines 1 and 3 and between lines 2 and 4. These lines may be remote. So far as copper saving is concerned, we obtain all the advantages of transmitting at one voltage (say, 141 or 282), and receiving without transformers or auxiliary devices at 70 per cent. of that voltage (say, 100 or 200 volts). We obtain the same benefit, so far as copper economy is concerned, as though each consumer were given a 10:7 transformer.

Such a transformer, however, would not give the advantage of independent lamp regulation which is obtained by the system under discussion.

Conclusion.—A careful study of the problem of joint transmission for a particular set of conditions will suggest details and modifications tending toward economy and improved service which have not been discussed in this brief paper. In this brief outline enough of the characteristics of joint transmission have been touched upon to show the utility of such a system. Although the writer has devoted a great deal of attention to the subject for several years, new phases of the subject are continually developing. It is a broad field and an attractive one on account of the variety, as well as the vastness, of its engineering possibilities.

1. Abstract of a paper read before the Electrical Society of Cornell University. February 2, 1903. The author is assistant professor in physics at Cornell.

2. Discussed fully by the writer in a paper entitled "Copper Saving in the Joint Transmission of Direct and Alternating Currents," Sibley Journal, Vol. XV., No. 1.

3. Proved rigorously in reference cited.

1. These were fully described with blackboard illustration.

2. See article under this title, Sibley Journal of Engineering, Vol. XIV., No. 9 p. 409.

1. In a single-phase system with direct current connected between the neutral point and an auxiliary conductor (or ground), the virtual value of potential between any two conductors is not raised unless the direct-current pressure exceeds 0.866 of the alternating-current pressure. In a three-phase system similarly connected, the potential between conductors is not raised unless the direct-current pressure exceeds 0.81 of the alternating current. In a four-wire two-phase system with direct-current connected between the neutral points of the two independent phases, this percentage becomes 0.707. Usually the direct current will be at a pressure much lower than that indicated in any of these cases.

2. The case taken is one in which each of the three conductors of a three-phase system is split into three lines, each of these three groups itself constituting an independent three-phase system of different frequency.

Storm Damages Telegraph and Telephone Lines.

The heavy snow and sleet storm which visited Chicago and vicinity on February 3d and 4th caused a great deal of damage to the telephone and telegraph companies and also hindered the operation of the electric-railway lines. The storm was centered in Chicago, and the region principally affected extended around this city to a distance of about 100 miles, the northern part of Illinois suffering the worse. Many hundred miles of wire weighted down by the heavy snow and ice were broken and put out of service, and a large number of poles were broken. Practically all direct telegraphic communication was cut off from Chicago to New York, and any messages transmitted for a time had to be sent by very roundabout routes. An example of this was a message sent from the Chicago office of the Postal Telegraph-cable Company to New York which went via San Francisco, Winnipeg, Manitoba, and Montreal. The message was sent and an answer received by this long route in the short time of 20 minutes. The Postal wires were down in many places in Illinois and Indiana and also in Michigan. At the close of the second day about a thousand messages for St. Louis and vicinity had accumulated in the Chicago office which could not be sent on, so a special messenger was sent by railroad to St. Louis to deliver them.

The Western Union Telegraph Company's lines suffered in a similar way, the principal damage being the breaking of wires within a radius of 50 miles from Chicago. The company was not completely shut off from New York, as it had one direct wire and one by way of Omaha.

Many of the telephone companies in the region affected had their lines damaged, but the principal loss was to the Chicago Telephone Company, which had 400 miles of wire put out of commission and 140 poles broken. This damage was principally outside of Chicago.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephony in Troy, N. Y.

The Rensselaer Telephone and Telegraph Company of Troy, N. Y., has reached the end of the first half year's trial of its new telephone system, and declares itself highly gratified at the successful results. The company was incorporated in December, 1899, soon after a franchise had been secured for an Independent system in the city of Troy. Preliminary work was at once taken up, but it was not until the late summer in 1901 that active construction work was started. At that time the work of putting in the underground conduit in the business district was commenced, and by the beginning of the winter the conduit was completed. As soon as the weather permitted of aerial construction this work was promptly started and rushed as much as possible, in order to put the plant in service for the summer. The Kellogg Switchboard and Supply Company of Chicago was awarded the contract for installing the central-office equipment. This contract called for an exchange equipment of 1,500 lines, with an ultimate capacity of 6,600 lines.

INDEPENDENT TELEPHONY IN TROY, N. Y. - EXCHANGE SWITCHBOARD.

The exchange is of the common-battery multiple type. The present installation consists of six sections of three operators' positions each, a main distributing frame, an intermediate distributing frame, a relay rack, a two-position chief operator's desk, a two-position wire chief's desk, a two-position toll board and a complete power equipment. The multiple switchboard, the toll board and chief operator's desk, are located on the second floor; the distributing frames, relay rack, wire chief's desk and power equipment are located on the first floor of the exchange building.

In the multiple switchboard the section framework is made of angle and channel-iron work, so arranged and braced as to make a rigid and substantial section. The legs of each section are 20 inches wide and 34 inches high, resting on the true floor. The sections are approximately five feet eight inches long and divided in six panels. The woodwork of the sections, such as the key and plug shelves, and frieze at the top of the sections, is made of mahogany.

Each switchboard section has a capacity for 6,600 subscribers' multiple jacks, 360 outgoing trunk jacks, 480 answering jacks and lamps, and is arranged for three operators' positions. A 24-inch box panel or cable-turning section is located at the left of the first subscriber's section. All switchboard and power cables are carried through the above box panel to the intermediate distributing frame in the terminal room below. All circuits used in wiring this exchange are of the well-known common-battery type, using lamps for subscribers' line signals and double supervision in the operators' cord circuits. The equipment grows from left to right.

The first position of the multiple board is not equipped as a regular operator's position. Testing trunk lines to the chief operator's and wire chief's desks are located in this position. The second position is equipped as a toll trunk-switching position, with incoming toll-trunk and recording toll-trunk circuits extending over to the toll board. The third to the seventeenth positions, inclusive, are each wired for 15 and equipped with 12 common-battery cord circuits, three order-wire circuits and an operator's telephone set. The eighteenth position is left blank. Positions three to 14, inclusive, are each equipped with 120 answering jacks and lamps. The fifteenth position is equipped with 60 answering jacks and lamps, making a present equipment of 1,500 subscribers' lines.

The main distributing frame provided for this exchange is constructed of angle and bar-iron work and consists of 24 pairs of uprights; one of each pair of uprights being arranged for mounting terminals and the other for mounting lightning arresters of the Kellogg type. This framework is arranged for 100 lines high on both the terminal and arrester uprights. The present equipment consists of terminals on the line side for 1,500 subscribers' lines, 100 toll lines and 100 miscellaneous lines and arresters for 1,500 subscribers' line, 100 for toll lines and 100 miscellaneous lines. The equipment grows from right to left, facing the terminals, and the framework is arranged so that an extension can be added on the left end when desired.

REAR OF SWITCHBOARD IN INDEPENDENT EXCHANGE AT TROY, N. Y.

The construction of the intermediate distributing frame is similar to that of the main frame, omitting the lightning arresters. The present framework has a capacity for 2,000 lines, is 100 lines high and grows from left to right. The terminals for the first 100 lines at the left end of the frame have been reserved for miscellaneous lines. A present equipment of terminals for 1,500 subscribers' lines has been provided. The framework is arranged so that it may be extended when desired.

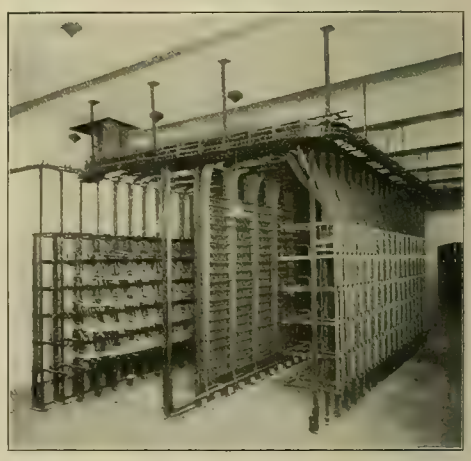
For the relay rack the framework is built of "T" and bar iron and is divided into 10 equal divisions, each division being referred to as a "bay." The present equipment consists of relays for 1,500 subscribers' lines. This framework is also arranged so that it may be extended when desired.

A two-position mahogany chief operator's desk is provided. The right position of the above desk is not equipped at present. The left position is equipped with an operator's telephone set and cord circuits. Monitors and listening-in circuits are wired to each equipped operator's position at the multiple switchboard. Lines have also been run to the multiple switchboard, wire chief's desk and the toll board.

The wire chief's desk is of the mahogany two-position type. The left position is equipped with testing circuits to the main distributing frame and the multiple switchboard. Lines are also wired to the chief operator's desk, the multiple switchboard and the toll board.

The toll board is of the two-position type. At present it is equipped with 40 toll lines, 20 to a position, each position being equipped with four cord circuits for making toll to toll connections and six for making toll to local connections. The recording and incoming toll-trunk switching circuits for making toll to local and local to toll connections with the local subscribers' line circuits are wired to the second-position local board.

Charging and ringing machines for the above exchange consist of a 3½-horsepower, 500-volt Roth motor connected to a 1½-kilowatt Roth generator; the second charging set consisting of a 3½-horsepower Otto gas engine connected to a 1½-kilowatt Roth generator. The generators deliver full-load current from 20 to 30 volts, running at a speed of 1,200 revolutions per minute. The gas engine and two generators are so arranged that the gas engine may be used for driving either of the generators. The ringing generators consist of one-fourth-horsepower motor-generators, the primary circuit being arranged to operate on 500 volts direct current, and the secondary to deliver pulsating and alternating current at 110 volts no load to 75 volts full load at 1,000 revolutions per minute. The battery ringing set consists of a one-fourth-horsepower motor-generator, the primary being arranged to operate on 24 volts direct current and the secondary to deliver pulsating and alternating current at the above-mentioned voltages. The gas engine is mounted on a stone-capped pier by itself, and all of the other machines are mounted on a brick pier. The power board consists of three panels of white Italian marble mounted on a framework made of angle iron and equipped with the necessary instruments, switches, fuses, etc., to accommodate the power equipment of the exchange.



TERMINAL ROOM IN INDEPENDENT EXCHANGE AT TROY, N. Y.

Storage-battery equipment for the operation of the exchange consists of two sets of 11 cells each of Electric Storage Battery Company's accumulators, F-5 elements in F-9 lead-lined tanks, so arranged that as the number of subscribers increase additional elements may be added.

All wires in connection with the power equipment are run in iron-armored conduit. The whole exchange installation is well designed and well built.

Credit for erecting the plant should be given to the Eastern Electrical Construction Company of Troy, and especially to Mr. W. Scarlett, this company's able and efficient supervising engineer.

The toll lines terminating at the toll board of the exchange are connected with the exchanges located at Sandy Hill, Mechanicsville, Lansingburg and Saratoga, N. Y.

The company opened its exchange for service about July 1st, and at the present time has over 1,400 subscribers connected. Telephones are being connected at the rate of about 25 a week, with the prospect that the number will reach 2,000 before

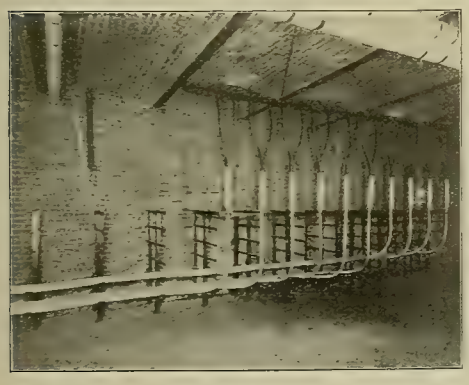
POWER PLANT IN INDEPENDENT EXCHANGE AT TROY, N. Y.

very long. At the present time, however, the company will be unable to accommodate this number of subscribers without considerable additional construction work, and it is already planning for an increase in this respect.

At the time the Rensselaer Telephone and Telegraph Company was organized it is stated that the Bell licensee in Troy had about 800 telephones. The appearance of a competitor on the field caused the older company to reduce its rates and canvass the territory very thoroughly for the purpose of shutting out competition as much as possible. The Bell people were enabled to increase their subscription list to about 1,200, it is said, but the opposition company says that it is increasing its list at a rate much more rapid than that of the Bell company.

The amount of underground and overhead cable which is in the service of the Rensselaer company at present is between 24 and 25 miles. The conduit used was made by the American Vitrified Conduit Company, and at present the Rensselaer company has about 30 miles of duct laid in the streets and alleys. The entire business district is of underground distribution, being made from one or two terminal poles in each block, depending upon the size of the block. The cables, wires, etc., were furnished by the Roebling's company. The entire amount invested in the new system, up to date, is about $285,000.

As to the matter of toll lines, the Rensselaer com-



UNDERGROUND CABLING AND POT HEADS IN INDEPENDENT EXCHANGE AT TROY, N. Y.

pany owns or is building at the present time about 65 miles of pole line, carrying about 260 miles of No. 10 copper metallic toll circuits. Through these circuits the company is put in communication with a number of other Independent companies operating from Troy, north along the Hudson Valley and east to the limits of New York state, the territory extending to the border of Massachusetts, and taking in the southern part of Vermont. The line from Troy to Hoosick Falls is practically completed, and the construction of the Albany line is underway. At the present time about 75 or 80 towns are in connection with Troy. The contemplated connection with the Albany system, which will also carry toll connections south and west of Troy and Albany, will greatly increase the territory covered by the Rensselaer Telephone and Telegraph Company's toll service. This connection, it is expected, will be made some time in January or early in February.

The officers of the Rensselaer company are: President, John T. Christie; vice-president, Edward Davis; treasurer, Peter McCarthy; secretary, W. Lewis Burk. The exchange building proper is a separate fireproof structure built to the rear of the office building, which contains ample room for the general offices of the company and also a retiring room for the operators.

Maximum Rate of $125 for Chicago Telephones Upheld.

The Appellate Court of Illinois has handed down an opinion, written by Judge Windes, upholding Judge Tuley's decision that the Chicago Telephone Company must not charge more than $125 a year for its business service, as is provided by its franchise. This suit began in 1901, when the Illinois Manufacturers' Association objected to the $175 telephone service. Judge Tuley issued an injunction against the telephone company, restraining it from charging more than the franchise rate of $125. The defense appealed, basing the $175 charge on the improvement wrought in recent years in the telephone service. The Appellate Court now concurs with Judge Tuley.

After passing on the various phases of the case, the reviewing court says:

"The defendant, to the extent of its ability, is bound to furnish any person applying therefor, within the district in question, telephone service with all the improvements thereon which the defendant had adopted and had in use within that district at the time of the filing of the bill—that is, said metallic service—at the ordinance rate of $125 a year.

"If, as it was contended by the defendant's counsel, the rates fixed by the ordinance were intended to apply only to telephone service then established and in use when the ordinance was passed, it would follow that any improvement in the art which made necessary the addition of another wire or any different instrument or appliance to use such improvement, if the company adopted and used such improvement, would allow the company, when it furnished a patron such instrument or appliance, to charge a rate without limitation. Such a construction, as it seems to us, would be unreasonable and could not have been intended by the language used in the ordinance."

The territory affected by the decision, and which was specified in Judge Tuley's order, is as follows: Beginning at North Avenue near the lake, west to the river, down the river east of Goose Island, west to Western Avenue, south to Twenty-first Street, east to La Salle Street, south to Thirty-ninth Street, and east to the lake.

"Notwithstanding the complainants' contracts," continued Judge Windes, "defendant, being a public-service corporation, is bound by the ordinance to furnish all persons alike with telephone service, within the district named in the schedule, at the ordinance rates—$125 a year. The ordinance is plain in its provisions, and, although complainants have, without protest and voluntarily, except for their business necessities and defendant's monopoly, made contracts to pay a higher rate than the ordinance permits the defendant to charge, that excess is illegal and may be stricken from the contract.

"The defendant is bound, from the public character of its business—it is a common carrier of speech through its telephone systems—to serve all its patrons alike, to furnish them telephone service, with all its improvements, which have been adopted and used by it, for the rates fixed by the city ordinance. This is a public duty which it cannot disregard nor escape by contracts which require its patrons to pay for the performance of that duty an amount in excess of what may be charged under the ordinance."

Attorney A. D. Wheeler, for the telephone company, said a final hearing would be had in the Circuit Court, and that the case then probably would be carried to the Supreme Court.

Cuyahoga Telephone Company's Finances.

The report of the financial affairs of the Cuyahoga Telephone Company, Cleveland, Ohio, made at the annual meeting on February 2d, showed total assets of $5,878,339.62 and total liabilities of $5,907,482.34, the deficit to balance being $29,142.72. Of the liabilities the Federal Telephone Company is put down at $475,392.92. The gross earnings for the year 1902 were $385,852.14, and the total expenses were $229,709.59. The total deductions from the income were $155,600.48, making the deficit noted above. The treasurer's report showed that the deficit was due to extravagant management, in having more employes than there was work for and too low rates. The president reports that there has been poor collections, and that some steps will be taken to correct the matter. The only change in the directorate was the retirement of N. A. Gilbert and the election of J. R. Sprankle to fill his place. The officers are as follows: President, F. S. Dickson; vice-president, E. W. Moore; secretary, James B. Hoge; treasurer, R. W. Judd.

Indiana Telephone Items.

The Oaklandon Western Telephone Company has filed articles of incorporation. The company will build an exchange and system in Oaklandon and the surrounding country. John Moore and Jobe McEvery of Oaklandon are the officials.

The Brownsville Co-operative Telephone Company has incorporated with a capital of $20,000. The principal office and exchange will be in Brownsville. The system will extend throughout Wayne and Fayette Counties. W. H. Hawkins, Daniel Paddock and R. S. Vernon are directors.

The Blue River Telephone Company has filed incorporation papers with the secretary of state. This company will locate its exchange in the Friends' Church, Shelby County, and furnish service to its members at cost.

The City Council at Anderson passed an ordinance requiring the Anderson Telephone Company to furnish telephones free to all members of the City Council, the city offices and the schools. The telephone company says it will ignore the ordinance, and the council threatens to grant a franchise to a rival company.

The fight between the two telephone companies at North Manchester, into which the Independent company of Wabash was drawn, has been carried to the courts, the North Manchester company filing suit for $10,000 damages against the Wabash company for alleged discrimination between the two companies.

The Lebanon Telephone Company's exchange was destroyed by fire on the 7th inst. The exchange will be rebuilt at once.

Hon. Hugh Daugherty, president of the United Telephone Company, operating throughout the gas belt, says the company is kept busy taking care of the farmers' trade. The plan usually followed is for a number of farmers to organize and incorporate a telephone company. They then get to work and put up their system, each contributing a number of poles and a certain sum of money to pay for the material and the instruments as his share. About the time the line is in good working order it is connected with the larger company by a sale outright or agreement as to rates, whereby they secure the service of the larger company. A farmer once placed in touch with the cities and towns by means of a telephone, will never do without it, if possible to retain the service.

The city of Evansville has filed its answer to the suit of the Cumberland Telephone Company to enjoin the city from removing its property from the streets, and alleges that the franchise under which the Cumberland company assumes to have a perpetual right to conduct its business in Evansville was, in the first instance, illegally acquired; in the second, abrogated by failure to observe its conditions and conform to the laws of the state; in the third, repealed by the petition for and acceptance of a new franchise. It points out that the Cumberland company never assumed to be operating under any other franchise than the one expressly granted it in 1887, until it expired in 1902. Now, that the issues are joined, the courts will decide what rights the company has under the franchises in question.

F.

Ohio Telephone Notes.

The earnings of the United States Telephone Company for 1902 were $312,717. The fixed charges and expenses have not been reported as yet, but it is believed there will be a nice surplus for stock when this is all deducted. At the recent annual meeting officers were re-elected the same as those of the Cuyahoga Telephone Company.

It is said that the Home Telephone Company of Toledo will shortly increase its rates to subscribers on account of the rapidly increasing number of patrons and the correspondingly better service it is able to furnish.

The Faller Automatic Telephone Exchange Company has opened a branch office in the Williamson Building, Cleveland.

The Kenton Telephone Company of Kenton has increased its capital stock from $50,000 to $100,000.

The West Alexandria Telephone Company, West Alexandria, has given notice of an increase of capital stock from $3,000 to $10,000.

The Bell company is attempting to advance its rates at Norwalk.

The St. Marys Telephone Company will rebuild its plant and make it larger to meet the demands for its service.

It is reported that Cleveland capitalists are endeavoring to purchase a franchise to string wires for electrical purposes in Cincinnati. It was granted to a man named Lawton, but has since been transferred to another man. Attorneys claim that the terms are so broad that the franchise will allow the construction and operation of a telephone plant.

O. M. C.

Telephone News from the Northwest.

C. E. Wisard of Howard, S. D., has been awarded the contract for a telephone system at Kimball, S. D.

The Supreme Court of Montana has decided that the state has a right to collect a tax of 75 cents each on each telephone in use in the state except those used for interstate commerce. This tax is in the nature of a franchise tax, and is regarded as a big victory for the state.

A bill has been introduced in the Minnesota Leg-

islature to protect slot telephones and other slot devices from bad coins, slugs or leads. Violation of the act is made larceny, punishable by a fine of $500 or imprisonment for one year. The author of the bill says that, under the existing law, offenders cannot be reached.

An automatic exchange is about completed for Pembina, N. D.

The Short Line Telephone Company has been incorporated at Nevada, Iowa, with $5,000 capital stock. The company's line is completed, and runs from Nevada to Iowa Falls.

The North Liberty (Iowa) Telephone Company has been incorporated with $10,000 capital.

The Northwest Independent Telephone Association has been organized at Emmetsburg, Iowa, to meet and discuss subjects of interest. Twenty lines are in the association.

A telephone war is on at Fremont, Neb., and the Independent people claim that the Nebraska company has no franchise, according to the records.

The Burlington Railway will install a telephone system of its own for the yards and offices at Burlington, Iowa. All division points are to be so equipped, and they will then be connected.

The Michigan Telephone Company will make extensive improvements to the exchange at Menominee, Mich., and will construct new exchanges at Powers, Spalding, Carney, Nadeau and Talbot.

The Nebraska Telephone Company will expend $100,000 at Council Bluffs, Iowa, in the construction of an exchange building and conduits. R.

TELEPHONE MEN.

Paul C. Graff, manager of the Richmond Home Telephone Company of Richmond, Ind., and one of the city's most prominent residents, dropped dead in his office on February 4th.

F. V. L. Turner, who has been acting as general manager of the Standard Telephone Company of Atlanta, Ga., has resigned to accept a similar position with the Federal Telephone Company of Cleveland, Ohio.

Vernon Wilder of the Northwestern Telephone Exchange Company at Anoka, Minn., has been transferred to the office at Red Wing, Minn., succeeding J. L. Hastings, who has been in charge since the institution of the exchange.

J. B. Ware, well known by his connection with the Independent telephone interests in Grand Rapids, Mich., is said to have accepted a responsible position with the Independent Long-distance Company of New York, with headquarters in Buffalo.

Fred W. Peirce has resigned his position as manager of the Madison-Clark Telephone Company of London, Ohio, in order to go into other business. He is succeeded by W. J. Meech of Louisville, Ky. Mr. Peirce has been in charge of the London exchange since its establishment, and owing to his management the business has grown from a small beginning in 1899 to over a thousand subscribers, and the system connects with over 2,500 in the county.

GENERAL TELEPHONE NEWS.

The Central Toll Line Company of Ennis, Texas, has been incorporated, with a capital stock of $30,000, by W. L. Harper, Charles Pippen, Tony Schaeffer and S. A. Haskins.

The Atlanta (Ga.) Standard Telephone Company's plant has been sold. The upset price of $200,000 was secured, the purchaser being Robert Alexander, trustee. The sale was the result of the foreclosure of a mortgage for $600,000 in the hands of the City Trust Safe Deposit and Surety Company of Philadelphia. The names of the real purchasers were not made public. Only one bid was received.

At a recent meeting of the Home Telephone Company of Rockford, Ill., the following-named officers were elected: President, E. W. Brown; vice-president, H. H. Clough; secretary, John Camlin; treasurer, F. F. Wormwood. Owing to the large and rapid increase in business it was found necessary to increase the capacity of the exchange. New cable, both underground and aerial, will be installed, enlarging the capacity to over 500 additional telephones. The Home company has 1,285 instruments in actual service.

The International Telephone Manufacturing Company of Chicago is reporting a constantly increasing demand for its long-distance generator-call telephones. It is said that the International telephone is especially adapted for long-distance interstate toll-line use and heavily loaded country party lines, they being provided with an extra strong generator of a heavy output and very sensitive adjustable ringer, a far-reaching, clear and distinct transmitter of large volume and a powerful, horseshoe magnet, adjustable receiver, all made of the very best material obtainable, and with the highest class of workmanship throughout. It is stated there is absolutely no possible danger from lightning when using the instruments, as there are no exposed metal parts that form any part of the circuit at any time, all connecting wires, binding-posts and terminal screws being completely concealed.

Toll Interchange in Ohio.

The general managers of the Ohio Independent telephone companies met at the Colonial Hotel, Cleveland, February 5th, for the purpose, it was at first supposed, of forming an association similar to the old organization of Ohio telephone men which failed to meet in annual session last year. However, after a two-days' session, at which only the managers were present, a company was formed with a capital stock of $10,000, the purpose of which, it is stated, is to maintain permanent headquarters for the auditing and clearing of interchange toll business, the publication of telephone books, the sale of telephone supplies, the operation of a bad-debt exchange and the maintenance of a corps of professional and technical men for such purposes as they may be needed. It is stated that one of the main purposes will be the securing and sale of supplies at reasonable rates to the various companies which use the service of this company.

The stock is to be divided into 1,000 shares of $10 each, and no one will be allowed to hold more than 10 shares. Only managers of Independent plants will be allowed to hold stock. Thirty-two companies became interested in the organization at the start. One corporation cannot hold stock in another in Ohio, but the managers may hold it individually.

The following officers were chosen for the coming year: President, W. Gilbert Thompson, secretary of the Valley Telephone Company, Lebanon; first vice-president, Judge Grissinger, president of the Marion County Telephone Company, Marion; second vice-president, H. C. Devin, secretary of the Mt. Vernon Telephone Company, Mt. Vernon; treasurer, A. V. Hageman, secretary of the Black River Telephone Company, Lorain; the office of secretary was left vacant for the present and the affairs of the association will be left temporarily in the hands of H. H. Robinson, assistant manager of the United States Telephone Company. The directors of the company are as follows: G. P. Thrope, secretary of the Clinton Telephone Company, Wellington; Frank L. Beam, general manager of the Citizens' Telephone Company, Columbus; C. C. Curtis, manager of the Sandusky Telephone Company, Sandusky; H. H. Robinson, assistant manager of the United States Telephone Company, Cleveland; R. E. Hamlin, secretary of the Home Telephone Company, Toledo. The headquarters of the company will be in Cleveland for the present.

Central Missouri Telephone Association.

The second annual meeting of the Central Missouri Telephone Association will be held at Sedalia, Mo., on February 27th, at 2 p. m., in the parlors of the Huckins Hotel. A programme has been arranged and an interesting meeting is expected. The meeting will be of importance, as the question of long-distance toll connection will be discussed. An Independent six-circuit toll line is to be built from St. Louis to Kansas City and from St. Louis to Joplin and farther south. Representatives of the long-distance companies will be present at the meeting. G. W. Schweer is president and M. L. Golladay of Windsor, Mo., is secretary of the association.

Electrolysis-proof Conduit.

The immense amount of underground electric conduits that is now in existence and the rapidly growing tendency of municipalities to compel the location of all electric-lighting, power, telephonic and telegraphic conductors beneath the surface of the earth, and the consequent demand for conduit of the highest grade—all this renders important information relative to the details of improved underground construction.

An essential of paramount importance in a good conduit, in view of the number of grounded circuits, is, perhaps, above all, its ability to withstand the electrolytic action of currents which may be present in the soil surrounding conduit lines. Again, it must have the ability to withstand the deleterious action of soil, which is more or less impregnated with oxidizing agents, and in some cases where direct chemical reactions are a positive danger. Besides possessing these properties, which make for the long life of the conduit, it must be of such construction as to facilitate its rapid construction, and the problem of making joints and easy angles is one which has required the best ability of the conduit manufacturer to overcome.

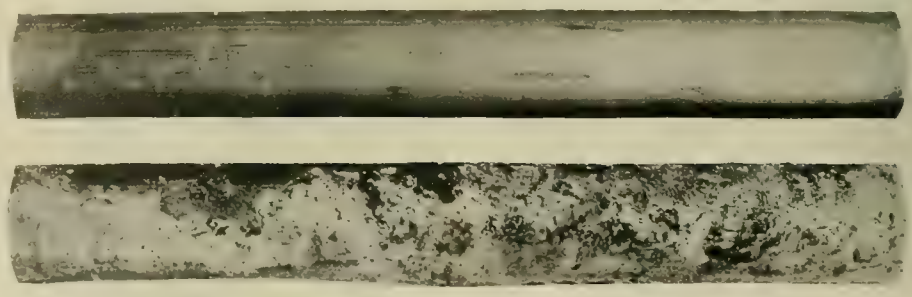
For a number of years the Electrolysis-proof Conduit Manufacturing Company of Chicago, under the management of W. F. McCarthy, has been exploiting bituminized fiber conduit in the electrical field. Recently the business of this institution has been acquired by the American Conduit Company, with factories at Chester, Pa., Chicago and Los Angeles, Cal., Mr. McCarthy having been retained as western manager, with offices at 822 Manhattan Building, Chicago.

The manufacturer's claims are essentially as follows: The bituminized fiber conduit is compressed paper and asphalt, which not only makes a strong and light conduit and a practically perfect insulator, but one that affords great strength when underground. On account of its electrolysis-proof properties, the conduit affords that protection to cables which is sought by the leading engineers, not only in the electric line, but by the engineers of gas and water companies, as it affords the same protection to gas and water pipes that it does to underground cables. It is being installed now in various cities by the gas companies for protection to their service pipes. This conduit is moisture-proof, and when joined together with a slip joint it makes a solid body from manhole to manhole. The joints are self-aligning, insuring a smooth and continuous-duct line.

It is an easy conduit to lay, requiring no skilled labor. It is also easy to draw cables through, as there is nothing in its composition to offer resistance to the motion of the cable. It is made in seven-foot sections and weighs 2¼ pounds to the foot, and can be shipped, particularly long distances, at cheap rates. It is made in sizes from two inches to six inches in diameter. Its life is as long as that of asphalt, which is the principal ingredient of the conduit. It is not brittle, and is of a tough nature, but can be cut with an ordinary hand saw. This conduit has been on the market and used for low-pressure water pipe for the last 18 years. In the last eight years it has been used extensively as an underground electrical conduit.

The nature of the conduit makes it electrolysis-proof, affording a thorough protection to the cable, as shown by the result of a test made upon a specimen of bituminized-fiber conduit and a piece of vitrified-clay conduit. (See cut. The upper picture shows the cable in electrolysis-proof conduit after test. The lower one shows the cable in salt-glazed vitrified-clay conduit under same time and conditions.) This test was made at Oakland, Cal., by the Sunset Telephone and Telegraph Company. The duration of the test was 524 hours, a section of each of the respective conduits being placed one after the other in a box having four inches space on all sides of the conduit filled with damp earth. A short length of lead cable was placed in the conduit, to which was connected the positive wire, and then a layer of pulverized coke laid between the cable and the conduit for effective contact. A lead plate was placed in the bottom of the box, to which the negative wire was attached. The voltage was 485 and the amperage 5.4 at the beginning, ending at 2.4, making an average amperage of 3.9. The resistance at the start was 89 ohms and at the finish 198 ohms. It is stated that under this test no electrolytic action was noticed in the bituminized-fiber conduit. The report of this test was signed by C. O. Poole, superintendent of the Standard Electric Company of California, F. W. Alston, electrician of the Sunset Telephone and Telegraph Company, and L. D. Fitzgerald, superintendent electrical department, San Francisco Gas and Electric Company.

After many severe tests, this conduit was adopted by the Chicago Telephone Company and also by the Sunset Telephone Company. The Chicago company has laid over 2,000,000 feet of it in the last two years. Chicago is conceded by engineers to be one of the most severe points in the country on underground ducts, as the lines are often submerged. The E. H. Martin Telephone Company, Rocky Mountain Bell Telephone Company, Pacific States Telephone Company, Home Telephone Company of Kansas City, Glen Telephone Company of New York, Elgin-Aurora Traction Company and Metropolitan Street Railway Company of Kansas City are all users of this duct.



ELECTROLYSIS-PROOF CONDUIT.—RESULT OF TEST.

The Des Moines (Iowa) City Railway Company has decided to make expenditures upon betterments and extensions of its plant that will cost about $500,000. An addition to the power plant, which will increase the operating capacity by one-half, is among the improvements contemplated.

Duncan Integrating Wattmeter for Direct Current.

The new Duncan integrating wattmeter is of an entirely new design, and embodies the most modern ideas in the art. For perfection of design, excellence of construction and accuracy of measurement it is said to have no superior. It represents the work of years of experience and is designed to meet every requirement of those whose duty it is in the central station, to test, install and inspect meters, so that their work may be facilitated, and assist in keeping the operating expense of the meter department at a minimum. The castings of the meter are made from nickel aluminum, making it light in weight, while every part is easy of access and interchangeable.

The terminals are situated at the top of the meter and connect the series coils with the inleading wires from the circuit, thereby removing these leads away from the retarding magnets at the bottom, and insuring in consequence a greater permanency and life for the magnets. The magnetic field set up by the inleading wires exerts a demagnetizing effect upon the magnets when in close proximity thereto, and this becomes very pronounced in case of heavy overloads and short-circuits.

The registering train is made large, and all of its parts are carefully adjusted to insure perfect ease of operation and freedom from "sticking," which creates so much trouble in smaller trains, even to stopping the meter. The pinions and gear wheels are cut very accurately by automatic machinery, and assembled by experienced watch-makers. The train is provided with dowell pins, so that when it becomes necessary to remove it from its bracket it can be again put back exactly into its position, thereby enabling the worm wheel and worm to mesh as originally set.

The dial is also much larger than is usually employed, making it easy to read at a distance; it has a porcelain face. The circles and figures are printed in heavy type and read in kilowatt-hours. Dials can also be furnished to read in watt-hours, horsepower-hours, Board of Trade units or dollars and cents.

A commendable feature of the meter is that it is direct reading; that is, the dial shows at all times the actual amount of energy that has been consumed without having to employ a "constant" or "multiplier," by which the reading would otherwise have to be multiplied. This eliminates a great source of trouble and inconvenience, and not only simplifies the work of the person who reads the meter, and the bookkeeper who makes out the bills, but also removes any doubt from the mind of the consumer, who is always more or less skeptical about the readings of his meter if a constant is used.

The cast back or support of the meter is provided around its outer edge with a groove that is lined with heavy felt, and over which the case closely fits, thereby rendering the meter absolutely dust and insect-proof. The dust-proof case is hinged at the bottom and is provided with a single screw at the top which answers for screwing it tightly into position and sealing the meter at the same time.

The series coils are machine wound and heavily insulated with linen tape, after which they are immersed in copal varnish, then baked for several hours until they are thoroughly dry. This enables them to withstand any commercial pressure without breaking down. The front series coil can very easily be removed from the meter by simply taking out the four screws that hold its corner clamps to the brass supporting rods. This removable feature of the front coil furnishes a quick and excellent means for inspecting the armature.

Great care has been exercised in selecting a resistance wire that will not become brittle and break by being alternately heated and cooled. The wire is wound in sections upon a flat, insulated support having saw-tooth edges, so that the difference of potential between each adjacent section is reduced to a minimum.

Realizing the trouble that has been experienced in the past with the commutator of this type of meter, the Duncan Electric Manufacturing Company of Lafayette, Ind., which makes this instrument, has adopted a special alloy that is said to be superior to any other metal used heretofore for this purpose, and which will retain its polish even in the presence of sulphurous gases. The segments are accurately cut and thoroughly insulated from each other and from the spindle, so as to prevent any possibility of the armature circuit becoming grounded at this point.

The brushes are easily detached by the removal of two small screws, which permits of their being lifted out for inspection without interfering in any way with the shunt-circuit wires. When they are detached they can be thoroughly cleaned and polished, if necessary, and replaced again without any fear of changing their original tension.

The spindle is provided with a removable pivot point, which is made in the most approved manner from the best quality of steel piano wire hardened in mercury, then polished to a very fine finish with Vienna lime and rouge. The point of these pivots is carefully rounded off by a machine expressly designed for the purpose, so as to give the least tendency to wear and at the same time reduce the friction to a minimum.

Appreciating the great amount of trouble that is given the users of electricity meters by the use of cheap jewels, the Duncan company has succeeded in procuring an especially high grade of Ceylon sapphire, that comes next to the diamond in hardness, and can recommend it as being the best medium-priced jewel upon the market. These jewels are made in accordance with a special design, and polished until they are free from scratches or flaws of any kind. The size and form of the cup is such as to give the best possible results with the aforementioned pivot point, resulting in low friction and long life. To protect the jewel against jarring and vibration it is seated upon a small spring, which is adjusted to balance the weight of the revolving element, and upon the slightest jar being imparted to the meter the spring takes it up and relieves the jewel from any possibility of being damaged.

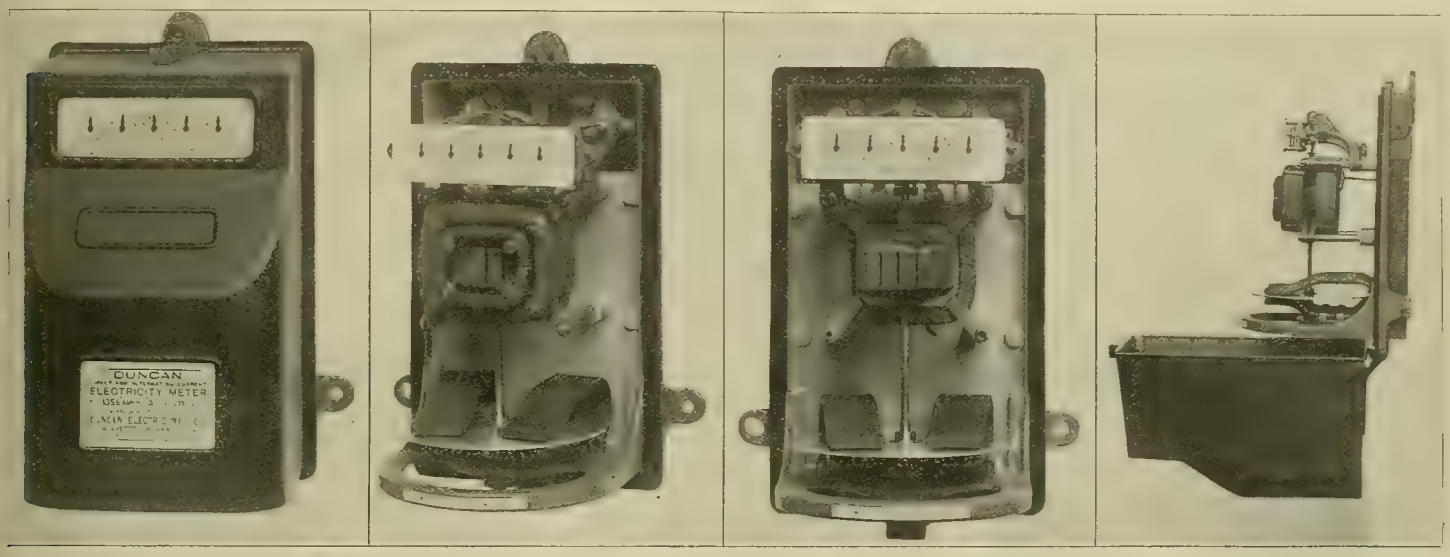
To those who wish to use the best bearing possible, the maker of this meter is pleased to state that it can furnish a diamond-jewel bearing with this meter. It consists of a diamond step, having a sapphire guide mounted upon it, and within which the spindle point revolves, the whole being seated upon a delicately adjusted spring, to protect it against jarring, in a manner similar to that of the sapphire bearing. Tests of meters equipped with these diamond jewels have demonstrated that as many as 5,000,000 revolutions of the spindle, with its accompanying armature and retarding disk, failed to produce the same wearing effect that usually results with a sapphire jewel and one-tenth the number of revolutions. The first cost of these diamond jewels is, of course, higher than the sapphire, but when their wearing quality is considered, together with the maintenance of low-load accuracy, by reason of their not becoming rough quickly and causing the meter to slow down gradually on light loads, they are much the cheaper of the two in the end.

It is conceded that there is no element entering into the manufacture of meters that is of more importance than the retarding magnets. The corroboration of this statement can be borne out by the users of direct-current integrating wattmeters who have experienced trouble through poor magnets becoming weak, and even worthless, by reason of their not being properly made and aged, or manufactured from a cheap grade of steel. Realizing the importance of having magnets that will withstand variations in temperature and mechanical vibration incident to shipping and handling and still maintain their strength for the purpose of enabling the meter to remain accurate for an indefinite period, the company has given a great deal of study, and made many experiments, with the view of producing magnets whose permanency or magnetic retentivity could be relied upon, and, from the results, it is satisfied that its efforts have been successful.

The usual means to compensate for the changes in friction of the meter is also provided to insure low-load accuracy. This consists of a small coil wound with many turns of fine wire and connected in series in the armature circuit and placed within the front series coil adjacent to the armature. It is held in position by four small wire brackets and thumb nuts, which prevent it from changing its position during shipment.

The testing constant (K) of each meter is marked upon the disk, and, as an example, it will be found in the case of a 10-ampere, 110-volt meter to be marked K ½. It should be borne in mind that this testing constant is to be used only in testing the meter, and must not be used in connection with the dial when the monthly readings are taken for the purpose of making out the bills for customers. The dials are direct-reading and do not require any constants.

This meter, while especially adapted for measuring the energy or direct-current lighting and power circuits, will also accurately measure alternating currents of any power factor, wave form, or frequency. This is made possible by its being of the commutated type, without iron in its series coils or armature, with its pressure current practically free from inductance.



Meter with Case in Position. Meter with Case Removed. Front Series Coil Removed to Reveal Armature. Side View, Showing Detachable and Hinged Case.

DUNCAN INTEGRATING WATTMETER FOR DIRECT CURRENT.

Steam-turbine Plant in Orangeburg, N.Y.

An interesting example of the application of the steam turbine to power generation from small central stations is afforded by the installation recently contracted for by the Rockland Light and Power Company of Nyack, N. Y. This company has for a number of years been engaged in furnishing light and power to the local territory surrounding the town of Orangeburg, N. Y., where the generating station is located. The electrical supply system covers a territory of considerable extent, embracing the towns of Nyack, Grand View, Piermont, Sparkhill, Orangeburg, Tappan, Blauvelt, Nannet, Spring Valley and Nonsay. The territory will be covered by five independent distributing systems, each fed by a separate transmission circuit from the power house at Orangeburg. The load consists mainly of incandescent lighting, but motors of considerable capacity are installed at a number of points. The present equipment of the station comprises a number of different types of boilers, engines and generators. The latter are belted outfits and will be largely replaced by the new steam turbo-generator unit to be installed. The present system is a two-phase, 3,300-volt alternating-current system, each generator operating independently upon a separate circuit. In the new arrangement, provision has been made for operating the entire system from the turbo-generator unit, the remaining machinery being held in reserve for periods of heavy load. The turbine is of the standard single-cylinder, multiple-expansion type, built by the Westinghouse Machine Company of Pittsburg. It will be furnished with superheated steam at 125 pounds pressure, this being accomplished by an independent superheater, with which a superheat of 100° to 125° F. will be obtainable. The mechanical equipment includes also a Snow condenser, capable of maintaining a high vacuum, an Alberger cooling tower for cooling the circulating water, and a mechanical-draft outfit.

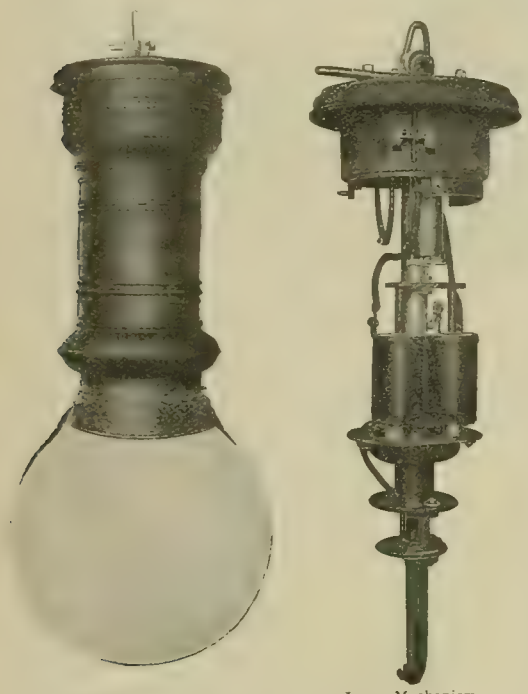
Toerring Enclosed-arc Lamps.

Enclosed-arc lamps for constant-potential, 110 and 220-volt, direct-current circuits have been manufactured by the C. J. Toerring Company of Philadelphia for the last three years. Wherever possible the lamps have been improved, and the lamp illustrated herewith, while similar to the old types formerly manufactured, retaining all their good points, such as long life and high efficiency and reliability, is said to have added to these much greater accessibility of lamp parts. All parts liable to wear or injury can be replaced without taking the lamp from its hook, an advantage especially apparent where lamps are used in large numbers.

The lamps, it is asserted, have a life of from 200 to 300 hours, using the same quantity of carbon which in other lamps produces but 100 to 150 hours, and leaving no more ash on the cylinder after 200 hours of burning than other types have after 100 hours. The saving above the cost of similar lamps burning about 100 hours will, it is said, vary in different cases, but on a conservative estimate will generally lie between the figures of $2 and $5 per lamp per annum.

In the design of the lamp the factor of safety of such parts as the magnet spools, resistance, etc., was made unusually large. Convenience in trimming, lightness and compactness, together with pleasing and ornamental design, are all embodied in the construction of the lamp.

The accompanying illustrations show the standard casing and the construction of the 110 and 220-volt single-burning arc lamps. The mechanism consists essentially of an inner carbon-carrying tube, suspended at its upper end within another, outer tube, by a chain, the other end of which, after passing over a small wheel, is fastened to the plungers of an electromagnet. The clutch is fastened to the lower end of the inner or carbon-carrying tube. A cap plate is fastened at the lower end of the outer tube and serves to act as a cover and support for the cylinder or inner globe. The inner globe is held in position by a phosphor-bronze spring of simple and durable design, so placed that it can cast but little shadow.



Standard Casing. Lamp Mechanism.

TOERRING ENCLOSED-ARC LAMPS.

There are no sliding contacts in the lamp. Current is carried to the upper carbon by a flexible, asbestos-insulated cable directly from the spools. This cable is mounted on both ends by a clip designed to take all strain from it in a manner similar to the ribbon which holds the cable to a telephone receiver without strain on the cables. This method has the further advantage of preventing all kinking, and therefore eventual breaking of the cable. The resistance wire is wound and laid in the grooves of a large porcelain cylinder. The advantage of this may be gathered from the fact that although the arc be short-circuited, the resistance wire as a consequence taking a current three or four times the normal, causing it to glow red hot, the wire will nevertheless retain its position and insulation, effectively saving the lamp from further harm. It is said to be impossible for the several turns of wire to sag and short-circuit.

Excessive breakage of the inner globe, due to poor methods of supporting it, has been overcome by eliminating all unnecessary curves. The ground upper edge of the glass is, of course, its most vulnerable point. By placing this point above the tripping plate it is shielded from the direct heat of the arc, and breakage at this point is practically eliminated.

The diameter of the cylinder is large enough to prevent discoloration of the glass through the heat of the arc, and large enough to admit the hand when cleaning.

The globe is furnished either of clear or opal glass. The shades are made of a heavy opal glass which reflects nearly the whole of the light. The metal shades furnished have a white painted reflecting surface, a corrugated mirror reflecting surface, or is porcelain enameled. These lamps are furnished either globe or shade, as desired. A five-ampere lamp is rated at 2,000 candlepower, a four-ampere at 1,600 candlepower and a three-ampere at 1,200 candlepower.

Rehabilitation of Power Service After Niagara Falls Fire.

[Special correspondence of the Western Electrician.]

Niagara Falls, N. Y., February 5.—Later investigations made by electrical engineers of the Niagara Falls Power Company into the causes of the fire that damaged the cable lines and transformer station on the night of January 29th lead to the belief that the fire had its origin in the basement of the transformer station, and that, after gaining good headway there, was carried by the draft through the bridge over the inlet canal toward the big generating station known as Power House No. 1. It has always been observed that there is a draft from the transformers toward the bridge. It is still believed that lightning caused the trouble, but that instead of striking the bridge it entered over the Echota line. This is an overhead line running under the transmission line through the lands of the Niagara Falls Power Company for the purpose of furnishing current for the Echota lighting system and power for the disposal works, the line branching off from the transmission line to run into Echota. The theory is that when the lightning came in over this line it started a fire in the basement of the transformer station. The idea is held that it burned in the basement some few minutes and finally caused a short-circuit. This opened the circuit-breakers located at the south end of Power House No. 1. The short-circuit, so it is believed, set fire to the cable insulation, spreading to other cables near by. When the insulation of these cables had burned, there was a general short-circuit, and this necessitated using the emergency switch to open the fields of the generators.

With all the facts about the manner in which the service was renewed at hand, electrical engineers will better understand the truly remarkable feat performed at Niagara on the night of the fire in re-establishing connections. The fire was not put out until midnight. It had eaten through the roof of the transformer station and through the roof of the bridge, and the inside of both structures was charred. The 52 1,000,000-circular-mil cables had been destroyed. The telephone and light wires had been burned, and the work of recovery from the fire had to be commenced without either service. The power company had several large headlights available, and these were brought into service until a string of lights could be established. The interruption of the telephone service was a severe blow. These wires had been most carefully installed with a view of escaping trouble should it occur, for the value of the telephone service was recognized. However, the fire burned the cables, leaving the power company officials without a telephone service, which would have been a great aid in summoning men from their homes, while it also made it impossible for the tenants of the company to reach the power house to ascertain the extent of the trouble and the prospects of delay. To meet the emergency, a number of carriages were secured from a livery, and throughout the night messengers hurried about in them, calling the skilled hands of the company and doing many errands. During the fire there was quite a gathering of laborers resident not far distant from the power house, and as soon as the fire was out, many of these, who had been immediately engaged, were set to work cleaning up the debris and helping where they could. By one o'clock that night over 200 men were working to effect repairs, and the work of replacing the burned cables was well under way. So rapid was the progress that by seven o'clock on Friday morning all cables between the generating station and the transformer station required for the 2,200-volt connections for the long-distance service had been replaced.

It was at this point of the progress that the water that had been thrown by the firemen into the transformer station served to delay matters. The air-blast transformers had been wet by the flood of water, and it was necessary to substitute for them several of the 1875-kilowatt oil-insulated transformers. These transformers had been in service at 11,000 volts, and before they could be adapted to the long-distance service the high-tension connections had to be changed to deliver 22,000 volts. The water had also wet the 22,000-volt bus-bars and wiring between the air-blast transformers and the transmission lines, and before the service was renewed an entirely new installation of 22,000-volt wiring, including bus-bar, connections from the transformers and connections to the transmission lines, was designed and installed complete ready for operation by 1 p. m. on Friday, about 13 hours after the fire. Current was then put on the 22,000-volt transformers, when short-circuits occurred in the terminals of three of them. This was due to water that had collected on the marble terminal boards immediately around the terminals and under the oil. The trouble was remedied by drawing off some of the oil, cleaning up all of the terminals, and refilling with clean oil. The time required to find and remedy the trouble postponed the service to Buffalo until about five o'clock on Friday afternoon, but the local tenants of the Niagara Falls Power Company had been taken back at intervals from 11:30 a. m. to 3 p. m. Friday, all agreeing that the recovery from the fire had been quite remarkable.

Vice-president William B. Rankine contributes quite a little information in relation to the protection afforded customers of the Niagara Falls Power Company, and outlines the company's plans to a considerable degree, in the following statement:

"The Niagara Falls Power Company recognizes fully and desires to acknowledge publicly its appreciation of the patience and good feeling which have been exhibited by the users of its power on the Niagara frontier and by the public generally during the recent trouble at Niagara Falls. Not until this unavoidable incident in the company's operation was there a full realization of the important part which Niagara power bears in the industrial and domestic life on the Niagara frontier. The importance of a suspension of a power supply which extinguishes the municipal and domestic lights in the cities of Buffalo, Lockport, the Tonawandas and Niagara Falls, cripples 350 miles of street-car service and shuts down over 150 manufacturing concerns, can be realized only from actual experience. This experience was had during 19 hours, beginning on Thursday evening last, and was caused by an absolutely unavoidable occurrence.

"It is of public as of private interest to give assurance that every precaution is taken by the power company to meet just such exigencies and to avoid their repetition.

"At this time it seems proper to make known to the citizens of Buffalo and of the Niagara frontier the provisions for securing continuous power supply now enforced by the power company, as well as the plans under construction for redoubling and trebling such security.

"There are three circuits of conductors for the transmission of power from Niagara Falls to Buffalo attached to two distinct transmission pole lines. These lines are inspected daily. Each of these circuits is composed of three cables and has a capacity of carrying the maximum load required by the aggregate users of power in the city of Buffalo, although this load is carried upon two of the circuits, leaving at least one of the circuits always in reserve.

"The present Buffalo service is supplied from Power House No. 1, and the company has on hand always spare parts of the hydraulic and electrical machinery ready for substitutions at any time in the place of injured or worn parts. Reserve cables are on hand in quantity sufficient to replace at any time the cables required for transmitting current for Buffalo from the generators to the transformers. Reserve transformers are installed with a capacity of 50 per cent. in excess of the normal use required. At the time of the fire on Thursday night the company had in its storeroom sufficient reserve cable to replace all the burned cable which had been supplying the Buffalo circuits, and this reserve was exclusive of the additional cables on hand for construction purposes in Power House No. 2.

"In the city of Buffalo a complete set of spare cables is laid in conduits from the terminal station, where the power is received from Niagara, to every power, light and railway sub-station within the city limits.

"When the company has finished Power House No. 2, now nearing completion, and when early next year the Canadian Niagara Power Company has constructed its first installation of 50,000 horsepower, now well under way, these three power houses, each containing a complete installation of 50,000 horsepower, will be so connected that power customers, including the city of Buffalo, will have the protection of three distinct sources of supply, and a recurrence of the recent suspension from the same cause would be impossible unless three separate bolts of lightning simultaneously should strike all the three separate power houses of the allied companies. It is proposed, also, as an additional reserve protection for Buffalo, to construct a transmission circuit from the Canadian power house on the Canadian side to

Fort Erie, where a crossing will be made into Buffalo, thus giving four separate circuits for the delivery of current to Buffalo consumers—one upon the Canadian side and three upon the American side. It may be said safely within a year that there will be no steam or waterpower station in the world with such ample reserve provision for the production of a continuous power supply."

The Niagara Falls Power Company has issued the following statement:

"The Niagara Falls Power Company desires to make public acknowledgment of its appreciation of the prompt and successful work of the city fire department in extinguishing the fire at its transformer house on Thursday evening. Valuable assistance and cordial offers of co-operation were received from representatives of the General Electric Company of Schenectady, Westinghouse Electric and Manufacturing Company of Pittsburg, Standard Underground Cable Company of Pittsburg, Buffalo and Niagara Falls Electric Light and Power Company, the Bell Telephone Company of Buffalo, Home Telephone Company of Niagara Falls, Cataract Power and Conduit Company of Buffalo, Tonawanda Power Company, International Railway Company, Acker Process Company, Castner Electrolytic Alkali Company, and the Union Carbide Company of Niagara Falls and others. The power company takes this means of expressing its grateful acknowledgment to its friends and neighbors."

DISTRIBUTION ON THE CANADIAN SIDE.

Joint operation of an electrical power scheme is the latest development of the municipal co-operation idea in Canada. The civic authorities of Toronto have a sub-committee on Niagara Falls power at work. All the important municipalities within a radius of 100 miles of Toronto are being interested in the scheme and will, it is said, demand of the Ontario Legislature, at its approaching session, a power concession at Niagara Falls. At present steam-produced electrical power in Toronto costs from $40 to $60 per horsepower per year. A competent engineer, acting for a number of western municipalities, has prepared an estimate showing the cost of a duplicate plant to furnish 30,000 horsepower to factories within 50 miles of the falls. The cost of installation would be $9,000 a mile, and plant to furnish about 50,000 horsepower would cost $12,000 per mile. On that basis the cost of conveying electrical energy to Toronto would be $5 per horsepower per annum. Allowing $10 per horsepower for the power at the producing point, $15 would be the annual cost per single horsepower supplied continuously. The idea of the municipalities is to string big trunk cables from Niagara Falls east as far as Toronto and west as far as London, Ont., and supply power to users all along the route. It is thus claimed that Niagara Falls would be to western Ontario what coal has been to Great Britain, and would make the Niagara area of Ontario one of the leading manufacturing centers of the world.

Siemens-Halske-Schuckert Combination.

Following the Allgemeine-Union amalgamation of last December, another consolidation of German electrical manufacturing companies is announced, this time the Siemens & Halske and Schuckert companies being the corporations to unite. The new concern is to be a limited-liability company, with a capital of $22,500,000. It will be known as the Siemens-Schuckert works. It is asserted that all "watered" stock and worthless assets will be eliminated, and only the factories, material on hand and sound accounts will figure on the new books. All the shares of sub-companies will be excluded. The combination is to take over the old companies in April. All the great electrical manufacturing concerns of Germany are now practically included in the two groups, and it is believed that the latter will make common prices.

In his article on "Electrical Progress on the Continent in 1902" in the Western Electrician of January 3d last, Mr. Francis E. Drake gave these financial particulars of the two companies in the latest combination: Siemens-Halske—Total stock and bonds, 84,500,000 marks; last dividend (1901), eight per cent.; stock quoted on November 1, 1902, at 113. Schuckert—Total stock and bonds, 77,000,000 marks; stock quoted on November 1, 1902, at 76.

Cement Butts for Pole Lines.

The use of cement butts for all kinds of poles that are either too short to use alone or have become rotten at the butt is an innovation recently put on the market. The cement is made of clean gravel and is thoroughly tested and is then molded in an octagonal form. Four galvanized steel straps are bolted to the cement at one end and project so as to receive the end of the wooden pole. The butts run from 10 to 20 inches in diameter and the top is convex, so that moisture cannot remain there. In the accompanying illustrations is illustrated one method of using the cement butts. Fig. 1 shows a 20-wire Postal telegraph line whose poles have rotted at the butt end, near the ground. The pole is first scored for connecting the side irons. Then the pole is supported as shown in Fig. 2, the old butt sawed off and removed, and the cement butt slid into place and bolted to the pole. Fig. 3 indicates the appearance of the completed pole, the work having been finished in 20 minutes by two men without touching the overhead wires. It is not necessary to dig a hole for the cement butt, as the old butt can be extracted. In the instance illustrated the pole was moved a short distance in resetting. The cement butt is allowed to project at least six to eight inches above ground. It is stated that 50 per cent. of the poles need not be scored, as experience shows the connection is elastic enough to offset ordinary diameters of butts. This construction is said to make the poles last three times as long, as the cement does not decay.

The cement butts are of special advantage along electric and steam railways and also for telegraph and telephone work, as they hold the bottom of the poles in place and in plain sight and prevent them from being burned or rotting at the ground. Poles with rotten cores can be used and new poles may be five feet shorter, if set with these cement butts. It is safe to put in a stock of the butts for use at short notice, as by stowing them out of doors and thus exposing them to all conditions of weather, they will be hardened and improved in the meantime. These cement butts are the invention of Lee K. Forsythe, and are being manufactured by the Durable Cement Post Company of Battle Creek, Mich. The company also makes a similar line of cement butts for fences, foundations, vineyards, etc.

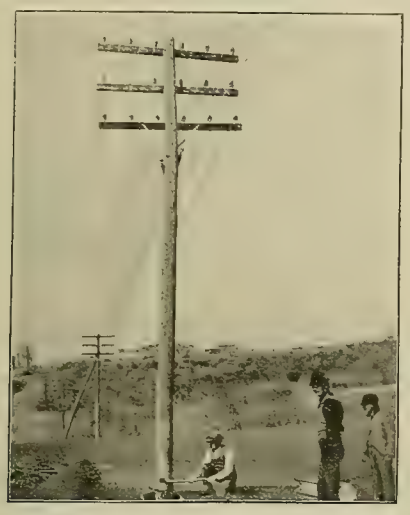


Fig. 1. Telegraph Line.—Scoring Pole for Connection.

Fig. 2 Sliding Pole on Cement Butt.

Fig. 3. Completed Pole.

CEMENT BUTTS FOR POLE LINES.

Boiler Test at University of Chicago Power Plant.

A 24-hour test was made on the 2,500-horsepower boiler plant of the power house at the University of Chicago last week by C. H. Hurd. The boiler equipment of this station, which was described in the Western Electrician of July 19, 1902, has only just been completed. It comprises unique features in the arrangements of tunnels under the boilers for heating the air supply and for containing the feed-water economizers, designed by J. D. Houghton. The tests showed that the gases on leaving the boilers were at the temperature of 400 degrees Fahrenheit. After passing through the water economizer the temperature dropped to 250 degrees, and after it had passed through the air economizer it was down to 100 or 125 degrees. The gases entered the smokestack at this temperature. This is considered a marked contrast to most plants, in which the gases enter the stacks at 400 degrees. The analysis of the flue gas shows that more than 20 pounds of air was used for one pound of coal. That amount of air raised to 100 degrees temperature means a constant saving. Exact figures on the total efficiency of the plant have not been given out.

Lamp-socket Litigation and Patent Monopoly.

In the case of the General Electric Company against James B. Wise of Watertown, N. Y., Judge Ray of the United States Circuit Court has decided that the defendant, in making and selling incandescent-lamp sockets, has infringed the Tournier patent, No. 559,232, issued April 28, 1896, and assigned to the complainant. The court finds that the Anchor Electric Company was held by Judge Shipman to have infringed the same patent. It then examines the particular claims made for the Wise socket as non-infringing and declines to uphold them, saying flatly that "the Wise socket is a copy of the Tournier." The injunction asked for is therefore granted.

In the opinion of the court are the following observations of general interest:

In a sense, the granting of a patent confers a monopoly on the inventor or owner of such patent, but such a monopoly is granted in the interest of the public as well as of the grantee of the patent and is an encouragement to the development of inventive skill and genius. The patent laws of the United States, while sometimes abused or perverted, have had much to do with the growth and prosperity of our country, and have added much to our material and intellectual development. Ultimately, these inventions are surrendered to the public, and it is only just that for a time the inventor reap the rewards of study and industry.

The cry of monopoly, therefore, has no place in the discussion of the question of infringement or priority of invention.

It is difficult to understand how or why a violation of the Sherman anti-trust law by this complainant (if there has been such a violation) confers any right on the defendant to infringe this patent. That act points out the penalties for its violation, and it is not understood that such law denies the grantees of patents the protection of the law because they may be violating some statute. However that may be, the evidence falls far short of establishing such a violation by this complainant. The testimony on that subject is squarely contradicted. An individual cannot confiscate the property or property right of a corporation on the ground it has violated that act.

Shawinigan Power in Montreal.

On Saturday, February 7th, the Shawinigan Water and Power Company successfully started its power-transmission plant between Shawinigan Falls and Montreal. The transmission line, which is of aluminum cable, is a fraction over 84 miles in length. The transmission is at 50,000 volts (30 cycles). The line has a maximum capacity of 8,000 horsepower. The apparatus at present installed is capable of delivering 2,500 horsepower, and additional apparatus is being put in as rapidly as possible for 2,500 horsepower more. The step-up and step-down transformers and switchboard apparatus were furnished by the Westinghouse Electric and Manufacturing Company, and the synchronous frequency-changers for changing from 30 to 60 cycles were furnished by the Bullock Electric Company. This apparatus was all set up, ready for operation, seven months from the date of the order for it. The 50,000-volt line insulators were furnished by the R. Thomas & Sons Company of East Liverpool, Ohio. The aluminum cable was supplied by the Pittsburg Reduction Company. The station buildings for the transmission were designed by Wallace C. Johnson, chief engineer of the Shawinigan Water and Power Company, who also had in charge the carrying out of the construction work. The transmission was laid out and the construction directed by Ralph D. Mershon, consulting engineer for the company.

Long-distance Electric Railroading.[1]

By Dr. Louis Duncan.

The problem of substituting electricity for steam on the trunk lines of the country is of such present importance, the efforts being made to solve the problem are so serious, the difficulties are so great, and the results so meager, that a general review of the subject cannot be without interest.

The applications of electricity to traction, which I will discuss this evening, may be included under three head:

First—Tramways.

Second—Suburban and interurban roads.

Third—The field at present occupied by steam locomotives.

In the first two of these applications, the problems presented are practically the same, although the scale of operation is varied. In either case, it is required to operate a considerable number of single cars, or single-motor cars and trailers, at frequent intervals. In the third application, however—i. e., in the field now occupied by steam locomotives—the problem is entirely different. Here the necessities of through-passenger traffic and of cheap freight transportation demand a few very heavy trains, and the system must be based on the economical solution of this problem. For tramways and interurban roads a practical and satisfactory solution has been found, although it is possible that more satisfactory methods may be developed. For existing steam roads there is at the present moment no electrical solution which has proved its adaptability.

A very brief history of the development of electric traction up to the present time will be instructive.

Prior to January, 1888, although experimental roads had been built and were in operation in England, Germany and the United States, yet they were not on a commercial basis, and did not offer any advantages over the then existing traction methods. At that time a road was opened in Richmond, by the Sprague Electric Railway and Motor Company, which in all essential particulars embodied the methods now used.

Mr. Frank J. Sprague graduated from the Naval Academy in 1878. While there he paid especial attention to electricity. I remember him distinctly, as captain of my gun crew at the school. For not reporting me as often as he might, he earned an esteem which 24 years of close association has failed to weaken. After graduation, Mr. Sprague spent six or seven years in the service. He was ordered to special duty at the Paris Exposition of 1881, and had a tour of duty at the Torpedo School at Newport. He resigned in 1885, and with Mr. E. H. Johnson, then president of the Edison Company, formed the Sprague Electric Railway and Motor Company, the object being to develop the application of motors, more especially for traction work. An experimental car was equipped and operated on a small spur of the elevated road. In the latter part of 1886 a contract was hastily closed for the equipment of the Richmond roads, and preliminary work was begun at once; but when the actual condition of affairs was investigated, it was found to be a much more difficult problem than was at first supposed.

The railroad company had stated that the maximum grade was from six to seven per cent.; in reality, there were grades as high as 10½ per cent. The tracks were badly laid in streets that were unpaved and muddy, and there were a great many curves of a very short radius. However, the work was pushed forward, and the road was formally opened in January, 1888. As I have said, all the important features of modern electric cars were contained at one time or another in this first road. Series motors were used, with a voltage of approximately 500 volts at the motor terminals. A successful under-running trolley was developed, a series-parallel control was at first used, and then, for reasons which at the time were good, was discarded. A single reduction gearing was at first employed, but afterward changed to double-reduction gearing. The only important feature that did not appear at one time or another in these motors was the use of the carbon brush, which is essential to the successful operation of continuous-current railroad motors; this was experimented on, but was discarded, because of the indifferent quality of the carbon used.

On the day that the road was opened there had been a heavy frost, and mud from the streets had accumulated on the tracks and frozen, the consequence being that there was no ground circuit at times. When the current was made by getting out and pushing the cars until they struck a clean rail, the inexperienced motorman, as a rule, had the controllers full on, and a number of motors were burned out. The brushes consisted of pieces of brass, set very much as the carbon brushes are now set; the average life of the commutator was not more than two weeks. On the first day 20 equipments were burned out. For some months the operation of the Richmond road was attended with great difficulties. The motors were not heavy enough for the work; the brushes gave an immense amount of trouble, and the roadbed itself was not fit for heavy traffic. These difficulties were gradually eliminated, and the new roads contracted for took advantage of the experience gained.

The development from the early Richmond experience has been in the direction of making heavier and better motors, of using carbon brushes, and a series-parallel control. The essential parts of the system are, however, adhered to.

As the economy and capacity of electric equipments increased, the city roads were pushed further into the suburbs, and finally roads were built from cities to outlying towns and between cities. This movement is now probably at its maximum; a great number of interurban and suburban roads have been built and more are under construction. The interurban-railroad system is simply an extension of the city tramways. The same system is used with the few modifications necessary for the much heavier cars and the much higher speeds required outside the limits of towns.

On some of the interurban roads very handsome and heavy cars are used, fitted out very much as steam cars are, and approximately of the same size, with speeds up to as much as 60 miles per hour. In fact, one road is building special cars which will attain a maximum speed of 75 miles per hour, and make a schedule speed of 60 miles an hour.

When electric roads operated within a short radius it was the custom to have a central station where the voltage was approximately that intended for use on the cars, and to distribute directly from feed wires connected at the station and to the trolley wire. When the distances became greater, a number of stations employed "boosters" for the outlying districts, the voltage being raised at the station to such an amount that the loss of potential in the feeders would be neutralized, the voltage in the outlying districts being the same as the voltage in the station. When the radius became still greater, as in the case of interurban roads, neither of these systems was applicable, and it is the custom now to distribute, when the distances are considerable, by a high-potential alternating current, which, at certain points along the line, is reduced in voltage and changed to continuous current by means of rotary converters. This continuous current has a voltage of from 500 to 600 volts, and the operation from such a sub-station is similar to the operation from an ordinary central station. The advantage of this system is that it allows a very considerable length of line to be operated from a single station, thus giving economy in the generation of power, while it does not interfere with the direct-current system of operation on the cars. The disadvantages are in the cost, the losses, and the attendance in the sub-station. If the service is frequent, the average load on the sub-stations will be fairly constant, but where the service is infrequent, then the load factor of these stations is very low. This has in a great many cases been remedied by putting storage batteries in the sub-stations and running the rotary converters at a constant load, the fluctuations being taken up by the storage battery.

It should be specially noticed in this connection that it is of extreme importance that the load on all parts of the system should be kept as nearly constant as possible; if the load on the central station fluctuates, the capacity of the station must be great enough to take the maximum load; this increases its cost and decreases the economy of operation. In the sub-station the same thing holds true, and it is also true of the feed wires. As the loss in the feeders changes with the square of the current, it will take approximately twice as much copper for the same loss with a 50 per cent. load factor; that is, where the average power is 50 per cent. of the maximum, as it would if the load factor were unity.

The system sketched above is, then, applicable to the first two classes of traction considered, and it is applicable because they embody a frequent service with small units.

When we consider steam-railroad traffic, however, we meet an entirely new set of conditions. For through-passenger service, a single car, or even two cars, are not enough to give the comfort to which the traveling public is accustomed. This requires heavy trains consisting of a number of cars. Even for a certain class of suburban traffic, where a large amount of travel is concentrated at certain hours, heavy trains, must be used, and a large amount of power utilized for each train.

As far as freight is concerned, the great development in railroads in the past 20 years has been in the direction of increasing the size and capacity of the cars and the weight of the train. For freight, especially bulk freight, the minimum of cost is attained with the maximum weight of train.

The annual reports of the more important roads show clearly the tendency to heavier cars and trains for freight. The average train load on the Pennsylvania Railroad has increased in 20 years by about 75 per cent., and the capacity of the cars is over 100 per cent. greater.

Under these conditions, 500 to 600 volts continuous-current motors, receiving current either directly from a central station or from sub-stations, are not applicable. The possibilities of congestion of traffic, especially of freight congestion, make the capacity of sub-stations enormous as compared with the average power required on the line, and there is required, in addition, an immense amount of copper for the feeders.

Another difficulty is in the large amount of switching to be done, much of it of a complicated nature. If electricity is to be used in terminals and freight yards, a locomotive must be designed which is economical at all speeds and which is under perfect control, and current must be supplied to these locomotives by some means which will not endanger the lives of the train hands. Railroading is dangerous enough, as it is, and any additional source of danger must be avoided.

To obviate these difficulties, several plans have been proposed. The first is to use alternating-current motors on an electric locomotive, the locomotive to be supplied with high-potential currents directly from the generating station, these currents to be applied at once on the motors or to be reduced by transformers carried on the locomotive. A modification of this is to generate a very high potential at the station and to reduce it to a lower potential by means of static transformers along the line, and to use this lower potential on the locomotive. These plans obviate the difficulty of the rotary transformers that would be needed for changing an alternating to a continuous current, and are cheaper in this way. The alternating-current motors also allow higher potentials to be used on the motors, so that it would be possible, for instance, to generate at the station 20,000 volts and transform along the line to 3,000, and apply the 3,000 volts to the motors.

To apply this system practically, there have been a number of experiments made, and some roads are operated on this basis. One method that has been used—the only alternating method now in commercial operation—is to supply three-phase currents either directly to the motor or to reducing transformers which are connected to the trolley wires and are carried on the car. As a rule, this system is installed by using two trolley wires above each track, the rails being taken as a return. A number of small mountain roads in Switzerland and one road in Italy are operated on this basis. I will refer to them later.

Another method that has been proposed several times and is being experimented on by the Oerlikon Works in Switzerland, is to use a single-phase alternating-current motor on the locomotive, connected to a continuous-current dynamo, the current from the dynamo to be used to run continuous-current motors on the axles. The regulation of the locomotive is obtained by varying the strength of the field of the continuous dynamo.

Still another method, proposed by Mr. Arnold, is to use a single-phase alternating motor, which, when working at normal power, will run the train, when running below normal power will store up air in a receiver, and when more than normal power is required, both motor and compressed air are used.

A further plan just proposed by the Westinghouse company, and which is being installed on a road between Baltimore and Washington, is, in many ways, the simplest of all. It is well known that a series motor will run on an alternating-current circuit, the alternations in the field and armature occurring together, the effect being, under certain circumstances, much like that of continuous current. The Westinghouse company proposes to take a motor like an ordinary street-car motor, to laminate the entire magnetic circuit, so that there will be little waste due to the alternations of the field, and to supply this with alternating current of 16⅔ periods. The characteristics of such a machine are very similar to those of the present continuous-current type of series motors, while its regulation is easily effected without breaking the circuit by introducing a variable electromotive force, either working with or against the impressed electromotive force. This variable electromotive force depends on the position of the armature of an auxiliary transformer in the circuit.

To take these methods up in more detail—the three-phase system has been, as a rule, advocated by European engineers. At first glance, it presents a number of advantages over continuous-current systems, and it has been practically operated in Switzerland. It has not met with any favor in this country, and its achievements on the other side have not been such as to inspire any great hope of its ultimate success. The roads in Switzerland show practically nothing except that a three-phase alternating motor can drive a car—a thing which was very well known before. There is no railroad problem involved in their operation. The cars are small, and the voltages used are in no case above 750 volts—the limit imposed by the Swiss government. The most ambitious three-phase road is one in Italy, running from a point a few miles out of Milan, called Lecco—a total distance of 60 miles. A particular interest attaches to this, because the system is that of the Ganz Company, which was strongly recommended by English engineers for the Yerkes tunnels in London. The position of the English engineers in this matter was warmly opposed by Mr. Yerkes and some American engineers, and an ordinary system, very similar to that used on the elevated roads in Boston, New York and Chicago, was adopted. It seems that very few experiments had been tried on the Ganz three-phase system before this discussion came up, and the road in Italy embodies most of the features that were to appear in the London project. The Lecco road was to have started a year ago the first of September. I was on the road the first of this September, and it was not then in commercial operation; an experimental car made trips over a part of it. Roughly, the system is this: Power is generated at a waterfall in about the middle of the line, and is distributed at 20,000 volts to sub-stations, where it is reduced to 3,000 volts by static transformers. The overhead system consists of two wires over each track, the tracks acting as a return

1. Paper read before the Society of Arts of the Massachusetts Institute of Technology, Boston, Mass.

for the third leg of the circuit. The current is collected by a trolley consisting of two metallic rollers about two feet long, mounted on a wooden axle. The rollers are separated from each other by about six inches of treated wood. The roller is held against the trolley wires by compressed air. There are four motors on a car—two of them for permanent use; the other two are merely used in starting. In starting, the fields of the secondary motors are put in series with the armatures of the permanent motors, and a water resistance is put in the armature of the secondary motors. This water resistance is quite ingenious, and will possibly some day work very well, although they have had a great deal of trouble with it up to the present. The plates through which the current passes are stationary; the liquid is forced by compressed air into the tank which contains the plates, and the resistance decreases as the immersed surface increases. When a certain train velocity is reached—which is approximately at half the full speed of the car—and the entire resistance is cut out, the circuits are broken, the secondary motors are cut out, and the permanent motors are put across the supply circuit, with the water resistance in the circuit of the permanent armatures. Then this resistance is gradually cut out as before.

I have not time to go into the difficulties that the Ganz Company has had with this road, but that they are serious is shown by the fact that they are over a year behind the proposed date of opening. The service required is not the heavy service that we need in our railroads, and if it was, the great uncertainty of operation that has been shown, would make the system impossible of operation. A great difficulty—in fact, almost a fatal difficulty—with such a scheme is in the liability of trouble with overhead wires. A two-track system, with four wires overhead, these wires having a great difference of potential between them, is almost certain to cause trouble even on a straight track, and where there is switching, the complication becomes enormous.

There is another difficulty of a more technical nature, which depends on the unbalancing of the circuit due to the rail return. I will not discuss this any more than to state that it decreases the normal capacity of the motors—i. e., for a given output they heat more than they should.

It is interesting to note that very close to this road, running about 80 miles out of Milan, is a road equipped by the General Electric Company. The railroad problem is the same in both cases. The General Electric Company finished its road over a year ago, before the time it was promised, and it has been operating successfully ever since, in fact, its service goes beyond the guarantees that were given.

Taking up the system of the Oerlikon Company, it has some advantages in that it requires but little trolley wire over the track, and affords an excellent means of regulating the motors. Its disadvantages lie in the fact that it interposes between the trolley and the motors a transforming station, which is not only expensive, but adds greatly to the complexity of the system. For heavy-railroad work, between this and the three-phase system, I would unquestionably choose the Oerlikon method. Mr. Arnold's proposition has yet to be tried. It affords an ingenious, if doubtful, solution of the railroad problem, but I am very much afraid that its complexity will prevent its adoption. Without going into any particular reason why, it does not sound like an operative system. The Westinghouse system promises much in the way of simplicity and applicability to the heavy problems of steam-railroad traffic. A series motor has the advantage that it is, to a certain extent, self-regulating. If a great torque is required, the armature slows down, the field is strengthened and the maximum effect is obtained. The details of the apparatus have not yet been given out by the Westinghouse company, but the fact that it has experimented for some time past in its own yards, and has closed a contract for an equipment, shows that it thoroughly believes in its success. One disadvantage is in the low period, which will require large static transformers; but if this is the only difficulty, we can afford to overlook it.

To sum up: As far as the substituting of electricity on steam roads goes, our present methods of electrical traction are not applicable. No method has yet been in successfully practical operation that solves the problem, but our most brilliant experts, having already solved the problem presented by tramway and interurban traction, are seriously attacking the field. The steam-railroad companies are becoming interested in the matter, and are lending their co-operation, and we may expect the same results that have been obtained in the past, i. e., that the problem will be solved, and satisfactorily solved.

Hewitt Lamp and Converter.

The Scientific American says that Peter Cooper Hewitt has obtained 15 patents covering the principles involved in his system of lighting, and has entered into an agreement with Mr. George Westinghouse for the sale of all his patents to the Cooper Hewitt Electric Company. The company has control of both the lamp and converter. A factory is being installed in New York for the manufacture of these lamps and converters, and it is expected that the lamps will be placed upon the market during the coming summer.

Northern California Power Development.

Electric power is rapidly extending its service to the mining industry in various important mining districts of California, and a notable instance of the economy it may work in reducing mining costs is afforded by the recent substitution of electric for steam power in the copper district of Shasta County, where, at the Mountain Copper, Bully Hill and some minor properties, the cost of power has thus been more than cut in two, says the Pacific Coast Miner.

The power is supplied by the Northern California Power Company, which has developed 3,000 horsepower at its power station at Volta, on Mill Seat Creek, about 30 miles east of Redding. This company has developed one of the important electric transmission systems of California, and provides light and power to many towns of that part of the state. From Volta its present distributing system extends southward through Tehama County to Willows in Glenn County, 99 miles from Volta. To the west and northwest, the transmission system reaches Redding, and extends west and north to the mining districts mentioned, where the mining industry consumes a large portion of the energy generated.

The largest consumer is the Mountain Copper Company, or was before the present strike caused a cessation of operations. The smelting plant at Keswick, which is 37 miles from Volta, is equipped to use electricity for nearly all purposes for which power is needed. Motors operate the blowers for the blast furnaces, air compressors, briquetting machines, the slag train, pumps, repair-shop machinery, etc. One steam boiler is kept in use. Steam locomotives are still used on the narrow-gauge railway connecting the smelter with the mine, seven miles distant. At the mine there is no hoist to operate, the mine being worked through tunnels, but the air compressors, pumps, ore tramway, etc., are operated by electric power.

The energy is transmitted at 20,000 volts to substations at smelter and mine, where transformers reduce the voltage to 2,200 volts, at which it is delivered. It is used at 440 volts at the large units and at 220 volts at the small units. Before the strike the Mountain Copper Company was using 1,230 horsepower.

One branch transmission line extends to the Bully Hill copper mine northeast of Redding, and to the towns of Copper City, Delamar and Bull Hill near by. The Bully Hill mine and smelter closed down several weeks ago, just as the electric installation was about ready for use. When operations are resumed about 500 horsepower will be used at the smelter and mine. There is now being put in a large air compressor, to be operated electrically, and which will supply compressed air for the operation of the present steam engine at the hoisting plant.

Another mine served with electric power is the Mount Shasta gold mine, a few miles from Redding. Here the mill is so operated, using 60 horsepower, and it is planned to put in an electric-power installation at the mine. The gold dredge of the Detroit and California Dredging Company, operating in Clear Creek, 12 miles southwest of Redding, is run by electric power.

All these consumers are supplied at the flat rate of $5 per horsepower per month. It is stated by officials of the electric power company that, with wood or oil fuel, steam power has cost $11 to $12 per horsepower per month at the Keswick smelter, more at the mine, and more at Bully Hill—$13 to $14 at the latter place. Power has cost the Mount Shasta people about $12.

A number of mining companies, operating minor properties in the Old Diggings, Muletown, Furnaceville and other districts in this region are contemplating the use of electric power, and within another year the consumption will doubtless be greatly increased. Other electric-power companies will also be in operation in this field, stimulating the use of this convenient form of energy and working a general benefit to the mining industry there.

The Northern California Power Company is preparing to create a second generating plant, with a capacity of 4,000 horsepower. The present plant and transmission system, which were installed under the general direction of President H. H. Noble, is a very efficient one. The waters of Mill Seat Creek are delivered under a pressure of 1,204 feet, to three Pelton wheels, flexibly coupled to three 1,500-horsepower, 750-kilowatt, three-phase Westinghouse generators. The transmission line consists of two three-phase copper circuits. The distributing system is being rapidly extended.

Professor Dolbear's Remarks.

At a recent dinner of the Boston Schoolmaster's Club Prof. A. E. Dolbear of Tuft's College talked about space telegraphy. He said that a recent message to England, sent by the Marconi system, was received at several stations in that country when it was intended for only one, and he asserted that until space telegraphy is so perfected that a message can be received only by the station for which it is intended, the greater part of its commercial value is missing. He believed that the space-telegraph experiments would teach something about the ether.

Chicago Street-railway Situation.

The first formal conference between the local-transportation committee of the Chicago City Council and representatives of the local traction companies was held on February 4th, and although but few conclusions were reached, a start was made on the settlement of the franchise question. Joseph S. Auerbach spoke for the Union Traction protective committee and Colonel E. R. Bliss represented the Chicago City Railway Company. The council committee held a meeting the following day, and the traction companies on Friday held a conference to decide on a definite proposal to be submitted to the city. Thus far, as the results of the conference, it has been practically agreed to eliminate the cable, grant universal transfers, rearrange routes and terminals, so that passengers may reach the center of the city without serious delay, furnish new cars of a modern size and type, lay grooved rails on improved streets, make extensions as may be desired and give reasonable publicity of the company's accounts. Among the questions, and they are the principal ones, yet to be settled, are the conditions governing occupation of subways, rates of fare and compensation, conditions of taking over property under municipal-ownership acts, termination of all grants at the same time and the subject of a 20-year grant. Representatives of both companies have made it clear that they will not relinquish their possible rights under the 99-year act until they know what the city is willing to do. It appears that the companies are virtually willing to abide by nearly all of the specifications for improvement dwelt upon in the special report of B. J. Arnold. Corporation Counsel Walker has appointed John C. Mathis and Edwin Burritt Smith as special counsel for the council committee.

At the meeting of the City Council on February 9th Alderman Foucek caused to be sent to the committee on local transportation a resolution declaring in favor of a 20-year franchise, municipal ownership at the end of that period, three-cent fare, with a two-cent for passengers who stand; universal transfers, the eight-hour day, and cars every 15 minutes on trunk lines after midnight.

A bill has been introduced in the Illinois Legislature, fixing the maximum rate of fare for passengers on elevated railroads in the city of Chicago at five cents for a single fare, and providing that six single-fare tickets be sold for 25 cents, 15 single-fare tickets for 50 cents and 30 single-fare tickets for $1. The tickets sold at the above-named reductions are to be good only between the hours of 5 and 8:30 o'clock in the morning and 4 and 7:30 o'clock in the afternoon.

WORLD'S FAIR NOTES.

The American Bridge Company has obtained the contract for the exposition power house, a fireproof steel structure, 220 by 300 feet, which is to stand between the Machinery Building and Skinker Road. The contract price is $100,000.

The council of the American Institute of Electrical Engineers has adopted a resolution in which it states that it is deeply interested in the success of the electrical features of the St. Louis Exposition, and especially in the matter of promoting a general exhibit by the electrical associations of America, and in the International Congress of Electrical Engineers. The council resolved that a committee of five members of the Institute be appointed by the president of the exposition to have general supervision of the Institute's participation in the exposition, and to advise the council with reference to the plan and scope of such participation.

April 30th next will be the 100th anniversary of the signing of the Louisiana treaty. The event will be celebrated by the dedication of the Louisiana Purchase Exposition's buildings and grounds and by other exercises extending over three days. The dedication ceremony will be performed by President Roosevelt. The principal address will be delivered by Ex-President Grover Cleveland. The presiding officer will be Hon. David R. Francis, president of the exposition. He will tender the building and grounds to Hon. Thomas H. Carter, president of the National Commission, who will then turn them over to the President of the United States. The exercises will be attended by many public and government officials, and features will be the music, a military parade and displays of fireworks.

The contract for the temporary boiler house for use during the pre-exposition period of the World's Fair was let last week to Williams & Wollender, and work will begin at once. It was found that it would be impossible to complete the big boiler house and equip it with the necessary machinery, in time for the dedication ceremonies on April 30th, and the Division of Works decided to erect a temporary building. This will be constructed of wood, covered with corrugated iron, and will allow of the construction of the permanent boiler house around it, after which it will be wrecked. The dimensions will be 36 by 65 feet. In it will be installed the Durr boiler, two Clonbrook boilers, rated at 250 and 300 horsepower, and two direct-connected units of 150 kilowatts each will furnish the current. A spur of the railroad will run just south of the boiler house, facilitating the handling of coal. The permanent boiler house will be of steel, and will cost $100,000.

Experience with the "Gang."

By Henry Burns Geer.

The "gang" is an unknown quantity—an elusive substance, compounded—made up of arms and legs, with spurs and pliers, rope and tackle, brackets, cross-arms, shovels and what not. It is a thing afar off and undefinable. Its purpose is to set things up, straighten things out, and to keep other things in working order. This it does—after a fashion, and a fashion of its own. That it ever mixes things is denied straight out; but that it does mix matters, and mix them very badly at times, is well known to the men at the key.

It appears to be a part of the "gang's" duty to make the life of the man at the board as miserable as possible, and to assist in giving the quad chief something to keep him from going to sleep on duty; while at the same time it enables the artist who is manipulating the circuit to sing that refreshing song, the title of which resembles that of the amateur's short story—"The Busted Quad; Or, The Unexpected Rest"—while the "average" goes down to zero.

To intimate that the "gang" is reckless and unmindful of the best interests of all concerned, when out in some rural district transferring wires, or re-cross-arming a stretch of poles, would probably be unfair, for who ever questioned one of the "gang" on this point that did not learn very promptly that there was a bad curve in the road, and the wires were swung at such an angle that it crossed 'em to string 'em straight!

No one, probably, has ever said that the "gang" was not a necessity, but it has been said time and again that there are times when it is an everlasting nuisance! It appears to possess in a marked degree the happy faculty of striking in just at the nick of time, when there is a "roast" on, or when a death message is all in but the sig, leaving the receiver to guess at it, or wait anywhere from five minutes to an hour, or until the "gang" gets around the convenient "curve" in the road.

Sometimes, on a long circuit, there are two or more "gangs" at work out in the glad sunshine that floods the shining string of iron or copper, and then there is confusion twice confounded on that circuit. One "gang" is bad enough—but two! Two are enough to sink the ship. For that which one misses the other one hits, and then patience ceases to be a virtue, and the aid of higher authority is invoked, and a message something like this is sent around so as to reach the two captains of the unconscious "wreckers" as speedily as possible: "Pat O'Flynn, foreman: Discontinue the work of transferring wires between the hours of 9 a. m. and 2 p. m. O. Helpem, Supt."

An order of this kind will generally bring peace to the troubled wires during the hours named; but, Great Scott! lookout for the resumption of operations. The "gang" then exerts itself, and makes things simply "hum" for the rest of the day. Messages are knocked silly, and it's a good operator, indeed, that can catch a whole one without a break.

This is one phase of the "gang," as it appears to the man who manipulates the wire; but it has other characteristics, too, and there are times when the noble qualities of the "gang" shine forth, and its virtues are brought to the front. For, it is not all sunshine out along the line, and there come times when the rain descends, the floods rise, and the tracks are washed away, carrying the poles and the wires with the general wreckage, and all communication in that particular direction is cut off. Then it is that the "gang" demonstrates its utility and the main reason for its existence. The elements must be faced, a charge made to the rescue, and communication re-established. This entails hardship, exposure and hard work for the "gang;" but no "kick" is put up, no complaint is made—simply a straight march off to study, and a hustle for first results, to get a wire through as soon as possible; and then, in a few hours, perhaps, we hear something like this: "O'Flynn is at the break. We get Chicago on the press wire." You see, O'Flynn is onto his job, and has fished out the most important string in the bunch first. That he will knock it out a few times during the day goes without saying; but that, even, is much better than having it down there among the reeds and the fishes where the floods landed it.

And then, when O'Flynn, and the rest of the "gang" come in, there is a general handshaking, or jollying all around, and the many sins of the erstwhile erratic comrades in the service are forgiven them, and a general harmony prevails.

An electric railway is to be built this spring from Utica to Deposit, N. Y., via Sidney, Masonville, Rockroyal and Cannonsville.

Report of Patent Commissioner Allen for 1902.

F. I. Allen, commissioner of patents, has submitted to Congress his annual report for the year ended December 31, 1902. A number of statistical statements and tables are given, from which the following facts are obtained:

In 1902 there were received 48,320 applications for mechanical patents, 1,170 applications for design patents, 151 applications for reissues of patents, 2,602 applications for registration of trademarks, 1,121 applications for registration of labels, and 266 applications for registration of prints. There were 27,776 patents issued, including designs, 110 patents reissued, 2,006 trademarks registered, 767 labels, and 158 prints. The number of patents that expired was 23,331. The number of allowed applications awaiting the payment of final fees was 9,284. The number that was forfeited for non-payment of the final fees was 4,471. The total expenditures were $1,393,345.54. The receipts over expenditures were $159,513.54. The total balance to the credit of the Patent Office in the treasury of the United States on January 1, 1903, was $5,488,984.61.

In proportion to population, more patents were issued to citizens of the District of Columbia than to those of any of the states or territories—one to every 1,080. Next in order are the following: Connecticut, one to every 1,240; Massachusetts, one to every 1,439; Rhode Island, one to every 1,558; New Jersey, one to every 1,605; Colorado, one to every 1,670; California, one to every 1,738; New York, one to every 1,764; Illinois, one to every 1,906. The fewest patents granted in proportion to the number of inhabitants were in South Carolina, one to every 29,137.

As to foreign patents, 1,000 were granted to residents of England; 956 to those of Germany; 392 to those of Canada; 346 to those of France; 132 to those of Austria-Hungary; 104 to those of Scotland.

The Patent Office issued 27,886 patents during the year 1902, the largest annual issue in its entire history. The total number of trademarks, prints and labels registered for the year 1902 was 2,931.

The condition of the examining divisions upon December 31st is indicated by the fact that of the 38 divisions 19 were then taking up new cases for action within one month from the date of filing, 16 were in arrears between one and two months, two divisions between two and three months, and one division between three and four months. The total number of cases awaiting action on the part of the office upon December 31st was 11,446.

The number of applications for mechanical patents exceeded by 4,347 the number of such applications received in the preceding year, an increase of approximately 10 per cent. in this class of applications.

Mr. Allen says in his report: "The operation of the new-design patent law, which was approved upon the 9th day of May, 1902, has been to decrease by 1,191 the number of applications for design patents, for this law has operated, as it was intended to operate, to make clear the fact that mechanical devices of little importance unaccompanied by the development of new mechanical functions were not to be protected by design patents. These patents are now restricted to those ornamental characteristics of manufactured articles which were intended primarily to be the subject for the application of this law before its employment had been widened beyond its originally intended scope.

"The number of mechanical patents issued during the year 1902 is 27,136, exceeding by 1,578 the issue of such patents for the preceding year, which was then the largest number issued by this office in any year. For the causes stated, which have resulted in the diminution of the number of applications filed for design patents, the number of such patents issued during the year was diminished by 1,094 from the number issued during the previous year. The number of patents reissued during the year was 110, making the total issue of these three classes of patents 27,886 for the year 1902, against 27,373, the corresponding figures for the preceding year. The number of certificates of registration of trademarks was 2,006, an increase of 78. The number of certificates of registration of labels was 767, a reduction of 111 in such certificates. The number of prints for which certificates of registration were issued was 158, being one less in number than those of the preceding year, the total number of certificates of registration of all classes issued during the year 1902 being 2,931, this being 34 less than were issued during the preceding year.

"In the work of handling this business it should be noticed that the class of mechanical patents which has increased so largely in numbers during the last year comprises those cases which involve the largest amount of work in their consideration. The increase of work indicated by the foregoing figures has been met in some degree by the increase in the number of examiners which was provided in the appropriation bill for the year 1902-3. This bill provided for an increase of 35 examiners of all grades and three clerks, and the additional force became available upon the first day of July, 1902. This increase of force has aided in the transaction of this increased business, and as the new examiners will undoubtedly be more effective in the next year, by reason of experience, than they have been during the year 1902, it is hoped that their efforts will enable the work to be kept in hand, although a natural increase should continue.

"The increase of work referred to in relation to the examining corps of this office has been accompanied by a corresponding increase in the attendant clerical work required, and as no increase of clerical force was provided corresponding to the increase in the force of examiners the clerical work of this office has been more onerous than usual.

"The duties of the assignment division of this office are to record assignments of patents and inventions and to furnish manuscript copies of records of the office when required. During the year 1902, 24,091 deeds were received for record, of which 22,833 were recorded. Copies of records were also made which included 16,576,150 words. The number of deeds received was 1,102 in excess of the number for the preceding year, and the number of words written in furnishing copies of records was 2,056,110 more than for the preceding year. These figures serve to indicate the rapid growth of this portion of the work of this office.

"The appropriation of $5,000 included in the appropriation bill of 1901-2 for the new steel stacks for the scientific library of this office has been expended, and the $2,500 provided for in the appropriation bill for the year 1902-3 will, it is expected, complete the installation of steel stacks for this purpose. This work has already increased the usefulness of this library and has added greatly to the safety of the books.

"The sum of $2,000 appropriated for the purchase of books and for the transportation of the publications of the Patent Office to foreign governments is insufficient for the purposes of this library, and it will add greatly to its usefulness as a working library for the examiners of this office, as well as for the public, if this appropriation can be increased, for which purpose an annual increase of $2,000 was asked in the estimate for the year 1903-4. This increase will be needed unless this library is to become deficient for the purposes for which it is intended.

"The growth of the business of this office and the accumulation of its records point to the conclusion that more room is required and could be used to great advantage if it could be furnished for the purposes of this bureau."

Power and Light for City of Mexico.

Final arrangements have been made for the organization of the Mexican Light and Power Company. Officers have been elected and contracts have been closed which will permit of the work being started at once. The following will be the officers: President, James Ross; vice-president, J. H. Plummer, Toronto, and second vice-president and consulting engineer, F. S. Pearson of New York. The first announcement given out respecting the character of the work that will be necessary to transmit electric power a distance of 85 miles to the City of Mexico is as follows: The waterpowers that have been acquired are distant 88½ miles in a direct line from the City of Mexico. The transmission lines on the route selected will be 95 miles long, with a branch to the city of Pachuca, 26 miles in length. The plan for the development of power and the generation of electricity is briefly: Three rivers have been secured and the diversion of the waters of the Tenango and Catepuxtla Rivers into the Necaxa is by an open cut and tunnel. A fall of 1,200 feet will thus be formed, and at the foot of it a storage dam will be erected. A small dam will be situated lower down to form a regulating reservoir. A tunnel and four lines of 46-inch feeders to the power station will then be added, and a power station containing hydraulic and electric machinery for the generation of 40,000 horsepower. The static head in the first installation will be 1,253 feet. The second installation will utilize a further fall of 1,220 feet and will be practically a duplicate of the first, but it will not cost nearly so much, because many items provided in the first installation need not be duplicated. Work will be started this month, and the first installation will be completed within two years, and the second in four years.

Is Wireless Power Transmission in View?

London dispatches state the articles of incorporation of the parent Marconi company have been amended, by sanction of the courts, so as to provide for new projects. The application for leave to amend described Marconi's new projects as "potentialities beyond the dreams of science." In support of the application counsel casually mentioned that Marconi expected shortly to encircle the earth with wireless messages, and hoped to apply his system to heating, traction, and to publishing daily newspapers on board ship.

Members of the committee appointed to formulate a plan for the financial reorganization of the Lake Street Elevated Railroad Company of Chicago have elected Harlow N. Higinbotham chairman. The other members are David R. Forgan, Helge A. Haugan, Cory E. Robinson and Thomas Templeton. The committee asks for the deposit of the securities of the company with the Illinois Trust and Savings Bank, and will submit a plan for the approval of the security holders if enough stock and bonds is deposited to make it operative. If the plan submitted be not satisfactory to the security holders they will be permitted to withdraw without cost.

CORRESPONDENCE

New York Notes.

New York, February 7.—The new service schedule for the Manhattan Railway Company, which was mentioned in this correspondence last week, went into effect on last Sunday and has afforded much of the relief on the company's elevated lines sought by the Merchants' Association in making its complaints to the state railroad commissioners. Other elevated railroad problems suggested by the Merchants' Association, and which are being considered by the commissioners, include a system for facilitating entrance to and exit from the cars; improvement and enlargement of the stairs and station platforms, and the removal of obstructions therefrom; the proper heating and lighting, at all times, of all cars; the application of the electric shoe to the third rail from underneath or at the side, or through a slot, thus protecting the third rail from the elements and doing away with the frequent delays to which the public has been subjected during recent snowstorms, and also eliminating the dangers incident to the exposure of the third rail; alternation of route, particularly by adoption of loop at the Battery; use of two-story cars; increase of terminal facilities at City Hall station; improvement of track system at congested points and at terminals. The quarterly report of the Manhattan Railway Company for the period ended December 31st, when complaints of overcrowding were loudest, shows that no fewer than 64,822,675 passengers were carried, an increase over the corresponding quarter a year ago of 7,596,825, while gross earnings increased $274,224 and net $423,559—this in spite of the fact that the increased cost of fuel for the quarter was $150,000.

At the annual meeting of the board of directors of the Brooklyn Rapid Transit Company on Monday, E. W. Winter was elected president, to succeed Jacob L. Greatsinger. The board re-elected all the other officers.

Experiments have been made this week with a system of space telegraphy with which it is believed it will be possible to send quotations of the prices of securities on the curb market directly to offices in the financial district. Yesterday an automobile, labeled "Wireless Auto, No. 1," standing in front of the Waldorf-Astoria, was used to send messages from the street to a receiving apparatus in a broker's office in the hotel building. To-day similar experiments were made between an automobile stationed at 25 Broad Street and the office of the Wall Street Journal, 44 Broad Street. Current quotations on the principal stocks were reported and, the test, which was conducted by the De Forest Wireless Telegraph Company, was said to be successful.

The feature of the inauguration exercises held at Steven's Institute, Hoboken, on Thursday, in honor of the new president, Alexander C. Humphreys, was a speech by Andrew Carnegie. Chancellor Magie of New Jersey administered the oath of office to President Humphreys. Others who spoke were President Thwing of the Western Reserve University and Dr. Pritchett, president of the Massachusetts Institute of Technology.

The Engineers' Club of this city has purchased the property at 32 and 34 West Fortieth Street, a plot facing Bryant Park and the new public library site, and will build a new clubhouse there, when its lease at 374 Fifth Avenue expires.

The Willyoung & Gibson Company of New York has been recently incorporated to manufacture scientific instruments. The company is capitalized at $25,000 and its directors are E. G. Willyoung, C. R. Gibson and Fanny L. Gibson, all of New York city.

The Metropolitan Street Railway Company plans to make several changes in the motive power of various branches before November 1st next. Three cross-town lines are to have the electric underground system. The first change is to be on the Grand Street cross-town line. The change of the motive power is to be begun on March 20th. The next change is to be on the Fourteenth Street cross-town line. The third is to be on the Eighty-sixth Street cross-town line. It is the purpose of the company to install electricity as far as Central Park West, with the idea of running the cars through West Eighty-sixth Street some time in the future. The opposition on the part of the residents of West Eighty-sixth Street at present prevents the continuation of the line on that street. An official of the company said that in all probability the east side lines on Avenue D, and possibly those on Clinton Street or Avenue B, would never have electric cars. The belief has been that if electricity were installed in the avenues mentioned the death rate would be increased materially. O.

New England News.

Boston, Mass., February 6.—The Edison Electric Illuminating Company of Boston will disburse $196,260 in paying its quarterly dividend of 2½ per cent., payable February 2nd.

The Boston Elevated Railway Company will pay out $300,000 in meeting its semi-annual dividend of 3 per cent., payable February 16th.

Representatives of the Fall River and Brocton (Mass.) employes of the Old Colony Street Railway Company, held a conference with Manager Goff, last week, in reference to an increase of wages. The request was refused, primarily because of the high price of coal. It is expected that the men will soon make a formal demand for an increase.

A bill giving steam-railroad companies the right to construct, buy, and operate electric railways, has been introduced in the Maine Legislature. The present laws of that state do not allow steam-railroad companies to own electric-railway franchises. There is much oppositon to the bill on the ground that its passage would pave the way to the monopolizing of the business of carrying passengers and result in higher fares.

The Boston and Northern Railroad Company has made a contract with the General Electric Company by which the latter will furnish a large generating plant to be located at Danversport, Mass. Sub-stations will be established at other points on the company's electric-railway lines, but the Danversville plant will be the central station for the company's entire system.

The W. B. Gill Company of Philadelphia has received the contract for building 3½ miles of electric-railway track from the Orange town line to Derby, Conn., for the Connecticut Railway and Lighting Company. This will complete the line between New Haven and Derby.

The Hartford (Conn.) Street Railroad Company elected the following-named officers for the ensuing year: President, E. S. Goodrich; vice-president, S. G. Dunham; secretary and treasurer, Daniel R. Howe; executive committee, E. S. Goodrich, S. G. Dunham, Atwood Collins and Daniel R. Howe. The company operates 71 miles of railroad. It carried 19,160,216 passengers last year, the gross earnings being $780,558. During the year the company paid out $104,535 as interest on its funded indebtedness, $60,000 in dividends and $373,666 in wages. The company is making extensive additions to its power plant.

During the present week Waterbury, Conn., has been the scene of considerable turbulence. The electric-railway company has been running cars manned by non-union men, and strike sympathizers or hoodlums have stoned the cars, breaking windows, and generally terrorizing the people. Owing to the city authorities' inability to preserve order, state troops were sent there to guard the railway company's property, and they were still there on Wednesday. One striker was arrested while on a pole, it being alleged that he was intending to cut the feed wire. Several have been arrested for assaults and other law breaking. The strikers continue to run a bus line, which is fairly well patronized, many people fearing to ride in the electric cars owing to the danger of attacks by the mob.

The New York, New Haven and Hartford Railroad Company has greatly increased the power for the Bristol, Conn., section of its third-rail system. It has a new rotary sub-station at Forestville, and three wires have been strung from there to the Berlin power station, where two large generators have been added to the equipment. B.

Canadian Intelligence.

Toronto, February 6.—The report presented to the annual meeting of the Toronto Electric Street Railway Company showed that the gross earnings for 1902 amounted to $1,834,908.37, as compared with $1,661,017.50 the previous year, being an increase of $173,890.87, or 3.7 per cent., owing to the scarcity of coal and other causes. There were 44,437,687 passengers carried during the year, an increase of 4,589,591. The following-named directors and officers were elected: President, William Mackenzie; vice-president, James Ross; and directors, Hon. George E. Cox, Frederick Nicholls, W. D. Mathews, H. M. Pellatt, James Gunn; manager, E. H. Keating; superintendent, James Gunn, and secretary-treasurer, J. C. Grace.

At the annual meeting of the Winnipeg Street Railway Company, held on January 28th, satisfactory reports were presented showing a large increase of traffic. The number of passengers carried was 4,490,566, as compared with 3,443,460 in 1901. The following directors were elected: William Mackenzie, William Whyte, Sir William C. Van Horne, D. D. Mann, A. M. Nanpon, D. B. Hanna and F. Morton Morse. The officers afterward elected were: President, William Mackenzie; vice-president, William Whyte, and secretary-treasurer, F. Morton Morse.

The report presented at the annual meeting of the British Columbia Electric Railway Company showed that the net profits up to June 30, 1902, were £39,544.

D'Arcy Scott, solicitor of Ottawa, has given notice of an application to the Parliament of Canada for an act to incorporate a company to build a railway from Berlin to Waterloo, Wellesley, Allen, Drayton, Forest, Markdale and Collingwood, with power to construct branch lines to Owen Sound and Wiarton. H.

Ottawa, Ont., February 7.—It is stated that the Dominion government will subsidize the Marconi company and that the latter will, as soon as spring opens, begin the construction of a number of stations on the lower St. Lawrence and gulf with a view to assist shipping.

The authorities of McGill University, Montreal, have protested to the mayor and City Council against the proposed establishment of a Marconi wireless-telegraph plant on Mount Royal. The protest states that Mount Royal is only 700 yards in a straight line from the physical laboratories of the university, and the establishment of the wireless plant would seriously impair the usefulness of the laboratories and prevent the university from effectively carrying on the important investigations which have been carried on there for years, also that the operation of such a station in Montreal would increase the danger of fires arising from defective insulation of electric wires all over the city. W.

Southern Developments.

Charlotte, N. C., February 7.—Frank Jay Gould has authorized the expenditure of some $50,000 for enlarging the power plant of his company at Richmond, Va. The work will be done by contract.

The S. Morgan Smith Company has secured right-of-way for transmitting power to Atlanta, Ga., from the power plant on the Chattahochee River.

The stockholders of the Natchez (Miss.) Gas Light Company are considering the matter of selling their electric-light plant. It may be bought by the Natchez Electric Street Railway Company, which would thus have a monopoly of the electric lighting.

The council of Petersburg, Va., has invited bids from the Virginia Passenger and Power Company and the Petersburg Gas Company for lighting the city for a term of years. The former company offers to furnish lights at $57 per arc light if a five-year contract is made.

Smith D. Pickett and Charles E. Garner of Jacksonville have purchased a waterpower for $6,000 near Albany, Ga. A power plant may be erected.

James U. Jackson of Augusta and other promoters have given notice that they will apply for a charter for the Augusta and Columbia Railway (electric) to operate a line between these points, using the Augusta-Aiken line as a part of the route.

A number of business men in Brunswick, Ga., have applied for a franchise for an electric-railway system. It is understood that an out-of-town company operating in other cities will also seek a similar franchise. L.

Detroit, Mich.

Detroit, Mich., February 7.—The Grand Rapids and Chicago Rapid Railway Company expects to secure a franchise soon permitting entrance to Kalamazoo from the north. This is the electric line projected between Grand Rapids and Kalamazoo which has been financed by Pennsylvania capitalists. Waterpower will be utilized at Allegan, and the car shops will probably be located in that town. The work of construction will commence early in the spring.

The Detroit Edison Company's $10,000,000 mortgage to secure an issue of five per cent. bonds has been filed in the register of deed's office. Manager Dow says only $1,800,000 will be issued at present, to construct the new power house in Delray. A. A. Albrecht has the contract for the building.

The Detroit United Railway has given an order to the St. Louis Car Company for 50 combination double-truck cars and 200 40-horsepower motors. The 40-horsepower motors will displace the 30-horsepower motors now in use on the single-truck cars, which, after being put through the shops, will be fitted to the double-truck cars, four of them being attached to each car. The outlay for equipment will be about $250,000.

E. D. Black, secretary of the Saginaw Suburban railway between Flint and Saginaw, states that $800,000 in bonds have been successfully floated in New York, and contracts let for grading, building and equipment. The work is to begin early in the spring. This is the third electric road projected to connect these cities. All the others have failed.

The directors of the Windsor, Essex and Lake Shore Railway, which will run from Windsor, through Essex, Leamington and Kingsville to Wheatley, on the Canadian side, decided to begin work at once. The road will be 43 miles in length.

The Michigan Central Railway has served an injunction on the Indiana Street Railway Company, which is building an interurban line between Niles and South Bend, Ind., restraining it from crossing a strip of land at Bertrand owned by the Central. An effort will be made to have the land in question condemned, as it is directly on the Indiana company's right-of-way. The village of Bertrand gave the land in dispute to the Michigan Central for a depot and yards.

The Rapid Railway barn at Roseville, near Mt. Clemens, burned early last Saturday morning. Seven cars were burned. One of them was a Lake Shore car, and was valued at $10,000. One Rapid $8,000 car was also burned. The power house was not affected. C. G. W.

From the Buckeye State.

Cleveland, Ohio, February 7.—It is reported from Ashtabula that the Lake Shore railroad officials are the owners of the Ashtabula and Lake Shore Railroad Company which was incorporated some time ago to build an electric line from Ashtabula to Woodland Beach Park, which is also owned by the Lake Shore steam road. Further than this, it is stated that the electric company will extend the line along the lake shore from Geneva to Conneaut. It is hinted that the company is planning this line to secure some of the short-run business it has lost to the electric roads and other business it will lose when the systems are completed between Cleveland and Buffalo.

The Pleasant Heights Traction Company of Steubenville will extend its line to Richmond.

The Wheeling Traction Company will build an extension between Brilliant and Martin's Ferry this year, thus making a through line from Wheeling to Steubenville.

The Pennsylvania and Mahoning Valley Traction Company, operating the street-railway system in Newcastle, Pa., will expend $250,000 in building five extensions this year.

The Youngstown and Southern Electric Railway Company has filed notice of an increase of capital stock from $10,000 to $1,800,000.

The Ohio Valley Traction Company has applied for a franchise to operate a line on Scott Street in Covington, Ky., and over Bighton Street in Newport.

There is a possibility that Cleveland may have to put in a municipal lighting plant to furnish lights on some of the streets, because of an injunction which prevents the renewal of the contract for vapor lights.

The Oberlin Electric and Heating Company, Oberlin, has been incorporated with a capital stock of $25,000. L. B. Fauver, L. E. Burgner and others are interested.

An ordinance has been introduced in the board of legislation in Cincinnati, granting the Cincinnati Inter-terminal Company a franchise to operate on the streets.

The large car barns of the Eastern Ohio Traction Company at Chagrin Falls were destroyed by fire Thursday morning, and the firemen had all they could do to save the power house. Eight large cars and a snow plow were destroyed. The night operator, at the risk of his life, succeeded in getting two cars out after the fire started. The building was of frame construction and was almost entirely destroyed within 30 minutes after the fire started. The company has but four cars left. The loss is $77,000.

The Appleyard line between Urbana and Bellefontaine will be completed this spring and an extension from Bellefontaine to Kenton and Findlay will be built.

W. H. Jackson has resigned the superintendency of the Marion Street Railway Company, Marion, Ohio, to accept a position in the operating department of the Union Traction Company at Anderson, Ind. O. M. C.

Information from Indiana.

Indianapolis, February 9.—Incorporation papers were filed with the secretary of state during the week by two new interurban traction companies. The Indianapolis, Danville and Rockville Traction Company, with a capital stock of $100,000, will build a line from Indianapolis to Rockville, via Danville and Bambridge. The promoters and directors are W. B. Blair, W. C. Osborn, J. W. Adar, C. P. Hornady and J. W. Trotter. The Indianapolis and Cincinnati Traction Company, with $1,500,000 capital stock, proposes to build a double-track line from Indianapolis to Cincinnati, via Rushville, Brookville and Harrison, and will connect with an Ohio line and thus make a continuous line to Cincinnati, Charles L. Henry has been elected president and W. L. Taylor secretary. Mr. Henry will open offices in Indianapolis and will give his personal attention to the securing of rights-of-way, plans and specifications for the work. It is the intention to push the line through as rapidly as possible.

The survey for the New Albany, Paoli and French Lick Springs Valley Traction line, to run through Orange, Washington, Harrison and Floyd Counties, has been completed. This line will ultimately form the southern link of a through route from Indianapolis to Louisville, by way of Columbus, French Lick and New Albany.

The City Council of Terre Haute has granted a franchise, extending to 1953, to the Terre Haute Electric Railway Company for the sum of $78,000, to be paid in yearly installments, as follows: Cash in hand, $16,000, and after 1918 $16,000 annually. The company will now make extensive improvements and build additional interurban lines, for which it holds valuable franchises.

There is an interesting race on between the Northwestern Traction Company and the Consolidated Traction Company to secure a franchise right to build lines in 10 miles of public road leading into Crawfordsville. The county commissioners have decided that the company which first builds its line to the road in dispute may have the prior right. This will require each company to build about 15 miles of road before reaching the road contended for. The Consolidated company has accepted the situation and will begin work as soon as the weather will permit.

The successful financing of the Garrett, Auburn and Northern road and the Chicago and the Indiana line has just been announced.

The Indianapolis Northern Traction Comapny, anticipating the passage of the pending bill requiring electric-railway companies to fence their tracks, has awarded a contract to Showers & Co., Detroit, to build 150 miles of wire fence, enclosing it's track from Indianapolis to Logansport and Peru.

All attempts to settle the strike situation on the Indiana Railway Company's line, operating between South Bend and Elkhart, have proven a failure. The committee appointed to settle the matter, in its report rather favored the strikers, and now ex-Mayor Deahl of Elkhart proposes to operate a bus line in opposition to the electric-railway company, which, he says, refuses to reinstate the strikers, and end the trouble.

A special election was held in Huntington township, Grant County, last Thursday, to vote a $30,000 subsidy in aid of a branch line of the Fort Wayne and Southwestern Railroad from Huntington to Marion, by way of Warren. The proposition carried by a large majority. The branch line will be built this season.

Fred Halloway of Anderson is said to be forming a trust to obtain control of all electric-light plants in the gas belt. Halloway has recently returned from New York, where he says he interested New York and London capitalists in his scheme.

The report of the municipal electric-light commissioners of the Richmond plant for the month of January is rather discouraging for municipal lighting. The report shows that the total cost of the plant to the city for the month was $1,779.91 over and above the receipts. The press of Richmond condemns municipal management of such utilities, and claims that the Richmond plant is shoddy and the machinery antiquated. F.

Northwestern Notations.

Minneapolis, February 7.—The New Ulm Electric Light Company of New Ulm, Minn., which has considerable of a war on its hands with the new municipal plant, seems disinclined to welcome a peace suggestion. The company submitted a proposition to the council to sell the plant to the city, but placed its valuation so high that the council would not consider it.

The Oskaloosa Traction and Light Company of Oskaloosa, Iowa, has completed its new street-railway system and put it in operation. The first day of operation was distinctly a gala day in Oskaloosa. The company gave the first day's receipts to charity.

The council of Luverne, Minn., has increased the flat rates on electric lighting from 25 to 50 per cent. No increase is made in the meter rates. The change is made because the village is losing money on the plant at the old rates.

The Oelwein and Northeastern Iowa Interurban and Street Railway Company has been incorporated at Oelwein, Iowa, to build a line to Arlington and Strawberry Point. The capital stock is $200,000.

The Burlington Railway will extend its electric railway from Lead, S. D., to Terry, a distance of 3½ miles. The electric line will connect with the Spearfish branch of the company.

Fort Meade, S. D., is soon to have electric lighting. Poles have been ordered for a wire line from Sturgis, S. D., from whence the light will be furnished.

It is understood that the Twin City Rapid Transit Company will soon extend its lines to Lake Minnetonka, as soon as the new power station is completed and in operation. It is understood that a line of steamers will be operated in connection with the proposed extension. It is further reported that the company will furnish power for an electric service to be installed by the Chicago Great Western Railway Company from St. Paul to Northfield and Faribault, Minn.

Montana capitalists propose an electric-railway line from Seattle, Wash., to West Seattle, just across the bay. It will require the construction of a long trestle bridge across the tidelands.

The Fargo and Moorhead Electric Street Railway Company has let contracts for the construction of a local system in Fargo, N. D. The Electric Installation Company of Chicago will construct the lines and a St. Louis firm will furnish the cars. The General Electric Company will furnish the electric equipment.

The Madison and Northeastern Electric Railway Company expects to build its line from Madison to Columbus, Wis., this coming season. The remainder of the line to Beaver Dam, Waupun, Fond du Lac, and a branch from Waupun to Brandon, Ripon, Green Lake and Berlin, will go over until next year, on account of the difficulties in securing steel rails and other supplies.

The Des Moines City Railway Company expects to make improvements and extensions on its system during the coming season to cost $500,000. Ten miles of new tracks are to be laid and the power-house capacity increased, as well as a car-building plant erected. R.

On the Pacific Slope.

San Francisco, February 4.—Chief Engineer Babcock of the North Shore Railroad Company announces that the company has purchased the latest automatic-block system from the Union Block and Signal Company for use between San Rafael and Sausalito for both electric and steam trains. The electric cars of the company on this line will be operated in trains of five coaches each, the operating power being drawn from a contact rail. The electric cars of the company will be 56 feet long and will have a seating capacity for 66 passengers. The platforms will be vestibuled. Four hundred and forty 16-candlepower lights will be placed five feet apart through the 2,200-foot Corte Madera tunnel.

The general offices of the United Railroads of San Francisco have been moved to the Rialto Building on Mission Street, where the entire floor of one wing will be occupied. The company has secured a lease of the old Pacific Power Company's steam plant at 23 Stevenson Street, which has a capacity of 1,000 horsepower at 500 volts. It is expected that the new power house of the company, which has a capacity of 8,000 horsepower, will be in operation before the end of March.

It is officially announced that the Monterey Gas and Electric Company, which recently purchased all the property rights and franchises of the Monterey and Pacific Grove Street Railway and Electric Company, will reconstruct the street railway and equip it as a modern electric system. The line will be immediately extended to Lighthouse Point, and will go beyond this as soon as prospective business will justify the expenditure. The present generating plant of the lighting company is to be entirely discarded. A complete new lighting system of sufficient capacity to supply Monterey, Pacific Grove and Del Monte will be put in. Both arc and incandescent lights will be installed.

Dr. L. Ray of Gold Bay, Ore., was in San Francisco a few days ago for the purpose of placing contracts for electrical machinery for the plant to be put in at Rogue River, Ore.

The Washoe Power and Development Company has been organized at Reno, Nev., for the purpose of constructing an electric-light and power plant on the Truckee River, for the purpose of supplying light and power to Reno and vicinity. The company has a capital stock of $300,000. J. N. Evans is the president. The company will divert the entire flow of the Truckee River into a ditch two miles long, where a reservoir five acres in extent will receive the water. From this it will be conducted over several waterwheels, with a head of 86 feet. The plant will have a capacity of 4,000 horsepower. The power will be carried from the reservoir to Reno, a distance of seven miles.

Edwin T. Osborn and Edgar T. Wallace, Yreka, Cal., have purchased the Quinore Electric Light and Power Company's plant at Yreka, Siskiyou County, Cal. It is given out that the new owners will spend $125,000 on improvements. Orders for new machinery to develop an additional 400 horsepower have been placed.

Officials of the Siskiyou Electric Power Company announce that the system of the company will be ready for operation by March 1st. E. H. Stul, formerly with the Mountain Copper Company at Keswick, Cal., has charge of the installation of the plant and will be the company's manager. The power house, which will contain four Pelton waterwheels of 100 horsepower each, is now well under way. The poles for the company's line are now being placed. Jerome Churchill is president of the company. The headquarters are at Yreka, Cal. The towns included in the lighting circuit are Hornbrook, Klamathon, Lairds, Ager, Montague, Fort Jones, Etna and Yreka in California, and Jacksonville, Medford and Ashland in Oregon. Power is to be furnished to 12 mines, two railroads, two pumping plants and several mills and factories. A.

PERSONAL.

W. G. Campbell of Traverse City, Mich., has been engaged to manage the electric light and waterworks plant at Manton, Mich.

A. C. Bartlett of Chicago was elected a director of the Western Electric Company at the recent annual meeting, to fill a vacancy. The rest of the board was re-elected.

John Boyer, an engineer well known in Rockford, Ill., employed by the Belvidere Electric Light and Gas Company, was instantly killed by an electric shock at Belvidere on January 31st. He leaves a wife and eight children.

Francis K. Carey, president of the Charleston Consolidated Railway, Gas and Electric Company, Charleston, S. C., will retire from the presidency of the company at the next annual meeting in March, and Philip H. Gadsden of Charleston, now vice-president, will be elected to the presidency of the company.

Miss Etta Roebling, daughter of Ferdinand W. Roebling, treasurer of the John A. Roebling's Sons Company, was married to William Townsend White in Trenton, N. J., on February 4th. Miss Marguerite A. Lee was the maid of honor and Ferdinand W. Roebling, Jr., a brother of the bride, was the best man. Mr. White is connected with the John A. Roebling's Sons Company.

At the recent convention of General Electric salesmen in Chicago a pleasant feature not down on the programme was the presentation of two handsome easy chairs—one for Mrs. Noe and one for himself—to E. C. Noe, late electrical engineer of the Chicago district of the General Electric Company and now general manager of the Northwestern and Lake Street electric elevated-railway systems in Chicago. The donors were the old office associates of Mr. Noe, and the presentation speech was made by Theodore P. Bailey, assistant manager of the Chicago office. Mr. Noe made a suitable response.

Hon. Elisha Morgan of Springfield, Mass., president of the United Electric Light Company of that city, died on February 1st. He was born in Northfield, Mass., September 7, 1833. He had been general ticket agent of the Connecticut River Railroad Company; served in the governor's executive council in 1892 and 1893, and was founder of the Morgan Envelope Company, and director in several paper manufacturing companies, and was trustee of

the Northampton (Mass.) Insane Hospital. He had been an active Republican, having been presidential elector in 1888 and 1892. He represented Massachusetts at the Chicago World's Fair, where he was a judge in the paper department. He left four children.

ELECTRIC LIGHTING.

An electric-light plant is to be installed at Duncan, Okla., in the near future.

The directors of the Pennsylvania Railroad Company have appropriated $27,000 for the construction of an electric-light plant at Erie, Pa.

J. W. Snow, who owns the waterpower plant at Alma Center, Wis., has secured the contract for furnishing the village with electric lights.

City Engineer Lamborn of Muscatine, Iowa, has been instructed to advertise for bids for public and private lighting the city for a period of 10 years.

The privilege to operate an electric-light plant is now being agitated by a number of capitalists of New Orleans, La., in which Jules Dreyfous is the leading spirit.

A bill has been introduced in the Illinois Legisture to enable cities of population of less than 10,000 to own and operate electric-light plants and to sell light to consumers.

The Sheffield Company of Jersey City, N. J., has been incorporated to manufacture electricity for light, heat and power. The company has a capital of $500,000. The incorporators are George Parsons, Henry Parsons and William H. Goodby.

ELECTRIC RAILWAYS.

The promoters of the Rockford and Freeport (Ill.) electric railway propose extending the line to Dubuque, Iowa. The road will run via Pearl City, Kent and Stockton to Dubuque.

A company has been incorporated to operate by steam or electricity a line of railway from a point on Lake Superior in Nipigon Bay, Canada, by way of the Black Sturgeon River and Black Sturgeon Lake, to a point on the shores of Lake Nipigon.

The Northern Texas Traction Company, owning and operating all street-car lines in Fort Worth, Texas, as well as the electric lines between Dallas and Fort Worth, and the Oak Cliff railway, has filed a deed of trust to the Prudential Trust Company of Cleveland, Ohio, the consideration being $2,500,000. The money raised by the loan is to be used in bettering the present line and building others.

The St. Louis, Kirkwood and Manchester Railroad Company seeks a franchise for a branch from its main line westward from Des Peres, through Valley Park to the Meramec River, a mile beyond. The company was organized October 25, 1901, for the purpose of constructing an electric road west from the limits of St. Louis at Clayton Road, and through Kirkwood to Des Peres, and out the Manchester Road to Manchester. The court granted the company a franchise, though no work has as yet been done toward its construction.

SOCIETIES AND SCHOOLS.

The next regular meeting of the Chicago Electrical Association will be held on February 20th, when H. M. Brinkerhoff, general manager of the Metropolitan West Side Elevated Railway Company, Chicago, will read a paper on "The Third-rail System for Electrical Railways."

The members of the New York Electrical Society at a recent meeting inspected the new Waterside station of the New York Edison company. The following members were elected: Harold D. Patterson, Richard H. Johnston, Andrew Moss, Almon B. Fuller, William Edward Hurley, William Taylor, Robert Charles Cole, Joseph Burkart, F. L. Scheffey, Ralph Ryder, Charles F. Case, Seth C. Adams, W. J. Floyd, A. E. Baker, F. E. Osborne, Prof. Magnus C. Ihlsing, Charles G. Whyte, Louis Dornbusch, Edwin Hopkins Seaman, Wallace Cudliff, Joel B. Ives, F. Schwanbausser, Norman A. Paul, Harry French, Edward Hartmann, Frank Cleary, John Benjamin Brown, John Ryan, Edward B. Stott, William Weidman, L. R. Wetherwax, Ernest W. Muller, Carl Stueve, Anson S. Rice, Walter M. McBride, John Bittner, E. W. Stevenson, William J. Ladley, Edgar B. Benjamin, Francisco Laurent Godinez, W. F. Hurlburt and J. F. Bidstrup.

PUBLICATIONS.

A recent catalogue issued by the Jeffrey Manufacturing Company of Columbus, Ohio, is descriptive of the Barney brick-conveyor system.

The Shelby Electric Company of Shelby, Ohio, in a leaflet, describes the new line of glass reflectors for incandescent lamps which it is putting on the market.

The Arlington vegetable boiler composition, which is said to stop incrustation, scale, pitting and corrosion in steam boilers, is the subject of a 16-page pamphlet distributed by the Arlington Manufacturing Company of Canton, Ohio.

The scope of the St. Louis World's Fair is well set out in a book of views published by Robert A. Reid, Hotel Usona, St. Louis, Mo. Excellent illustrations are given of the site for the exposition, of the principal buildings proposed and scenes in St. Louis, and there are included a large number of portraits of the officials. The book is sent to anyone for a small sum.

MISCELLANEOUS.

"If municipalities persist in embarking on commercial undertakings," says Lord Avebury of England, "they will, I am persuaded, increase rates, check progress in scientific discovery and stifle, if not destroy, that spirit of private enterprise to which in the past our commercial supremacy has been mainly due."

In last week's issue of United States patents four patents were granted to Charles J. Reid of Philadelphia for electrolytic apparatus, and assigned to the Security Investment Company. The patents described cells in which the cathodes consisted of vertical amalgamated plates of conducting material with horizontal grooves containing mercury. The electrolyte contains a salt of zinc.

TRADE NEWS.

The American Electrical Novelty Manufacturing Company of New York city has leased 70,000 square feet of floor space in the building on the east side of Hudson Street, between Spring and Vandam Streets.

The Railway Electrical Improvement Company of Jersey City, N. J., was recently incorporated to manufacture electric-lighting apparatus. The company is capitalized at $50,000, and its incorporators are Ernest P. Hoes, Jesse A. Whitaker and K. K. McLaren.

E. A. White of Punta Gorda, Fla., is in the market for shipment, within 90 days, for the following material: Dynamo, incandescent lamps, switchboards, meters, mast arms, wire, engines, arc lamps, transformers, switches, carbons, insulators and telephone supplies.

The Eickemeyer Electric Pump Company of Jersey City, N. J., has been incorporated to manufacture electric pumps. The company has a capital stock of $50,000, and its incorporators are Carl Wickman, Yonkers, N. Y., and John W. Avery and S. R. Bullock of New York city.

A press dispatch from Berlin states that it is understood that the purchase of the business of the gas-engine firm of Koerting Bros. of Hanover by the newly organized German electrical combination will be effected shortly. The new combination will have a capital of £15,000,000.

Dugald C. Jackson, C. E., professor of electrical engineering, University of Wisconsin, and William B. Jackson, M. E., until recently traveling engineer with the Stanley Electric Manufacturing Company, have opened an office at Madison, Wis., for the practice of engineering, especially as relating to applied electricity. In their announcement circular the Messrs. Jackson present a fine line of "gilt-edged" references. Their long-distance telephone numbers are (Bell) 147, and (Dane County) 1223, Madison, Wis.

Like other central-station companies in large cities, the Missouri-Edison Electric Company of St. Louis makes free lamp renewals of standard 16-candlepower incandescent lamps. The interesting announcement is now made that it is also the intention of the company to renew the Hylo (turndown) lamps without charge to customers. The Hylo lamps are made by the Phelps company of Detroit, and S. B. Pike, the enterprising secretary of the Missouri-Edison Electric Company, says that his company considers that every up-to-date central manager should avail himself of them.

Where it is not thought advisable to incur the expense of equipping all the cars of an electric railway with automatic circuit-breakers, the next best thing is a fuse block possessing the same qualities of easy accessibility, replaceability and freedom from danger. A fuse block made by the Westinghouse Electric and Manufacturing Company can be easily gotten at for renewing the fuse, and, when open, the contacts on which the fuse is supported are cut out of the circuit, making it perfectly safe to replace the fuse while the line is alive. A straight piece of copper wire is used as a fuse and is secured in place and clamped in the contacts by the act of closing the block. When a fuse blows, all that is necessary is to open the block, drop a piece of straight copper wire in place, and then close it again. The fuse block is ironclad, being completely enclosed in an iron casing, excepting where the vent for the arc extends through the bottom.

BUSINESS.

The Electric Appliance Company, Chicago, Ill., carries, it says, the largest stock of circular loom in the West. The stock is well assorted in all sizes, from one-quarter inch to 2¼ inches inside diameter. The ability to ship directly from stock saves valuable time in delivery.

The Central Electric Company of Chicago is distributing to the trade a pamphlet descriptive of the Alpha and Omega toggles, two new devices for which there is likely to be a large demand. These toggles are strong, well made and low priced. The pamphlet also contains a description of the new Zero solderless lug.

The Whitehead Machinery Company of Davenport, Iowa, has purchased some 1,500-horsepower of Babcock & Wilcox water-tube boilers from the Benedict & Burnham Manufacturing Company of Waterbury, Conn., and has also purchased 1,000 horsepower of Heine water-tube boilers from the L. Hoster Brewing Company of Columbus, Ohio. Both plants will be dismantled at once. The changes, in both instances, are due to radical alterations and enlargements.

The Mechanical Boiler Cleaner Company of Chicago has received a letter from John I. Beggs, president of the Milwaukee Electric Railway and Light Company, in which he states that he now has 15 of the Garrigus cleaners in operation, is equipping eight more and is gradually putting them in all his boilers. He writes that his experience has been such that he "unreservedly commends the cleaner," and that its use has enabled him to more than double the time between cleanings.

Marshall H. Coolidge of Minneapolis, a large and well-known producer of cedar poles, has already secured a number of orders for poles for spring delivery. The product of Mr. Coolidge is known all over the West and Northwest for its excellence, and as a consequence Mr. Coolidge does a large pole business each year. Pole producers state that the demand for poles promises this year to be as brisk as ever, and Mr. Coolidge will undoubtedly obtain his share of the pole business.

The Charles E. Dustin Company, 11 Broadway, New York, dealer in "used" electrical and steam machinery, reports most satisfactory business for the month of January. This company carries one of the largest stocks of machines of this character in the East and has exceptional facilities for doing this class of business. The company will be pleased to hear from those in the market for slightly used machinery, and desires to send its new complete catalogue to all interested persons.

Evidence of the rapid and substantial manner in which Manager N. T. Brenner of the American Insulated Wire and Cable Company has pushed his product to the front with the western electrical trade, is to be found in his recent improvements on his Chicago plant. About a year ago the American company's factory at 241 South Jefferson Street, Chicago, was increased in capacity and recently the company has had practically to double its factory facilities. Orders have been placed for wire braiders to insure this doubling of production. The American brand of weatherproof wires and cables seems to be popular.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 3, 1903.

719,418. Electric Accumulator Plate. Auguste Bainville, Nanterre, France. Application filed July 14, 1902.

The accumulator consists of a number of rods separated from each other by a removable corrugated sheet of perforated insulating material arranged in such manner as to cover the face of one rod and the back of the next.

719,432. Telephonic Apparatus. Charles G. Burke, Brooklyn, N. Y., assignor of one-half to John Q. A. Whittemore, Boston, Mass. Application filed November 12, 1900. Renewed April 9, 1902.

In the system are a line, a local circuit, a number of independent induction coils composed of long fine-wire and short coarse-wire coils, the first-named coils being connected with the line circuit and the others being connected up in the local circuit, and a telephone receiver in the local circuit.

719,452. Trolley System for Electric Railways. James S. Fox, Jackson, Mich. Application filed June 28, 1902.

Combined with a surface rail are an electric conductor carried by the rail, a yielding track normally out of electrical connection with the conductor and means to connect the track and the conductor electrically when the track is in depressed position, the track and rail being out of electrical circuit when the track is in normal position, the ends of the rails being insulated one from another.

719,458. Combined Telegraph and Telephone System. Charles H. Gaunt, St. Paul, Minn., assignor of one-half to Oscar C. Greene, St. Paul, Minn. Application filed February 15, 1902.

In the system, combined with a metallic-circuit telephone line, are an electromagnetic retardation coil bridged across the same and comprising two coil members, each wound with the same number of turns, and a branch telegraph circuit leading from the retardation coil at a point between the coil members thereof to the ground, the coil members being so wound and connected as to constitute an ohmic resistance merely in the telephone circuit, but a

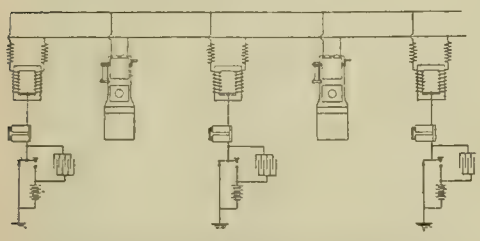
self-inductive resistance in the telegraph circuit. (See cut.)

719,463. Electric System for Elevator Safety Appliances. George Hail, Providence, R. I. Application filed April 8, 1902.

The system includes a main lighting circuit, a branch circuit including an electric lamp, the branch circuit also having two shunt circuits in multiple with each other and in series with the lamp, one of the shunt circuits having a rheostat or resistance placed therein in constant electrical connection with the lamp, and the other having included therein an electrically actuated device in intermittent electrical connection with the lamp.

719,465. Electric Clock. Vitalis Himmer and Vitalis Himmer, Jr., Bayonne, N. J. Application filed March 15, 1902.

An electromagnet forms the driving means.



NO. 719,458.—TELEPHONE AND TELEGRAPH SYSTEM.

719,466. Traction Apparatus. Nelson Hiss, New York, N. Y. Application filed March 8, 1902.

The apparatus consists of an endless driving cable in two bights, electromagnetic means for imparting motion to each bight of cable and means for holding either of the bights stationary at will. A controlling means is adapted to start one of the electromagnetic means alone while operating the holding means on the opposite bight of cable.

719,484. Apparatus for Electrothermally Treating Materials. Hudson Maxim, London, England. Application filed August 17, 1898.

Combined with a crucible having a number of electrode ports or openings on one side thereof, and an opening opposite the ports, are a number of electrodes entering the crucible through the ports and means for simultaneously and progressively withdrawing the electrodes from the crucible.

719,504. Automatic Fire-alarm Apparatus. Harry Plowman, London, England. Application filed July 3, 1901.

A thermostatic device is described.

719,506. Llectric Lamp. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Original application filed November 21, 1901.

In the lamp described are a glower, one or more heaters and a refractory cage embracing the glower and independent of the heater or heaters.

719,507. Electric Furnace. Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Original application filed November 21, 1901. Divided and this application filed November 20, 1902.

The furnace consists of a tube composed of a mixture of dry electrolytes, and provided with confronting electric-circuit terminals arranged in pairs at its opposite ends, each pair of terminals being in series with a separate ballast device. (See cut.)

719,508. Clamp Device for Electric Welding Machines. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding Company, Lynn, Mass. Application filed June 14, 1902.

In an electric metal-working apparatus are combined a lever carrying a clamp-jaw, a vertically adjustable support therefor, a threaded bolt connected to the support and an adjusting nut.

719,549. Liquid-resistance Switch for Electrical Purposes. John H. Woolliscroft, Sandycroft, England. Application filed October 3, 1902.

An inclosed drum or case has a liquid resistance therein, and internal and external blades in electrical connection are carried by the drum but insulated therefrom. A short-circuiting plate is in electrical connection with the drum, and a collector is adapted to make contact with the external blade and also with the short-circuiting plate.

719,551. Electric Time-alarm System. Edwin T. Ackerman, Chicago, Ill., assignor of one-half to Thomas A. Smyth, Chicago, Ill. Application filed October 4, 1901.

In the system are an electric-alarm circuit, a clock mechanism having a moving member forming a part of the circuit, an alarm contact for the member forming a part of the circuit, an alarm and a switch included in the circuit, a cut-in contact with which the member connects, a switch circuit including the cut-in contact and member, and a switch-actuating mechanism included in the switch circuit for opening and closing the alarm circuit.

719,556. Telegraph Instrument. Edward Bing and Henry Nevill, Pernambuco, Brazil. Application filed April 18, 1902.

In a siphon recorder are combined a bridge wire, a cradle mounted on the wire, a siphon attached to the cradle, a movable coil operatively connected to the cradle, and adjustable means for approximately balancing the cradle and the siphon.

719,566. Electric Brake. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 31, 1899.

There are combined an electric brake, a mechanical brake, a common handle for actuating them, and means for releasing the electric brake irrespective of the position of the handle.

719,574. Portable Bracket. Alan R. Fergusson, Mount Vernon, N. Y., assignor to the Electromechanical Specialty Company, New York, N. Y. Application filed September 4, 1902.

A hollow standard with ball-and-socket joint has electric wires passing through it.

719,600. Insulating High-potential Apparatus. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 19, 1902.

Combined with a conductor forming a part of a high-potential electrical apparatus are insulating material formed about and extending along the conductor, and a disk or disks of insulating material mounted thereon.

719,609. Power-factor Indicator. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 7, 1902.

719,659. Galvanic Battery. Henry Halsey, New York, N. Y. Application filed September 21, 1901.

A case contains a number of independent cells, each of which contains an excitant, a horizontally mounted revoluble shaft, and an independent rotatable element comprising a disk vertically mounted upon the shaft and immersed in the excitant. An independent driving shaft mounted upon the case crosses the upper ends of all the cells with gearing, whereby movement of the shaft causes movement of all of the elements. Means are provided for gradually feeding a chemical depolarizing agent to the excitant solution.

719,660. Electric Battery. Henry Halsey, New York, N. Y., assignor to the Halsey Electric Generator Company, Jersey City, N. J. Application filed April 18, 1902.

Combined with the electrolyte and the elements are means for maintaining movement of one of the elements, and means for freeing the electrolyte from precipitates.

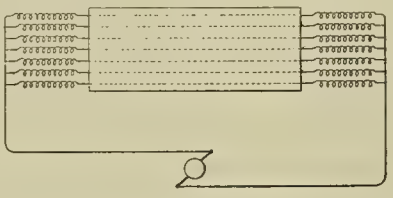
719,661. Electric Battery. Henry Halsey, New York, N. Y., assignor to the Halsey Electric Generator Company, Jersey City, N. J. Application filed April 18, 1902.

A number of concentrically arranged elements have an electrolyte between them, and means for moving a brush around the channel between the elements.

719,692. Safety Device for Elevators. Edward H. Price, Sioux City, Iowa. Application filed June 23, 1902.

The device is operated by electromagnets.

719,736. Service-meter System and Apparatus for Telephone Exchanges. Albert M. Bullard, Somerville, and Louis A. Falk, Boston, Mass., assignors to the American Telephone and Telegraph Company. Application filed April 10, 1902.



NO. 719,507.—ELECTRIC FURNACE.

719,752. Voltaic Cell. Miller E. Conrad, Atlantic, Iowa. Application filed December 18, 1900.

In the cell are combined positive and negative electrodes, an electrolyte, and means for depolarizing the cell consisting of a metallic oxysulphide, the oxysulphide being in contact with the negative electrode so as to combine with the hydrogen of polarization to form sulphuretted hydrogen.

719,753. System of Electrical Distribution. John L. Creveling, New York, N. Y. Application filed December 7, 1900.

A pole-changer has a movable member yieldingly maintained in one operative position, a counteracting electromagnet, and means for operatively energizing the magnet by current in one direction only.

719,768. Electrohydraulic Valve. Carl Engberg and John Erickson, St. Joseph, Mich. Application filed April 7, 1902.

The apparatus comprises a main valve, a balanced slide valve for operating the same, a rocking member for actuating the slide valve, the rocking member being provided with a clutch, a motor provided with a revoluble armature, and a clutch member connected with the armature.

719,778. Storage-battery Tank. Bruce Ford, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed December 11, 1902.

The tank consists of two or more compartments, each of which is lined with acid-resisting material. The compartments are separated by a double-wall partition having an air-space between the two walls of the partition which extends from the bottom to the top of the tank.

719,791. Electrolytic Cell. Robert Grisson, Hamburg, Germany. Application filed December 8, 1902.

In a transforming or condensing cell are electrodes, and a suitable electrolyte, one of the electrodes being of aluminum and having substantially no vertically disposed active surfaces.

719,824. Electric Brush-holder. Harry T. Maker, Milwaukee, Wis. Application filed November 12, 1902.

The brush-holder comprises cast-metal hub and a sheet-metal brush-supporting arm formed at one end with a sleeve for the brush and embedded at the opposite end in the hub.

719,859. Electrical Contact for Cartridge Fuses. Clarence D. Platt, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed December 2, 1902.

The contact plate has a back-stop formed of lateral wings bent up toward each other over the body of the plate.

719,870 to 719,873. Electrolytic Apparatus. Charles J. Reed, Philadelphia, Pa., assignor to the Security Investment Company. Applications filed May 5, 1899.

719,901. Photochemical and Electrotherapeutical Apparatus. Albert E. Sterne, Indianapolis, Ind. Application filed October 23, 1901.

One claim reads: The combination, in an electrical apparatus, of the main circuit leading to the primary coil of a transformer, one of the wires of which leads through a choke-coil, the choke-coil, the transformer, wires leading from the secondary coil of the transformer to the primary coil of a Tesla high-frequency coil, one of which leads through a condenser and is separated by a primary Tesla spark-gap, the condenser, the Tesla high-frequency coil, wires leading from the secondary coil of the high-frequency coil and terminating in points forming a secondary Tesla spark-gap, and a single "electrode" having a non-conducting exterior and a conducting interior arranged to be operated when in proximity to or in contact with one of the points where the last-named wires terminate.

719,915. X-ray Apparatus for Treating Diseases. Henry E. Waite, New York, N. Y. Application filed March 8, 1902.

The inventor describes the combination with an X-ray generator of an X-ray shield connected to the generator and having an opening for the passage of X-rays, and a tube connected to the shield opposite the opening.

719,917. Door-operating Mechanism. George T. Warwick and Rob R. Macdonald, Springfield, Mass. Application filed July 12, 1902.

Electromagnets are used in the mechanism.

719,932. Danger Signal for Railways. Charles P. Bass, Portland, Ore., assignor of one-half to Tom Thomas, Detroit, Mich. Application filed January 25, 1902.

The electric signaling means described comprises, in combination with the trolley wire, an electric line circuit and a number of electric-light circuits, a switch mechanism, including a rotator having a stepped contact member, a series of contacts for each set of lights for engaging with the stepped contact member, electromechanical means for imparting intermittent motion to the rotator in electrical connection with the line-circuit, a switch in the line-circuit normally held open and including a lever-arm projected on the path of the trolley adapted when engaged by the trolley to close in the line-circuit with the trolley wire and energize the electromechanical means to bring into action the signal lights.

719,937. Storage Battery. Bruce Ford, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed December 19, 1902.

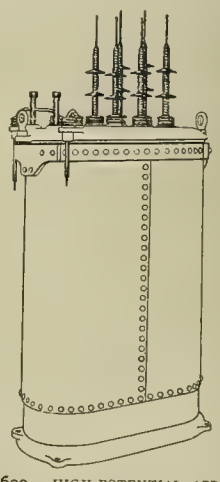
In combination are a cell containing an electrolyte and its complemental elements, separators buoyant in the electrolyte, and a holder arranged above the separators to prevent their rising.

719,971. Magneto-electric Generator Mechanism. Leonidas G. Woolley, Kenton, Ohio, assignor to the Magneto Electric Company, New York, N. Y. Application filed May 26, 1902.

The machine comprises a magneto-electric generator, including an oscillatory armature, a motor for imparting movement to the armature in one direction, and automatically operating means for imparting motion to the armature in a reverse direction.

719,972. Telephone Transmitter. James A. Wotton, Atlanta, Ga., assignor to the Wotton Electric and Manufacturing Company. Application filed June 8, 1901.

The transmitter comprises a vibrating diaphragm, a rigid cup of conducting material, a fixed and a working electrode within the same, a variable-resistance medium between the electrodes, means for insulating the fixed electrode from the cup, a flexible disk of conducting material for supporting the working electrode in the cup and electrically connecting the working electrode with the cup, a circuit connection through the cup and disk to the working electrode, and means for connecting the disk with the diaphragm to receive its vibrations.



NO. 719,600.—HIGH-POTENTIAL APPARATUS.

719,973. Process of Manufacturing Electric Condensers. James A. Wotton, Atlanta, Ga. Application filed January 23, 1902.

The process comprises arranging a sheet of plain paper of a given size between two condenser plates of predetermined size, similar sheets of paper at the outside of the condenser plates, rolling the same together and subjecting the whole to a bath of molten wax from which has been driven all moisture.

REISSUE.

12,079. Electrical Switch-operating Mechanism. Clifton B. Russell, Marlboro, Mass., assignor of one-half to Herbert E. Ryder, Marlboro, Mass. Application filed December 9, 1902. Original No. 680,626, dated August 13, 1901.

Electrical means are provided for exciting either of two electromagnets to throw the switch.

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Saut-Mortier Power-transmission System in France.

By Frank C. Perkins.

Jura is one of the industrial sections of Eastern France, and electrical power is utilized to a great extent in connection with the factory work at St. Claude. There is a transformer sub-station located at St. Claude, which is connected by a power-transmission line with the hydro-electric station at Saut-Mortier. The waterpower is obtained from the River Ain, which rises in the Jura Mountains, flowing through that section as well as the Ain, and emptying into the River Rhone. The ordinary flow available from the River Ain is somewhat more than four cubic meters per second, while during high water it rises to about seven cubic meters per second.

Of the accompanying illustrations, Fig. 1 shows the interior of the power house at Saut-Mortier, which was equipped with electrical generators and switchboards by the Maschinenfabrik Oerlikon. Advantage is taken of the Lac de Chalain as a reservoir for the water, which provides a reserve of about 20,000,000 cubic meters. The normal discharge is 16 cubic meters per second, which gives a total of 3,000 horsepower, with a fall of 18.4 meters and 2,500 horsepower, with a fall of 13.4 meters. The water is conducted to the power house through a canal 1,500 meters in length (Fig. 2) and enters the entrance canal at the power house, which is 45 meters in length, the weir being 10 meters high. There are three sluices, each one meter in height and 1.78 meters in width, connecting with the canal, which is 234 meters in length and 11 meters wide, with a fall of one to 25. The double supply pipes are constructed of steel, eight millimeters in thickness and 1,700 millimeters in diameter.

The power house has a total length of 34.8 meters, while it is 14.5 meters in width, and has a capacity for four units. The turbines are four in number, and each has a capacity of 700 horsepower when operating at a speed of 250 revolutions, and under a head of 18.4 meters. These turbines will develop 500 horsepower under a head of 13.4 meters. They are connected to the electrical generators through elastic insulating couplings of the Rafford type. The turbines are equipped with regulators of the Piccard system, which are said to be very accurate in the governing of the machines.

The electrical generators are of the Oerlikon drehstrom type, supplying a current of 50 amperes per phase, at a potential of 7,500 volts. The frequency is 50 periods per second when the machines are operating at 250 revolutions per minute. The diameter of the field magnet is 1,870 millimeters, the breadth being 920 millimeters. The two parts of the field coil are each wound with 83 turns of copper band 60 by two millimeters, and the two coils are connected in series, making a total of 166 turns. The copper of the field magnets weighs 1,250 kilograms. The enclosing frame of the machine has 12 openings for ventilation, and has an exterior diameter of 309 millimeters and a total width of 900 millimeters, while the interior diameter is 2,540 millimeters.

The outer diameter of the armature core is 2,540 millimeters, the rings being 170 millimeters in width. The armature is 250 millimeters in width, and each of the two halves has 72 slots, two per pole and phase, in which the coils are placed, with mica insulation. Each coil consists of 33 turns of two diameters in parallel, each 3.2 millimeters in diameter. The copper of the armature weighs 600 kilograms, while the total weight is 1,500 kilograms. The normal working current is 50 amperes per phase and the machine has a power factor of 80 per cent. The efficiency at normal load is 93.5 per cent. The exciting machines have a capacity of 3,600 watts at 30 volts, and are of the four-pole, shunt-wound type of drum winding.

The switchboard gallery (Fig. 3) of the main power station at Saut-Mortier is 6.7 meters long and 4.28 meters high, the inner height below the gallery being 2.8 meters. The switchboard proper consists of a number of marble panels, 2.25 meters in height, the total length of the board being 4.5 meters. The switchboard framework, as well as that of the gallery, is of steel and iron, the flooring being of cement. The rheostats, lightning arresters, fuses and busbars are located in a room under the switchboard gallery, and the various ammeters, voltmeters and other measuring instruments, together with the controlling apparatus, are placed on the upper gallery.

The high-tension, power-transmission lines from the power station at Saut-Mortier to the sub-station at St. Claude are 26 kilometers in length. Two transmission lines are installed, each consisting of three conductors of a diameter of eight millimeters. Another transmission line connecting the power station with the town of Montau is nine kilometers in length, and consists of three wires having each a diameter of eight millimeters. With this line other branch lines are connected of four and six-millimeter conductors, supplying current to Oyonnax, Belignat, Montreal and Marchon. The high-tension transmission line from the power house to Arinthod is eight kilometers in length, while those to Cernon and Moirans are five kilometers and 10 kilometers, respectively, each of the three conductors of which measure four kilometers in diameter.

The total length of the high-voltage, power-transmission lines is 105 kilometers, and all of the receiving stations are connected with the power house by telephone lines, the two wires of which are two millimeters in diameter. The total number of poles used was 3,940, measuring nine, 10 and 12 meters in length, the poles being placed from 1.4 to two meters in the ground.

On the transmission line to St. Claude there is a transformer located in the station at Jeurre. In the St. Claude sub-station there are four transformers, each of 70 kilometers, and further on in the city there are five other transformer installations. Fig. 4 shows the St. Claude sub-station, which has a floor area of 188 square meters. It is equipped with a seven-ton crane for handling the various machines making up the motor-generator sets.

The three-phase motors driving the motor-gen-

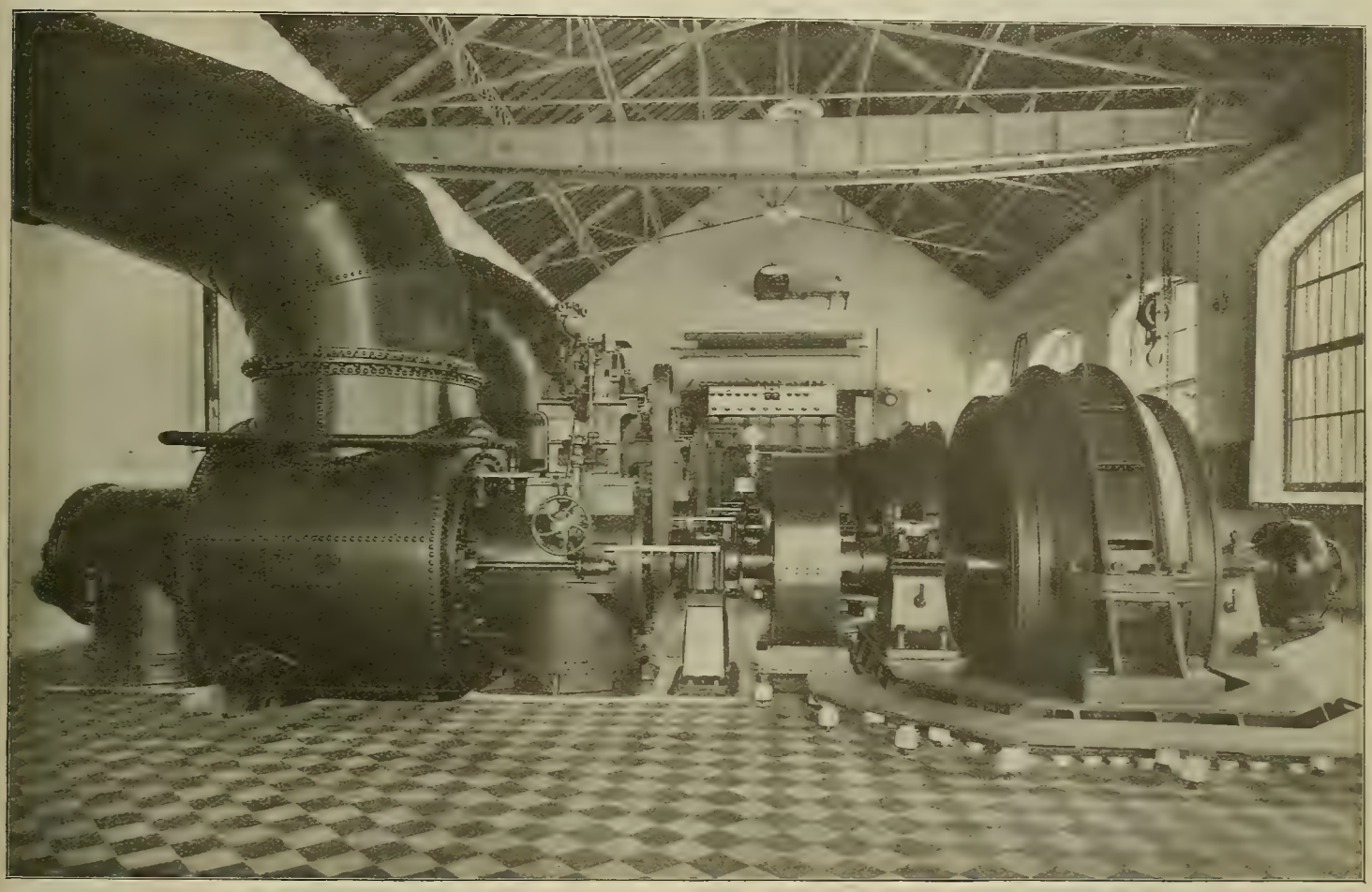


FIG. 1. SAUT-MORTIER POWER TRANSMISSION SYSTEM IN FRANCE.—INTERIOR OF HYDRO-ELECTRIC POWER PLANT.

erator groups are 10-pole Oerlikon machines, each having a capacity of 150 horsepower. They operate at a speed of 590 revolutions per minute, and are supplied by a low-tension, three-phase current of 200 volts from the step-down transformers, the frequency being 50 periods per second. The stators are 800 millimeters internal diameter and measure 230 millimeters in width. They are provided with 150 slots, with 14 parallel copper conductors, measuring 3.8 millimeters in diameter. The rotor has an outside diameter of 898 millimeters and has 180 slots,

FIG. 2. SAUT-MORTIER POWER-TRANSMISSION SYSTEM IN FRANCE.—POWER CANAL.

in each of which there are six parallel copper conductors four millimeters in diameter.

Each three-phase motor is directly connected to two direct-current dynamos, one on each side, each having a capacity of 75 horsepower. These machines operate at 590 revolutions per minute, supplying a continuous current at 200 volts. The armatures of these machines are 470 millimeters in diameter, and the iron core measures 320 millimeters in width. Each armature has 117 slots of a section six by 30 millimeters, and in each slot there are two conductors, each of which consists of three parallel wires four millimeters in diameter. The commutators of these direct-current machines have each

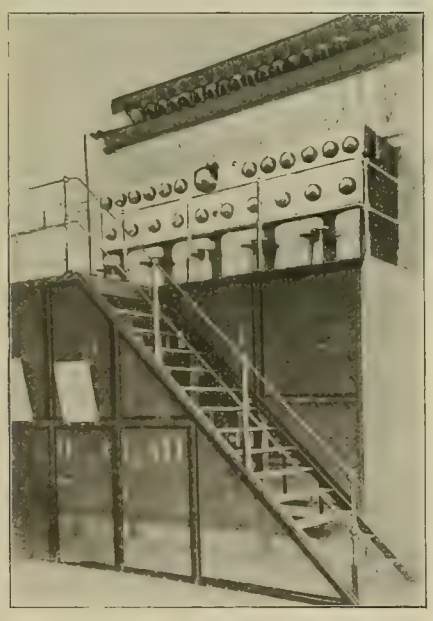


FIG. 3. SAUT MORTIER POWER-TRANSMISSION SYSTEM.—SWITCHBOARD GALLERY IN MAIN POWER HOUSE.

117 copper segments. The inside diameter of the magnetic field measures 486 millimeters. There are four field-magnet coils, each having 2,450 turns of wire of a section 1.8 by 2.2 millimeters.

The switchboard equipment of the sub-station at St. Claude is divided into two parts, the one for the high-tension apparatus and the other for the low-tension switches, meters, rheostats, etc. The rear of the board is shown in Fig. 5.

The following table gives the data of a test of one of the transformer groups in the sub-station, consisting of a 150-horsepower Drehstrom motor and the two 75-horsepower dynamos. It shows the speed, voltage, current, etc., of the motor, as well as the output of the direct-current machines at various loads, together with the efficiency of these machines.

150 Horsepower Three-phase Motor.							Direct-current Dynamo No. 1.			Direct-current Dynamo No. 2.				
Revolutions per Minute.	Periods per Phase.	Voltage.	Amperes per Phase.	Motor Output, Kilowatts.	Cosine.	Slip.	Voltage.	Useful Current, Amperes.	Exciting Current, Amperes.	Voltage.	Useful Current, Amperes.	Exciting Current, Amperes.	Efficiency of Group.	Kilowatt Output of Direct-current Generators.
598	50	205	75	6.0	0.23	0.3%	.....	.....	.....	.....	.....	.....	.....	.....
608	.....	205	88	8.4	0.27	.....	210	.....	1.4	210	.....	1.4	.....	.....
601	.....	212	200	60.9	0.83	.....	210	125	1.52	214	120	1.5	85.5%	52
587	.....	203	275	82.3	0.851	.....	208	168	1.6	210	173	1.6	86.3%	71.2
583	49.5	215	385	123.0	0.857	1.9%	210	267	1.75	209	243	1.75	86.8%	107.0
587	.....	210	350	.....	.....	.....	245	223	2.3	245	178	2.5	.....	.....

The temperature of the stator of the three-phase motor, after operating 4½ hours at full load, was 42.5 degrees C., while that of the rotor was 44.0 degrees C., and of the stator iron 52 degrees C. The armature of one of the direct-current generators reached a temperature of 45 degrees C. and its commutator 55 degrees C., while that of the field was 31 degrees C. The temperature of the armature of the other machine was 55 degrees C., while its commutator was raised in temperature to 74 degrees C. and the field to 31 degrees C. The temperature of the surrounding air during this test was 24 degrees C. As will be noted by the table, the efficiency of the entire motor-generator group was 86.8 per cent. with a load of 123 kilowatts on the motor, the two direct-current machines supplying 107 kilowatts.

The low-tension power distribution circuits are operated at a potential of 200 volts on the three-phase lines, the motors varying in size from one-half to 35 horsepower each. There are a total of 85 three-phase motors working in the various factories, with a total output of 684 horsepower.

The arc and incandescent lighting in St. Claude is operated both on the 200-volt, three-phase distribution circuits and also on the 120-volt direct-current lines. In St. Claude there are 3,200 incandescent lamps in operation, with a total of 36,000 candlepower. In the other villages along the transmission lines there are 2,000 incandescent lamps employed on the three-phase, low-tension circuits, having a total of 23,500 candlepower.

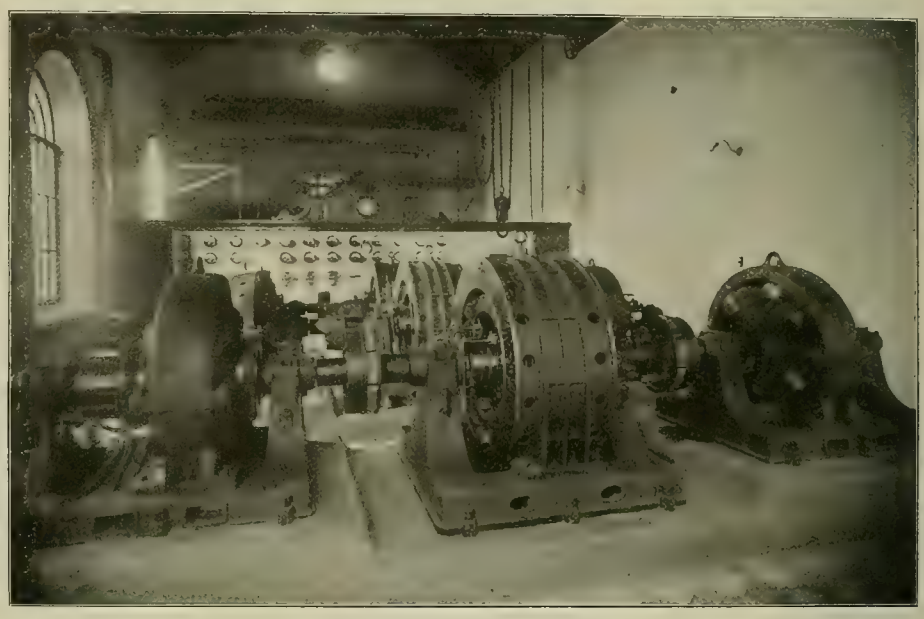


FIG. 4. SAUT-MORTIER POWER-TRANSMISSION SYSTEM IN FRANCE.—INTERIOR OF ST. CLAUDE SUB STATION.

Awards of the Franklin Institute.

At the recent annual meeting of the Franklin Institute President John Birkinbine spoke as follows concerning the awards of the Institute: "In the work of the committee on science and the arts, the Franklin Institute stands alone, and its medals and awards are eagerly sought for. Of the 109 cases before this committee, 52 were disposed of and 22 medals, or awards, allotted. The gratuitous service which members of the Franklin Institute render through this committee to inventors and others is of incalculable value, and the thoroughness of the investigations, and the equity of the awards are evidenced by the small number of protests made. Errors have been or will be committed, but the safeguards thrown about the investigations and discussions, and the opportunity given for protest before an award is effective, minimize the risk of this important service, rendered without demand or expectation of return. The demands on the members have been so great that, upon the recommendation of the committee on science and the arts, its number was increased to 60, by amendment to the by-laws."

At its meeting on January 7th this committee adopted a report on "Blue-printing," awarding to the inventor, Samuel Brent Whinery, the Institute's certificate of merit. The apparatus is designed to facilitate the manipulation of cylindrical glass-printing frames in the process of photographic printing by electric light. An advisory report was received on a "Dirt Eradicator for Trolley Lines" by Henry C. Mayer of Blooming Grove, Pa., and reports on a "Magnetic Clutch" by Bion J. Arnold of Chicago and "Multiple-unit System of Electric Traction" by Frank J. Sprague of New York, passed first reading.

Cheap Electricity in Montreal.

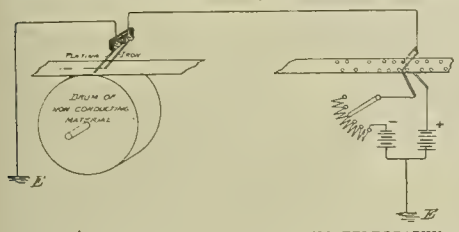
A Canadian correspondent writes: "The city of Montreal has entered upon a brief era of cheap electricity. From the present month until the first of October next electric energy will be almost as cheap as water in Montreal. The advent of power from Shawinigan Falls into the city is responsible for this unique condition of things. The Lachine Rapids Hydraulic Company, having obtained control of this new power transmission, is now anxious to dispose of the power as extensively as possible. With this object in view, it has just been announced that manufacturers, from now until next October, will be granted power at one-half the usual rate. The

FIG. 5. SAUT MORTIER POWER-TRANSMISSION SYSTEM.—REAR OF SWITCHBOARD AT ST. CLAUDE SUB STATION.

company also purposes making a house-to-house canvass throughout the city, and will offer to provide light for every householder at a figure similar to that paid the gas company. For cooking and heating purposes electricity will be supplied to those using gas ranges at one-half the price being paid for gas."

Delany's Improvement in Automatic Telegraphy.

The capacity and consequent retardation of relatively long telegraph lines or cable circuits has been a serious obstacle to transmission and chemical reception of signals at high speed, causing elongation of the characters to such extent frequently that the dots and dashes run into each other. Patrick B. Delany, South Orange, N. J., the well-known inventor, proposes to utilize the heretofore objectionable "retardation" of a circuit as an element in producing the record upon the receiving ribbon, and contemplates adding capacity or retardation artificially when required in the operation of the invention. Each signal transmitted, whether it be a dot or dash, is composed of two impulses of opposite polarity, one of which initiates a record of the signal and the other terminates it, the interval between



DELANY'S IMPROVEMENT IN AUTOMATIC TELEGRAPHY.

the two impulses determining whether the signal is a dot or a dash. When the primary impulse of a signal is transmitted, it initiates a record of that signal on a chemically prepared receiving tape, and after disconnection of the transmitting generator from the circuit the formation of the record character on the receiving tape will be continued by the capacity effects of the circuit, but will be terminated by the secondary impulse of opposite polarity, which is preferably not otherwise manifested upon the receiving ribbon.

"The character produced upon the receiving ribbon," says Mr. Delany, in describing his recently patented invention, "will therefore be short or long —i. e., either a dot or a dash—according to the interval elapsing between the primary and secondary impulses constituting a signal. As is apparent, the primary impulses may be of uniform duration. The secondary impulses may also be of uniform duration and of the same duration as the primary impulses. The primary and secondary impulses may be of the same strength or the secondary impulses may be of reduced strength, as may be determined to produce the best results over any given circuit. The intervals between the primary and secondary impulses representing dots and dashes depend in a measure upon the rate at which the impulses are sent into the circuit and upon the speed of travel of the receiving ribbon. The initial impulses of the signals being of uniform duration, dots only from such impulses would be produced on the chemically prepared receiving ribbon if the capacity or retardation of the circuit be so small as not to cause their elongation, and therefore I propose in such a case to increase the capacity artificially to such an extent as to produce a proper legible record in dots and dashes. Where, under the conditions of working, including the elements of strength of current employed and speed of transmission, capacity should be added to the circuit, it is best done at the receiver, the character of the record being an efficient index of the change required in the condition of the circuit.

"I have demonstrated that by the use of a perforated transmitting strip I may send into a circuit of very large capacity signals at a high rate of speed and obtain sharp clear definition of the characters recorded upon the receiving ribbon. In machine or automatic telegraphy where transmitting ribbons are employed various modes of sending alternating currents separated by proper intervals may be adopted. The invention is not dependent upon any special mode, many of which are known. Proper results may be produced by arrangement and spacing of the perforations or embossings and also by proper relative arrangements of the contact fingers or devices operated by the transmitting ribbon. In the accompanying drawing I have shown diagrammatically one way of practicing this invention which experience has demonstrated to be practical and efficient."

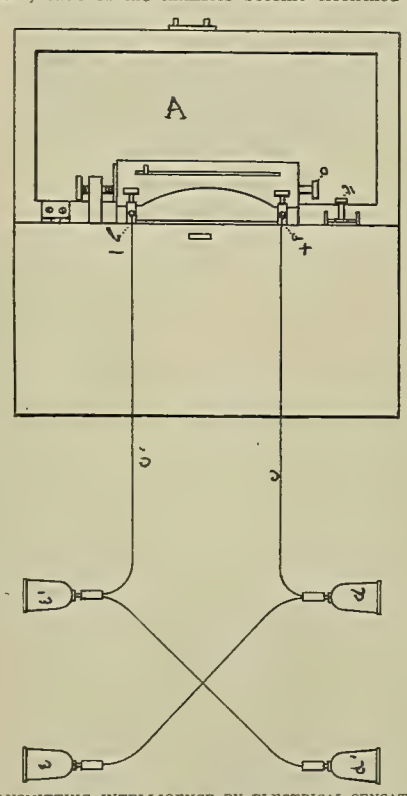
The Observer of Coopersville, Mich., published a recent issue as an interurban-railway number, the occasion being the completion of the first year's service of the Grand Rapids, Grand Haven and Muskegon Railway, which operates a third-rail electric railway through Coopersville. A history of electric railways in general and of this road in particular is given, together with illustrations of a car, the power house, sub-stations, etc.

Transmitting Intelligence by Electrical Sensation.

The language of deaf mutes has generally been confined to the manipulation of the fingers or the movement of the lips, both of which are very difficult to learn, and can only be used in the light and within the range of vision, while the language of blind mutes is confined to the use of raised letters. By the use of an ingenious invention recently made and patented by Jacob Reese of Sharonhill, Pa., deaf mutes and blind mutes are enabled to dispense with the finger-and-lip service, as well as the raised-letter method, and converse freely, as well in the dark as in the light. The invention consists in establishing communication by electric impulses through a circuit in which a source of electricity and a person or persons receiving the impulses form a part, with apparatus under the control of such person or persons for making the impulses with rapidity and facility.

The accompanying drawing is a plan view of an ordinary battery having electrical conductors provided in accordance with the invention. Referring to the drawing, (a) indicates a binding post for attaching the positive wire, and (b) a post for attaching the negative wire. Bifurcated wire conductors (c) and (c') are attached at their upper ends to the posts (a) and (b). To the free end of these conductors and their bifurcated points are attached metallic finger thimbles which form contact members.

The key of the battery is indicated by (n). Now, when one person incases the thumb in (d) and the forefinger in (d') of one set of conductors and another person incases the thumb in (e) and the forefinger in (e') of the other set, and the key end is closed, each of the thimbles become electrified and



TRANSMITTING INTELLIGENCE BY ELECTRICAL SENSATION.

both persons are impulsed; but when the thimbles (e) and (e') are touched the current is short-circuited and neither party feels the impulse, and if (e) and (e') are left open and thimbles (d) and (d') are made to touch the current is short-circuited, and there is no impulse to either party. Thus the impulses may be sent from one to the other with instant rapidity by means of touching and opening the thumb and forefinger thimbles.

"Now, by using the Morse code," says Mr. Reese, "two persons within this circuit can converse together as rapidly, as distinctly, and as accurately as a person can now telegraph a message. There need be no mistakes, as both persons feel the same impulses. The strength of the impulses may be made lighter or stronger by adjusting the regulator (o). When the current is not required, it should be shut off by opening the key (n).

"By the use of my improved method persons may carry pocket batteries and converse with each other while walking on the street or while on the cars or other mode of transit. They can talk in the dark as well as in the light, and where the house is properly wired persons in different rooms or in different beds may commune together. The blind mutes can throw their cumbrous fingerboards away and receive and send their impulses by electricity with as great rapidity as can be done by telegraphing to-day. The school houses can be wired, so that the teacher can speak to any one or to every scholar in the class-room at the same time and can call any one or class to the office at any time. The great advantage of the bifurcated wires is that they bring both parties in when the circuit is open and throw them both out when either side is shunted. When two parties hold the thimbles, a third party may send a message to them by using key (n); but he could only receive the answer through the thimbles. The thimbles are such as ordinarily used by women in sewing. They have an opening in the end, so as to receive the wire, which may be easily separated, so as to attach a thimble of the desired size."

American Railway and Mechanical and Electrical Association.

[Special dispatch to the Western Electrician.]

Cleveland, Ohio, February 17.—The committee appointed at the last meeting of the American Street Railway Association in Detroit to arrange for the organization of an association of master mechanics and electricians closed its meeting at the Hollenden Hotel here late yesterday evening, after having effected an organization to be known as the American Railway and Mechanical and Electrical Association, the members to consist of the companies and lessees of electric railways, through their representatives, which are engaged in the departments named. There was considerable discussion over the membership, as to whether it should be the companies or simply individuals employed by the various companies, the forenoon being taken up very largely in this way.

The purposes of the association, as stated in the constitution and by-laws, is the improvement of the members by the interchange of opinion and the betterment of the properties they represent from a mechanical and electrical point of view. It follows, in general, the plan of similar associations in the work it has laid out for itself. The dues for active members are fixed at $5 a year. In addition, there will be a number of honorary members, and these will include the street-railway, electrical and mechanical journals, conditioned upon recommendation of the executive committee, the applications of several, including the Western Electrician, Street Railway Journal and Street Railway Review, having already been accepted.

The officers chosen were: President, Thomas Farmer; vice-presidents, W. O. Mundy, Alfred Green and E. W. Olds; secretary and treasurer, Walter Mower; executive committee, the vice-presidents and H. H. Adams, D. F. Carver, T. J. Mullen and C. F. Baker. The annual meeting will be held one day before that of the American Street Railway Association and at the same place.

Those present were Thomas Farmer and Walter Mower, Detroit; C. F. Baker, Boston; D. F. Carver and Fred Heckler, Cleveland; H. H. Adams, Baltimore; E. W. Olds, Milwaukee; W. W. Annable, Grand Rapids; W. O. Mundy, St. Louis; Alfred Green, Rochester; T. J. Mullen, Scranton; J. Miller, Buffalo; C. A. Brown, Toledo; R. E. Danforth, Rochester, and representatives of the Western Electrician, Street Railway Journal and Street Railway Review. O. M. C.

Stanley-General Electric Deal Confirmed.

Definite announcement has now been made of the long-contemplated transfer of the Stanley Electric Manufacturing Company of Pittsfield, Mass., to a syndicate of New York capitalists affiliated with the General Electric Company. Under the change the John A. Roebling's Sons Company of Trenton, N. J., will retire from the control of the Stanley company. It is understood that Ferdinand W. Roebling, who was one of the directors, will retire, together with President Perrine and Treasurer Gamwell. W. R. Plunkett and G. H. Tucker of Pittsfield, directors of the old company, will remain as directors under the new management. The transaction puts an end to the contemplated increasing of the stock of the Stanley company from $3,000,000 to $10,000,000. It is expected, however, that at least $1,000,000 will be spent by the new owners in enlarging the plant at Pittsfield, which employs about 1,500 men. It is said that the stock of the Stanley company was sold for approximately $125 a share. It is officially announced that the Stanley company will continue to devote its efforts to the manufacture of high-voltage apparatus for the transmission of electric power at great distances.

Picou Permeameter.

The new permeameter which has been devised by R. V. Picou, a prominent electrician of Paris, for measuring the magnetic permeability of iron samples, is said to be an improvement over the existing instruments, and is of especial value as applied to the measurements upon sheet iron which may now be easily carried out without any special preparation of the samples. The difficulties which have been met with in existing instruments are due to the

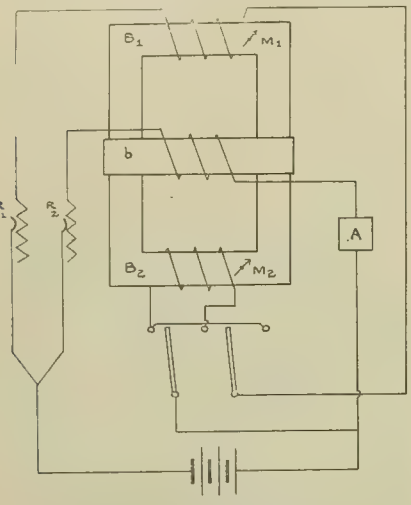


FIG. 1. PICOU PERMEAMETER.—DIAGRAM OF CONNECTIONS.

joint which is formed between the sample to be tested and the iron yokes of the instrument. This joint introduces an air-gap into the magnetic circuit. It may be reduced to an extremely small figure if the mechanical adjustment of the ends is perfect, but it still presents an important value in the measurement. The value of the air gap, supposing that there are two joints of 0.01 millimeter each, when reckoned in an equivalent length of iron, may equal 40 millimeters of iron (supposing $\mu=2{,}000$, which gives a possible error of 20 per cent. in the measures. It is especially difficult to

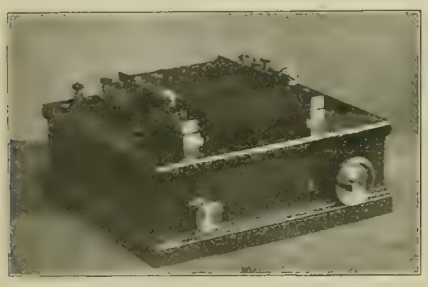


FIG. 2. PICOU PERMEAMETER.

make magnetic measurements upon laminated iron by the usual forms of instrument, and nevertheless the measures are here of the greatest value as applied in the design of alternators and especially of transformers. The iron-ring method gives exact results, but the construction of the samples is so tedious that it cannot be used in most cases. The present apparatus uses straight samples and at the same time eliminates the errors due to the joints.

The diagram (Fig. 1) shows the general arrangement which has been adopted, while the photograph (Fig. 2) gives the appearance of the instrument. Two horseshoe yokes of soft iron (B_1) (B_2) are

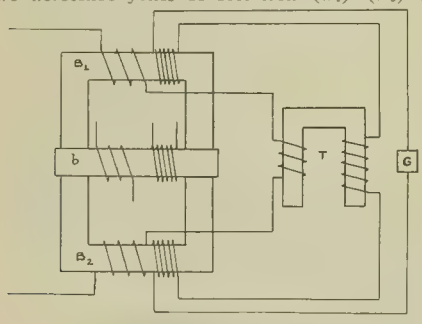


FIG. 3. PICOU PERMEAMETER.—ARRANGEMENT WITH TRANSFORMER.

placed opposite each other and hold between the ends the sample (b) to be tested, which may be a bar or an assemblage of flat iron. Each of the yokes carries a magnetizing coil and the sample also carries a coil. The circuits of the three coils can be combined in different ways. Suppose, first, that the current is sent into (B_1) and (B_2) alone, but in such a direction that the flux of one yoke is concordant with the other. No flux will then pass through the test bar, seeing that its two ends are at the same magnetic potential, but the flux will traverse all the joints, passing across the ends of the bar. It is not necessary to know the magnetomotive force of the circuit (B_1) (B_2), and for this reason the circuit is not provided with an ammeter. But the flux in the circuit should be indicated and measured, and it may be supposed for the moment that this is obtained by means of the small magnetometers (M_1) (M_2) inserted in the yoke. Let ϕ represent the value of the flux. If we now invert the magnetizing current of the coil (B_2) alone, the flux of each yoke is opposed to the other, and the magnetic circuit is closed through the test bar. The flux ϕ is thus weakened by introducing into the circuit the reluctance of the bar (b).

To bring back the flux to its original value it suffices to send a sufficient current in the coil (b). The measurement of this current by the ammeter (A) gives the value of the corresponding magnetomotive force. This, however, is precisely what corresponds to the magnetization of the bar (b) alone, abstraction made for all the joints and for the yoke. The demonstration is simple. Calling (F) the magnetomotive force of one yoke and F′ that of the bar (b); (R) the reluctance of one yoke including the corresponding joints, and (R′) that of the bar

FIG. 4. PICOU PERMEAMETER.—BALLISTIC INSTRUMENT.

alone. The first experiment gives $2\phi R=F$ and the second, $2\phi R+2\phi R'=F+F'$, from which, by substraction, we obtain $2\phi R'=F'$. As ϕ is known, we deduce the induction (B) from the section of the bar. The equation for the magnetomotive force being $F'=Hl$ the value of μ, or the permeability, is immediately deduced when l is known.

In the actual instrument all the above parts are found with the exception of the magnetometers for measuring the flux. After a number of experiments it was found that the ballistic method was the best for this measurement. But the ballistic methods are always somewhat slow, and again in order to reproduce by regulation a given flux which has a predetermined value, it is necessary to make a number of readings. The practical difficulties which would result from the use of the ballistic under ordinary

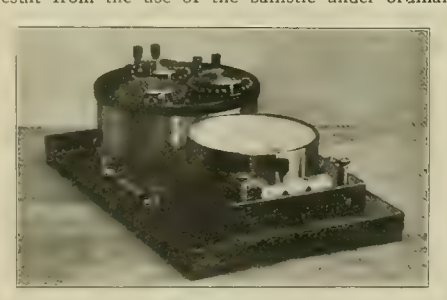


FIG. 5. PICOU PERMEAMETER.—SET WITH RHEOSTAT AND GALVANOMETER.

conditions, and which led to a trial of the magnetometers, have been overcome by an ingenious method devised by Mr. Armagnat. Each of the branches (B_1) (B_2) (b) of the complex magnetic circuit has received a secondary winding, which is used for the ballistic measurements. The first operation consists in indicating the flux which is formed in (B_1) and (B_2) by the concurrent magnetomotive forces. This flux is simply indicated but not measured, as it is sufficient to be able to reproduce it later on without knowing its absolute value. It is the value of the flux in (b) which must be measured finally. To the flux is opposed that of a transformer (T), Fig. 3, whose coefficient of transformation can be varied by a hand regulator. The measurement is thus brought to a zero method, and if a revolving commutator is used to carry out the successive operations of magnetizing and discharging, the regulation is very easily made. Once the regulation obtained, the transformer thus serves to indicate the value of the flux to be reproduced.

The second phase of the measurement is the inversion of the current in one of the yokes. This inversion weakens the flux and the previous value is established by sending a magnetomotive force (H) around (b). This force is read on the instrument. It now remains to find the flux in the bar (b). For this, a special commutator connected with the ballistic removes from the circuit the coils (B_1) and (B_2) and substitutes the coil of (b). A single movement of the revolving commutator produces the discharge, and the swing of the ballistic gives the measure of the flux on a scale which has been calibrated beforehand in C. G. S. units or gausses. To render the standardizing of the ballistic independent of the respective position of the apparatus, and also to simplify the installation, the use of a mirror has been abandoned, and for this purpose the ballistic which is shown in Fig. 4 has been provided. Here the mirror is replaced by a needle. The ballistic is graduated directly in gausses, which makes it convenient to read. Fig. 5 shows a set consisting of a rheostat of three dials, which measure from one to 11,110 ohms, and from 10 to 1,100 ohms, for regulating the magnetomotive force, and a galvanometer graduated in gausses and in milliamperes.

This apparatus has given good results in practical measurements. The readings are exact, and have been found independent of the joints. This latter point is brought out in a striking manner in one experiment, in which a pile of sheet-iron strips which were straightened without any special precautions, gave readings which formed a very good curve; the same pile was taken out of the apparatus, taken apart, handled and remounted, and then gave a set of readings which could be placed on the same curve as before.

Hubbard Storage-battery Systems.

Some improvements in storage-battery distribution systems have recently been patented by Albert S. Hubbard of Greenwich, Conn. One invention relates particularly to a system wherein two storage batteries are connected in parallel to a generator or charging circuit and to a consumption circuit, with a resistance or electromotive-force reducer between the charging circuit and one of the batteries, so that one battery receives a higher voltage and tends to charge from the generator, while the other battery receives a lower voltage from the generator and tends to discharge to the consumptive circuit. By interchanging these batteries at intervals the necessary conditions for continual charging of one battery and discharging of another battery are maintained. In such a system any large variation in the number of translating devices, such as lights or motors in circuit, will result in considerable fluctuation of intensity of the remaining lights or of speed of the remaining motors. Similarly the dropping in voltage of the discharging battery will correspondingly affect the translating devices.

To overcome these difficulties, Mr. Hubbard makes the connection of the consumption circuit to the resistance intermediate the battery connections, and makes this connection to the resistance adjustable differentially, so as to approach one or the other of the battery connections, so that whatever be the conditions of load and battery voltage the potential at the translating devices may be maintained constant within reasonable limits. The adjustment of this connection may be made by hand or it may be automatic, under control of electromagnetic devices responsive to the voltage in the translating circuit. The same switch that controls this resistance connection may also control another resistance directly in the translating-circuit connection, so as further to regulate the potential and the circuit.

In the drawings on the next page Fig. 1 is a diagram of a system of distribution embodying the invention, showing a manually operated switch for controlling the resistance connection. The generator is indicated at (1) and the two storage batteries at (2) (2′) and the intervening resistance at (3), the storage batteries being connected by the charging-circuit wires (4) (4′) in parallel, so that the generator is connected to battery (2) directly and to battery (2′) through resistance (3). Consequently the electromotive force impressed from the generator on the battery (2′) is less than that on the battery (2) by an amount depending on the drop in the resistance (3). The consumption or load circuit (indicated at 5) is connected at one side to the generator and the common return of the batteries and on the other side to a switch (6), whose movable part or contact is adapted to engage suitable contacts to connect different parts of the resistance (3), according to the position of the switch. The switch has a handle (7), whereby its position may be adjusted so as to maintain a desired condition of potential on the translating circuit, this handle operating the switch in the form shown by a screw (7a), working in the switch contact, which acts as a nut thereon. Thus, if more lights are switched into the circuit the attendant will note the fall in intensity due to increased drop in the circuit and will move switch (6) so that its contact will approach the higher-potential end of resistance (3). This causes a higher electromotive force to be delivered to the circuit (5) to make up for increased drop and prevents an objectionably high rate of discharge in battery (2′).

In some cases it is desirable to render the operation of the regulating device automatic, and for this purpose the system as shown in Fig. 2 is arranged wherein the resistance switches (3a) (3b) (6)

(8) are arranged as shown. The operating spindles or screws (7a) (7b) of the switches are both attached to the armature (11) of a common operating motor, which operates the switches simultaneously and correspondingly. This motor is controlled by a relay (12), connected across the translating circuit, so as to be responsive to the electromotive force of that circuit at the point or place of consumption. The armature (13) of this relay co-operates with contacts (15) (15'), connected by circuits (16) (16') with the motor, the armature thereof being driven in one direction or the other, according to which of these contacts is closed. For reversing the motor either the armature or the field may be reversed.

The inventor has shown a field-reversing arrangement, the field magnet of the motor having two coils (14) (14') connected through spring switches (17) (17') with the contacts (15) (15'), the other side of these coils being connected by wire (18) through the armature with the other side of the circuit. The armature (13) is under normal conditions of electromotive force held out of contact with both contacts (14) (14') by the opposing action of magnet (12) and a spring (12'). If the load increases, causing voltage to drop, the spring (12a) will draw the armature (13) to contact (15), and a current impulse will pass from main circuit

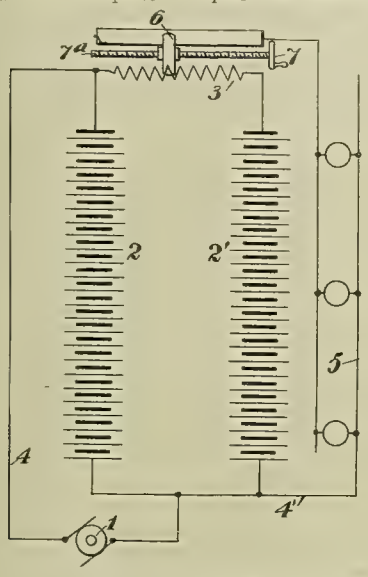
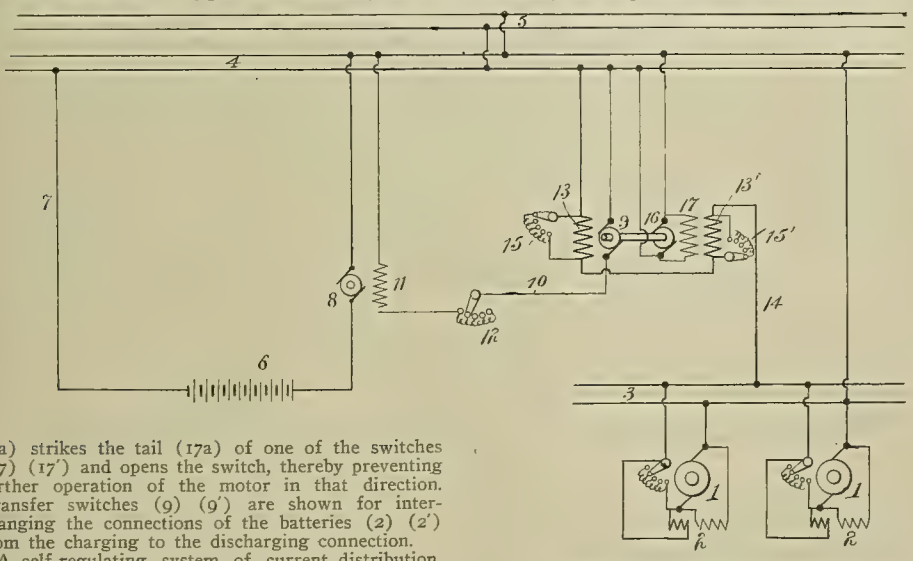


FIG 1. HUBBARD STORAGE-BATTERY SYSTEMS—SIMPLE DISTRIBUTION SYSTEM.

(4) by wire (18) through armature (11) and field coil (14'), switch (17), circuit (16), contact (15), relay armature (13), and a wire (19) with the other side (4') of the main circuit. The armature (11) is then rotated by this current until it has moved the switch contacts (6) (6') sufficiently to restore the proper electromotive-force conditions on the consumption circuit, whereupon the armature (13) resumes its open position. On reverse conditions an inverse action occurs. When the switch device (6) reaches either end of its path of movement, its lug



(6a) strikes the tail (17a) of one of the switches (17) (17') and opens the switch, thereby preventing further operation of the motor in that direction. Transfer switches (9) (9') are shown for interchanging the connections of the batteries (2) (2') from the charging to the discharging connection.

A self-regulating system of current distribution, in which auxiliary devices, such as storage battery and booster, are provided to respond to and take up fluctuations of the load, is represented in Fig. 3. The invention further relates to self-regulating systems of current distribution in which an auxiliary source of current is provided to regulate the field of the booster. The object is to provide a source of power for the auxiliary source of current, which source of power shall be responsive to electrical conditions in the consumption circuit. The invention also comprises a system in which both the auxiliary source of current as well as the source of power for the same are responsive to electrical conditions in the consumption circuit.

Referring to Fig. 3 (1) (1) represent the main generators, with their fields represented at (2) (2), the fields being provided with adjustable resistances, as shown. The generators are connected in parallel to bus-bars (3) (3) and (4) (4), the latter being connected to the consumption circuit (5), as shown. A storage battery (6) is connected across the bus-bars (4) (4), in the circuit (7) of which is in-

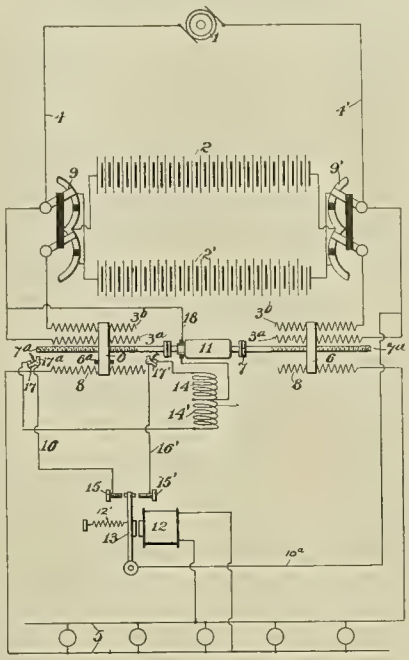


FIG. 2. HUBBARD STORAGE-BATTERY SYSTEMS.—SYSTEM WITH AUTOMATIC REGULATING DEVICE.

cluded the booster armature (8). The auxiliary generator (9) is provided, with its armature connected across the bus-bars (4) (4), as shown. In the armature circuit (10) of this auxiliary generator is booster field coil (11) and an adjustable resistance (12). The field coil for the auxiliary generator or exciter (9) is shown at (13), and this exciter field coil is connected in series with the main generators by connection (14). In the same connection (14) is a motor field coil (13') also in series with the main generators. Each of the coils (13) (13') is provided with a regulating resistance (15) (15'), respectively.

At (16) is represented a motor which has driving connection with the armature of the auxiliary generator or exciter (9). As shown in the drawings, this driving connection is direct, making the generator (9) and motor (16) a single unit as a motor-generator; but any suitable driving connection—as, for instance, by belt—may be employed to connect the motor (16) with the generator (9). The motor (16) is connected across the bus-bars (4) (4), as shown, and is provided with a shunt field wind-

FIG. 3. HUBBARD STORAGE BATTERY SYSTEMS.—SELF-REGULATING SYSTEM.

ing (17). The motor field windings (17) (13') are wound differentially with respect to each other.

With the above system under normal conditions the main generators (1) (1) are adjusted to supply current for the average conditions of load in the consumption circuit (5). Motor field coil (13') and exciter field coil (13) are in series between the main generators and the load. Exciter (9) is arranged under normal conditions to give a voltage exactly equal and opposite to that of the bus-bars. Under these conditions no current flows in the booster field (11), and consequently the booster armature (8) generates no electromotive force and the battery neither charges nor discharges. The field windings (17) (13') of the motor (16) are balanced differentially, as above described, so that the motor runs at a speed sufficient to give an electromotive force to the exciter armature equal and opposite to that of the bus-bars. Upon an increase of load in the consumption circuit an increased current flows through field coils (13) (13'), which, as above stated, are in series with the main generators. This increase of current in the motor and exciter field coils results in an increase of field strength, and consequently an increase of electromotive force in the exciter circuit (10), in which is included the booster field (11). The increase of current in motor field coil (13'), the field being differentially wound, as described, results in the weakening of the said field and a consequent speeding up of the motor, thereby resulting in increased speed of the exciter armature (9), causing an additional increase of electromotive force in the exciter circuit (10) and booster field (11). The increased intensity of booster field (11) causes a booster electromotive force in such a direction as to be in series with the battery and cause it to discharge.

Upon a decrease in the load in the consumption circuit a reverse action takes place, the motor speed falls, and the field strength of the exciter decreases, with the result that the exciter voltage is less than the bus-bar voltage, and there is a current flowing in booster coil (11) which causes the booster to generate electromotive force in such a direction as to be in series with the bus-bars, causing the battery to charge.

These inventions of Mr. Hubbard are covered in three patents, issued last week, and assigned to the Gould Storage Battery Company of New York, or Charles M. Gould of Bayside, Long Island, N. Y.

New Telegraph System Proposed to Connect Western Cities.

A plan seems to be launched for the building of a telegraph system to connect some of the larger cities in the West in opposition to the Western Union and Postal Telegraph Companies. The immediate purpose of the promoters is to build a telegraph line between Chicago and St. Louis and then to bring into connection Milwaukee, Minneapolis, St. Paul and Kansas City. Entrance to Chicago will be secured over the lines of the Chicago and Milwaukee Telegraph Company, which now runs to the center of the city. This company's lines will be leased and a similar entrance will be obtained in St. Louis, and a line built to connect the two cities. The project is said to be backed up by the Orthweins of St. Louis, who are large grain commission merchants in that city. They hope to raise a preliminary fund of $1,500,000, of which $500,000 has already been subscribed in St. Louis, it is said. The plan is to secure the co-operation of the leading brokers and business men of the several cities named—the largest telegraph toll payers—and establish a system that will offer cheap and reliable service. The idea is that a start may be made with a guaranteed business sufficient to insure the profitableness of the venture as it progresses, and then to extend from city to city as fast as the construction can be pushed and entrances effected. The new company will, for the present, be known as the Continental Telegraph News Company. It is said to have already made arrangements to merge the Chicago and Milwaukee Telegraph Company, the Telegraph News Company of Chicago and the Sempire Clock Company of St. Louis, a concern controlled by the Orthweins. It has been stated that the new company will also establish telephone toll lines between the cities mentioned, but there seems to be no definite foundation for this report.

Nernst Lamps for a Pittsburg Office Building.

The Farmers' National Bank Building, which is to be the largest structure in Pittsburg and one of the tallest office buildings in the world, is nearing completion and will be occupied early in March. Contracts for the electrical apparatus have been signed, and much of it is already in place. The generating plant will consist of three 150-kilowatt and one 75-kilowatt Westinghouse machines. The lighting contract was the most hotly contested of any in the building, and the outcome is that the entire building is to be lighted with Nernst lamps, made by the Nernst Lamp Company of Pittsburg, and supplied by the Doubleday-Hill Electric Company of the same city. There are to be installed 1,000 55-watt single-glower, 1,250 88-watt single-glower, 20 two-glower and 20 six-glower lamps. The fact that this immense building has been equipped with alternating-current apparatus for the sole purpose of making the Nernst lamp available constitutes a high tribute to the new illuminant and is an indication of the rapid strides which the Nernst lamp is making in the electric-lighting field.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Central Missouri Telephone Association, Huckins Hotel, Sedalia, Mo., February 27th.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

Independent Telephone Association of Wisconsin, Madison, Wis., June.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

THE convention of the Independent Telephone Association of Wisconsin at Milwaukee last week was a well-attended meeting and a profitable one. The Wisconsin organization is probably the strongest of the state Independent associations, and its deliberations are always productive of good results. This year's meeting was no exception, as may be judged from the account of the convention given elsewhere in this issue of the Western Electrician. The subject of toll rates, especially as relating to the proportionment of charges for joint service, was the chief topic discussed, and definite action was taken by the adoption of a report, which, if lived up to by all Independent companies in the state, should prove equitable to the public and companies alike. In the re-election of President Valentine and Secretary Winter the association paid a well-deserved compliment to these competent officials. Action looking toward the establishment of an Independent exchange in Milwaukee was taken by the appointment of an investigating committee, and the association adjourned with the hope that at its annual meeting in Milwaukee next year its members might be able to visit such an exchange.

IN pointing out the advantages of electing a western man as president of the American Institute of Electrical Engineers, as we did last week, we were under the impression that President Scott, the present efficient head of the organization, was eligible for re-election. This, it appears, is not the case, under the present constitution, and the fact strengthens the position of the western members who would like to see one of their own number elected to the position in view of the approaching Louisiana Purchase Exposition (with a probable International Electrical Congress) and of the fact that no man living west of Pittsburg has as yet been honored with the presidency of the society. The members in this section are now free to point out the peculiar combination of conditions favoring the election of a western man at the present time, without even seeming to reflect on the merits of the present incumbent of the office. Of course, no man should be elected president of the Institute simply because he is a western man or an eastern man; the organization should select its officers on the ground of merit; but, other things being equal, the fact that a candidate is of the West is this year an added argument in his favor.

INTERNATIONAL co-operation in the issue and protection of patents is a subject that deserves greater attention than it receives. In a recent article in a law journal Mr. John S. Seymour, former United States commissioner of patents, proposes an international concert in the examination of applications for patents. When an inventor applies for a patent for the same invention in the United States, England, Germany, Austria and Sweden, the same search as to patentability is necessary in each of these countries. This means much useless labor, since a thorough search made in one of these countries should furnish sufficient ground for granting or refusing the patent in all the other countries where application for a patent is made. Mr. Seymour's proposal is to establish some kind of co-operation between the patent offices of different countries to avoid this waste of labor. Joint action, as he points out, has already been established in the matter of foreign mails, ocean cables, arbitration of international disputes and on many other matters. An international office for patent search ought to result, also, in a great reduction of the burdensome fees now necessary. Mr. Seymour's recommendations are rather indefinite, but the idea is a good one and is worthy of attention.

Somewhat allied with this suggestion, but of a more immediate and practical nature, is the bill now before Congress to carry into effect one decision of the convention for the International Protection of Industrial Property held in Brussels in 1900. The convention, in which the United States was represented, adopted the following, among other results of its deliberations: "Anyone who shall have regularly deposited an application for a patent of invention, of an industrial model or design, or of a trade or commercial mark, in one of the contracting states, shall enjoy for the purpose of making a deposit in the other states, and under reserve of the rights of the third parties, a right of priority during the periods hereinafter mentioned. In consequence, the deposit subsequently made in one of the other states of the union before the expiration of these periods cannot be invalidated by acts performed in the interval, especially by any other deposit, by the publication of the invention or its working, by the sale of copies of the sign or model, or by the employment of the mark. The periods of priority above mentioned shall be 12 months for patents of invention and four months for models or designs, as well as for trade or commercial marks." Many of the countries represented in the convention, including Great Britain and France, have adopted legislation making this provision a part of their patent law. The United States has not yet done so, but the committee on patents of the House of Representatives recommends that the bill covering the subject be passed, and there seems to be no good reason why their recommendation should not be heeded.

THE standard price of street-railway transportation—five cents a ride—remains the same as for many years; efforts to change it are in the direction of lowering it rather than raising it; but nevertheless anyone familiar with street-railway affairs who follows the trend of events cannot fail to be impressed with the constant tendency to increase the cost of operation, particularly in the very important item of wages. All over the country the companies have been forced within the last year or so—and rightfully enough, no doubt, in most cases—to increase the wages of their men. One can hardly pick up a newspaper without reading of some advance in the wages of street-railway employes, sometimes voluntary, often as the result of a threatened or actual strike and occasionally as the result of arbitration. This is the result of an industrial tendency seen in other lines of business and is due to higher cost of living and greater alertness and better organization on the part of workingmen. But the trouble with the street-railway company, in contrast with most other proprietors, is that it cannot correspondingly increase the price of its product. In addition, there is a constant demand for more and better service in the larger cities, making necessary the employment of more expensive construction and machinery. In considering the renewal of franchises and the uncertainties of public ownership, municipalities may well bear in mind these pertinent facts.

ELECTROCHEMICAL processes are applied in constantly increasing variety and number. From France comes news of a new method invented by Jacolliot for extracting the tin from tin-plate scrap by electrolytic action. The scrap is first treated with a bath of caustic alkali or hydrochloric acid. The tin thus dissolved is precipitated by placing metallic zinc in the liquid. For the latter purpose galvanized-iron scrap is preferred. The tin is deposited on the fragments of galvanized iron, while the zinc is dissolved in the liquid. The process is carried out in practice by using a tank filled with the tin solution; into it dip a number of porous vessels containing galvanized-iron scrap in an alkaline or acid liquid which is required to dissolve the zinc. In the solution of tin in the main tank is immersed a plate of sheet iron which is connected electrically to the scrap in the porous vessels. The iron plate and the zinc-covered scrap form a couple, and the current thus produced causes the tin to precipitate on the iron plate, while at the same time the solvent, acid or alkali, of the tin is recovered and can be used again. The zinc in the porous vessels is dissolved by the acid or alkali. Thus, the tin is recovered in a precipitated state, as well as the original solvent of the tin. The remaining products are the iron scrap freed from zinc and zinc in solution. The latter can be precipitated by electrolysis. The solution of tin should be made preferably with hydrochloric acid, as this acts better than sulphuric acid or alkali. But in the latter case the operation is much better if the cuttings of tin are alternately placed in the bath, then exposed to the air, and the tin rapidly dissolves. To do this the liquid can be made to rise and fall in the tank by a pump, thus uncovering the metal at intervals, or the scrap can be placed in a revolving barrel full of holes, which is partly immersed in the bath.

Chicago Automobile Show.

The second annual automobile show under the auspices of the Chicago Automobile Club and the National Association of Automobile Manufacturers was held at the Coliseum this week, opening on Saturday, February 14th. The show of last year was the first held in Chicago under the auspices mentioned and was a decided success. This year's exhibition, however, goes ahead of anything ever held previously in Chicago, both in quantity and quality of exhibits. No decided departures were noticed, the main improvements made during the last year being those that help to make the vehicle more convenient in handling, stronger and more efficient in operation. Nearly 300 vehicles were shown, and of these about 70 per cent. were gasoline, 20 per cent. electric and 10 per cent. steam. The proportion of electric vehicles has fallen off somewhat from last year's show, but there are more vehicles shown, and the proportion exceeds that at the recent New York show, where the electrics were but about 10 per cent. All the exhibits were on the ground floor, and while the main building contained all the display last year, this year the entire annex had to be brought into service.

The speed and endurance trials that have been features of previous exhibitions were entirely eliminated this year, as the room was needed for the exhibits. It is thought that by another year the automobile parts, which were shown under the gallery, will have to be placed in the gallery, so as to make additional room for the display of complete vehicles. As last year, the electric signs and decorations were a feature of this show, and electricity was also put to good use in operating many of the working exhibits. Samuel A. Miles was the efficient manager of the show.

Of the electrical vehicles exhibited, the largest number displayed by a single exhibitor were shown by the Electric Vehicle Company of Hartford, Conn. This company had a large space near the center of the hall and displayed 14 Columbia automobiles, 13 of which were electric. The models included an electric brougham of the extension-front pattern with inside accommodation for four passengers. This carriage has a double-motor equipment and an underslung Exide battery of 44 cells, with a capacity of 140 ampere-hours at a 0.85-ampere rate, affording 40 miles on one charge. A hansom cab, designed exclusively for private service, was one of the most elegant and thoroughly distinctive vehicles in the exhibit. An inside-operated coupe is a new vehicle made for physicians' and similar use. The controlling, steering and brake levers are conveniently located within the compartment, which may be securely closed in bad weather. A foot warmer is supplied for winter use. A rear-boot coupe, also built for private service, combines on a smaller scale the distinctive features of both the brougham and hansom types. The Columbia light runabout shown is said to be the lightest electric automobile of its capacity ever placed on the market. Its weight, including the battery, which affords 40 miles on one charge, is under 1,000 pounds. The cabriolet on exhibition is attractive by reason of its pleasing design and beauty of finish. Two victorias were exhibited, one being the regular model furnished with the usual victoria hood and nickel mountings, and the other having a canopy top and brass mountings. The Columbia electric tonneau, which is constructed on lines suggestive of gasoline types, was exhibited, as were also an electric surrey and a "Seabright" runabout. A special-service wagon shown is intended primarily for the departmental work of inspectors, fire and police officials and others requiring a high-power electric automobile, suited for hard service in all weather. The latest type of the company's commercial vehicles shown was an electric truck of 2½ tons' capacity, equipped with two five-horsepower motors. A special feature is the vertical controller operated by a small wheel beneath the steering wheel. The underslung batteries are put in from below and are held by an ingenious automatic device.

The International Motor Car Company of Indianapolis, Ind., whose space was tastefully decorated with festoons of electric lamps, showed, from its Waverly department, a full line of electric vehicles. The motors of these machines are of an improved multipolar type, with high overload capacity. The driving and pinion gears are of the herring-bone type, running in oil and protected in dustproof cases, thus giving practically noiseless operation. An electric brake is operated independent of the foot brake and is manipulated through the controller handle, by means of which the motor is converted into a generator. The vehicles shown comprised a road wagon, also one with top, a surrey, a delivery wagon equipped with two three-horsepower motors, a tonneau, a chelsea and a stanhope. The International company distributed a neat booklet, which contained a list of stations in the United States where electrical vehicles may be charged.

The National Motor Vehicle Company of Indianapolis showed seven electric automobiles, including an "electrobile," road wagon, runabout, stanhope, "electrobile special" and park trap. All these vehicles have motors suspended on the rear axle and geared to the axle. The Western battery is used. A new model exhibited was a long-distance electric vehicle similar to the tonneau of other manufacturers. This machine has 36 cells, divided between the front and rear compartments, and is said to have a capacity of 100 miles on one charge. A special construction has been adopted for the motor, which is of the axle type, the motors and gears being enclosed in one case.

Five electric vehicles, all handsomely finished in black, were shown by the Woods Motor Vehicle Company of Chicago and New York. They were a stanhope, brougham, victoria, covered runabout and cab.

The Studebaker Bros. Manufacturing Company of South Bend., Ind., exhibited a runabout with top and one without and a stanhope with top and one without. Features of these machines are the wooden wheels, the method of construction by which the motor is hung from the body frame, thus being supported by the springs, a tubular frame said to be practically indestructible, and a chain drive. Exide batteries are used.

Among the other electric vehicles exhibited were a runabout by the Fanning Manufacturing Company of Chicago, a runabout and a covered runabout by the Centaur Motor Vehicle Company of Buffalo, and two stanhopes by the Buffalo Electric Carriage Company of Buffalo.

The Westinghouse Electric and Manufacturing Company of Pittsburg exhibited a complete line of electric automobile equipments and charging outfits. The motors shown comprise both high and low-speed machines with plain or ball bearings. These motors are cylindrical in shape and are specially adapted for universal methods of suspension and facility of removal, inspection or repair. The controllers exhibited are designed for both single and double-motor equipments, and have four speeds, both forward and backward. Battery-indicating meters, cut-out switches, charging plugs and receptacles were also shown. The charging outfits exhibited include both station and private switchboards and motor-generator sets. The exhibit was in charge of Malcolm Baxter.

The storage-battery exhibits were quite complete. The Electric Storage Battery Company of Philadelphia had a display board containing vehicle-battery parts and also exhibited the well-known Exide battery and sparking outfits. G. H. Atkins has charge of the exhibit. The Western Storage Battery Company of Indianapolis showed a standard small-vehicle battery of 32 cells. A similar set was displayed by the Porter Battery Company of Chicago, which also had on view a vehicle which had made a record of 187 miles on one charge of a 600-pound Porter battery, the average speed being 10 miles an hour. The Northwestern Storage Battery Company of Chicago exhibited a small vehicle battery and also some of its Bull Dog sparking batteries for gasoline engines. An interesting feature of the Chicago Storage Battery Company's display was a runabout mounted on testing rolls for operation, the speed being indicated by a large dial. Large signs were displayed which contained the information that this company's battery has a guaranteed life of 12½ watts per pound of cell and that it can be charged in one hour. The battery shown, of 28 cells and weighing 170 pounds, gave a run of 40 miles. The batteries have no lead, no acid and are all sealed.

A large number of exhibits are made of jump-spark coils, igniters, dry batteries, etc., for use with gas and gasoline engines in automobiles. One of the best of these exhibits is that of the Dayton Electrical Manufacturing Company of Dayton, Ohio, which consisted of an Apple igniting dynamo, arranged to give sparks for the four cylinders of a gasoline vehicle. A board is arranged so as to show the sparks for the different, accurately timed by a King timer. Other exhibitors of ignition equipments are the Dow Portable Electric Company of Braintree, Mass., showing coils, plugs and batteries; the Hercules Electric and Manufacturing Company of Indianapolis, Wizard spark generators; the Crescent Machine Company of Detroit, Mich., Huff jump-spark coils and plugs; the National Carbon Company of Cleveland, Ohio, ignition batteries, including the Autocell, Multiplex and Columbia batteries, also spark coils; G. F. Splitdorf, showing his coils and also a large 22-inch hospital coil suitable for space-telegraphy work; Motsinger Device Manufacturing Company of Pendleton, Ind., auto-sparker; Miller-Knoblock Company of South Bend, Ind., sparking coils; Induction Coil Company of Milwaukee, Mueller high-tension induction coils; Electric Contract Company of Chicago, Williams spark coils. This last-named company also showed a line of portable electric lamps, and a new duplex copper terminal for battery and like connections.

The Vesta Accumulator Company of Chicago, in the person of President D. P. Perry, showed an interesting line of portable storage batteries, which, he says, are the best cells on the market for automobile purposes; also automobile electric headlights and spark coils. Mobiline and Vulcabeston sheet packings, asbestos coverings, etc., were exhibited by the H. W. Johns-Manville Company of Chicago and New York. The Standard Welding Company of Cleveland showed samples of its electric welding process. A full line of lubricating materials was exhibited by the Joseph Dixon Crucible Company of Jersey City, N. J., and a special hit was made by the distribution of Dixon's "Mum" pencils. The National Engine Company of Chicago had in operation one of its charging sets, consisting of a five-horsepower gasoline engine, direct-connected to a three-kilowatt Northern generator. The Chicago Fire Appliance Company, agent for Kilfyre, the fire-extinguishing compound, was late in getting its exhibit in place on account of the death of President D. J. Swenie.

The Institute Election.

In accordance with its constitution, the American Institute of Electrical Engineers has sent to each member and associate a "nomination circular" on which nominations are to be made for the various offices to be filled at the ensuing annual election in May. From these nominations, which must reach the secretary prior to March 1st, the board of directors prepares a complete ticket, known as the "directors' nominees," and also a second list containing all the eligible names proposed receiving two per cent. or more of the entire number of nominating votes cast, with a statement of the number of votes cast for each. With this information to guide them, the members and associates proceed to the regular election.

The officers to be elected are a president to succeed Charles F. Scott of Pittsburg (not eligible for re-election as president); three vice-presidents to succeed Dr. M. I. Pupin, Dr. Samuel Sheldon and George F. Sever, all of New York (not eligible for re-election as vice-presidents); four managers to succeed John J. Carty and W. S. Barstow of New York, Ralph D. Mershon of Montreal and Calvin W. Rice of Pittsburg (not eligible for re-election as managers); a treasurer to succeed George A. Hamilton of New York, and a secretary to succeed Ralph W. Pope of New York. Both Mr. Hamilton and Mr. Pope may be re-elected to their present offices.

Much interest is taken in the approaching election. It is understood that there are two candidates for the presidency—Mr. Bion J. Arnold of Chicago and Mr. C. O. Mailloux of New York, while the names of Dr. Pupin of New York and Prof. R. B. Owens of Montreal have been mentioned also. Messrs. Arnold and Mailloux are both vice-presidents of the Institute, and are both competent engineers of wide reputation. Either one will preside worthily over the deliberations of the society, perpetuating, no doubt, the excellent record which President Scott has made and is making. Western members and associates are taking particular interest in this election, inasmuch as one of their number is a candidate for the presidency. Heretofore no man living west of Pittsburg has been chosen for the Institute's highest office.

Electric Heating.

In a recent address James Swinburne, president of the British Institution of Electrical Engineers, says: "The limit of electric heating is clearly purely financial. To convert heat into other energy with a very small efficiency and to send it out by expensive cables, and then to degrade the energy down to heat again is obviously much dearer than burning coal or gas direct. But in many domestic cases the convenience is so great that the limit is not so low as might be thought, and electric heating for cooking and other domestic uses may develop considerably. The electric arc and incandescent lamps are essentially cases of electric heating. By far the most important use of electric heating is the furnace. Here the temperature available is only limited by the volatilization of the electrodes, and this enables us to get temperatures otherwise unavailable, so that we can get chemical actions which are impossible at lower temperatures, either because they are endothermic or because the materials do not come into chemical contact at ordinary temperatures. It is impossible to say what our limits are in the electrical furnace. Probably the temperature is limitted by the volatilizing of carbon. The products are not limited to endothermic compounds. The furnace is useful for the reduction of metals and phosphorus and for melting glass, and, it is hoped, silica for optical and laboratory purposes, and perhaps for cooking utensils and evaporating pans and crucibles in chemical engineering and metallurgy."

Steinmetz on Future of Electricity.

Charles P. Steinmetz, in a recent address on "Future Possibilities of Electricity" at Schenectady, N. Y., said that the success of space telegraphy would in the future prevent anyone from being completely isolated, and that, by its means, Arctic explorers would be able to communicate with civilization, and thus prevent any more expeditions being lost and perishing. He said that it would also be generally used in war, so that an opposing force could not cut wires and thus cut off communication. He said that the telephone is yet in its infancy, and that within half a generation it will be possible for Americans to talk with friends in Europe, as a transatlantic telephone is a question of only a few years. With reference to electricity as a motive power, he said that it will never supersede steam for long distances, as each locomotive generates its own power, and that in direct proportion to its size.

Rates and Methods of Charging.[1]

By J. W. Shuster.

I will endeavor to present a few of the more promising methods of charging which are being adopted in this country. In the outline which follows, the several systems are scheduled with the particular point of service which they are designed to cover.

Methods.
- 1. Flat Rate. — Contract price on 16-candlepower lamp per month.
- 2. Meter Rate. — a. Charge per kilowatt-hour. b. Discount or sliding scale depending on total power consumed.
- 3. Wright Maximum Demand. — a. Charge on maximum demand of capacity for first two hours per day. b. Charge on basis of cost of generating per kilowatt-hour for power used subsequently.
- 4. Doherty Rate. — a. Fixed Charge — Office expenses, reading meters, etc. b. Stand-by Charge — Interest, depreciation, taxes and insurance. c. Power Charge — Cost of generating per kilowatt-hour.
- 5. Fore-see System. — a. Stand-by charge on sliding scale. b. Power charge.
- 6. Double Rate Meter — Different rate per kilowatt-hour depending on the time of day.

Taking the systems in the order named, I will endeavor to bring out the distinguishing feature of each. The only apology for mentioning the flat rate in this discussion is the fact of its existence. It came into use as the first method of charging before meters were developed and before the station man had gone into details as to methods of charging. One feature of this method which makes it popular with consumers is that the charges are a fixed amount per month, and the customer knows just what he will be called upon to pay. The fact that the station has no check on the length of time the lamps are in use, or the power delivered, makes it obvious that the rate is unjust and entirely void of business principle. Therefore, the rate should be refused entirely, or what is equivalent, it should be made so high that all consumers will prefer some meter rate.

The progress in the question of rates is the ordinary development from the crude to the more refined. The natural step from the flat rate was the introduction of a meter which would record the power used by a consumer; and then make a charge per unit of power consumed. This condition was approximated when the ampere-hour meter was introduced and a charge made per ampere-hour. This instrument did not take into account the variation in line voltage, and was soon displaced by the recording wattmeter, which is now almost universally adopted for measuring the power delivered. The charge was then made on the kilowatt-hour basis.

On the face, this seems a very adequate method of charging, for in the majority of business undertakings if the seller is paid for the commodity delivered, the transaction is satisfactory. While in dealing with most commodities a charge for the product delivered is an equitable one, the supplying of electric power involves conditions which are seldom or never met with in other lines of business. These conditions require the working out of special systems of charging which are more equitable to both station management and consumer, and which are reasonably applicable to all cases.

The most important of these special conditions is the fact that no adequate method of storing electrical energy economically is in existence. This necessitates the keeping in readiness at all times the apparatus of the station, such as dynamos, engines, boilers, transformers, etc., which are loaded to their full capacity for only a short interval each day during the busy part of the year, and are never fully loaded during the season of light loads. To keep in readiness this large installation, requires a corresponding investment on which a reasonable return for interest, depreciation, tax and insurance must be obtained before any profit can accrue. Now, if a consumer uses his power for only a short period of time each day, and that at the time of heaviest load, or during the peak, it means that the station management must purchase and maintain all the apparatus necessary to supply this consumer and depend on him for returns on the same. If it does not do this, it must serve him at a loss and overcharge the long-hour consumer to make up the deficit.

On the straight meter rate with the present limitations, it is practically impossible to charge the short-hour consumer a sufficiently high rate per kilowatt-hour to cover the expense to which he puts the company.

To devise a system by which each consumer pays his proportionate part of the stand-by charges, has been the purpose of a number of leading station men in this and other countries. Mr. Arthur Wright of Brighton, England, was one of the first to attack the problem of capacity charge in a systematic manner. He introduced what is known as the Wright maximum-demand system in Brighton in 1893.

Mr. Wright determined from his station costs that the stand-by charge was the main item of expense. He devised an instrument by which he could determine accurately the maximum capacity of the station used by any customer. He also determined the cost of generating per kilowatt-hour after all stand-by charges were paid. From these stand-by expenses and the cost of generating power he determined the income which he must have from each kilowatt of plant installed if used for two hours per day throughout the year. Then for power used in excess of two hours per day he charged at a rate per kilowatt-hour determined from the cost of generating. The ratio between these two rates he found to be 4.4, then if the first rate was 20 cents per kilowatt-hour, the power subsequently used would be furnished at 4.5 cents.

Mr. Wright invented a very serviceable instrument known as the Wright maximum-demand meter. This meter records the maximum current used by a consumer during the interval between two readings. This meter is read at the same time as the recording wattmeter, and from its indication the amount of station capacity used by this consumer, and the amount of power to be charged at the high rate is determined. All power in excess of this is charged at the lower rate. For example, if the demand meter reads 10 amperes on a 100-volt circuit, and the recording wattmeter registers 90 kilowatt-hours, and the maximum charge is made on two hours per day, the first charge will be on $10 \times 100 \times 2 \times 30 \div 1000 = 60$ kilowatt-hours. Taking the rates at 20 cents and 4½ cents, respectively, the bill will be $(60 \times \$.20) + \$.045 = \$13.35$.

This system gets at the correct basis of charging, but has a weakness in that the very short-hour consumer will not use power enough to pay for the demand or stand-by charge even at the higher rate. Taking the case above: If the wattmeter reading is 30 kilowatt-hours, the total bill will be $30 \times \$0.20 = \$6$, or only half the amount determined on as the stand-by power charge; so that the system fails to reach the very class at which it is aiming. This defect in the system is obviated in some cases by making the high-rate charge a fixed charge and collecting it whether the power is consumed or not. Besides this, the managements in many cities are limited by franchise so that eight or 10 cents per kilowatt-hour is the maximum charge which can be made. Obviously, the Wright demand system would be of little benefit in such cases.

The leaders in the rate reform in the United States have attacked the problem of determining equitable rates in much the same way as it was taken up by Mr. Wright. However, instead of making the capacity charge payable on a kilowatt-hour rate on the first two hours' use of the installation per day, it is made a fixed charge per lamp and the total amount of this fixed charge is determined by the number of lamps which the customer demands at any one time. His service is then limited by an interrupter or similar device, which winks the lights when the predetermined demand is exceeded. While an interruption of the circuit in this way may be objectionable in some cases, it has the advantage that it can be checked by the consumer, and there can be no suspicion on his part that the meter reader is beating him.

When a consumer has settled his demand and paid or fixed his demand charge, he is charged for the power consumed on the basis of generating costs which obviously gives him a low kilowatt-hour rate, and he will for this reason use his lights more freely, and thus broaden the peak of the load and greatly improve the load factor. One station which has used this system for a little more than a year reports an increase of 50 per cent. in the output of the station for the year, with an increase in the cost of coal of 20 per cent.

This method of charging has been advocated quite thoroughly before the National Electric Light Association, particularly by Mr. H. L. Doherty, past-president of this association, in 1900, and in a modified form, called the Fore-see system, by Mr. Wallace, in 1901.

The apparent equity of the capacity-charge system and the hearty discussion and approval which it has received from leading central-station men point to its general adoption, and a study of the methods of determining this charge is of considerable interest. Differences of opinion are encountered as to what should be included in the stand-by or capacity charge. Mr. Doherty takes the general office expenses, and makes this a fixed charge per customer, while Mr. Wallace includes this in the stand-by charge. The first is the more logical, since the capacity charge is on stand-by losses and is calculated as a definite per cent. on the cost of the station per kilowatt, on the assumption that it is not being used. Evidently, the office expense is not a factor in this case. It has the disadvantage, however, of making the divisions of the charge too numerous to suit the consumer who does not understand the method by which they are determined.

While it is desirable to make a capacity charge sufficient to insure the plant from a loss on short-hour consumers, this charge should be made as small as possible, so that the lamps demanded will be a large per cent. of the total lamps connected.

The items which unquestionably come into this charge are interest, taxes and insurance. Depreciation is usually figured in on this charge, but in my opinion only so much of this item as is due to apparatus going out of date should be included. Depreciation due to wear and tear should go to generating expenses.

Numerous other items, such as coal for banking fires, etc., are sometimes included in the capacity charge, but when there is a question as to where a charge should go, I would put it in the generating costs, and make the actual output pay expenses just as far as possible, and not impose on the special privilege granted on account of special conditions.

The distribution of the loads of different consumers as to time, makes the maximum demand on the station much smaller than the sum of the demands of the individual consumers. On the meter basis of charging it has been found that the maximum load on the station is usually from one-third to one-half of the total lamps connected. Under the new method the lamps demanded will be considerably less than the total lamps connected, and experience with the system is required before one can determine with a reasonable degree of accuracy the maximum load which is likely to come on the station. This once determined, the stand-by charges per lamp demanded should be equally distributed.

If we take interest at five per cent., depreciation as above stated, taxes and insurance seven per cent., we have from the following table the stand-by charges per kilowatt installed per year on stations which cost from $100 to $400 per kilowatt, and in columns 5, 6 and 7, the annual charge per lamp, figuring that the ratio of station capacity to lamps demanded is one to one, one to two and one to three, respectively.

1	2	3	4	5	6	7
Total Cost of Station per Kilowatt.	Interest.	Depreciation, Taxes and Insurance.	Annual Stand-by Charge per Kilowatt.	Annual Stand-by Charge per Lamp. Ratio 1 to 1.	Annual Stand-by Charge per Lamp. Ratio 1 to 2.	Annual Stand-by Charge per Lamp. Ratio 1 to 3.
$100.00	5%	7%	$12.00	$ .60	$ .30	$.20
200.00	5%	7%	24.00	1.20	.60	.40
300.00	5%	7%	36.00	1.80	.90	.60
400.00	5%	7%	48.00	2.40	1.20	.80

This charge and the office charge make a definite fixed charge by contract corresponding to the flat rate. The power consumed is then charged for by the kilowatt-hour at a rate based on the cost of generating.

This method charges the expense of readiness to serve equitably among consumers and relieves the plant from the chance of a loss on the short-hour consumer.

The low rate per kilowatt-hour delivered will have a strong tendency to broaden the peak and increase the output of the station.

The double-rate meter developed by the General Electric Company is a recording wattmeter with a clock movement, by which the driving mechanism is shifted from one dial to another at a predetermined hour. The object of this system is to give a low rate to customers using power during the part of the day when the station is not loaded. While this method would have a strong tendency to broaden the peak, it would also tend to reduce the maximum, which should not be done. Obviously, the high rate will come at an hour in the evening, especially in the business district, when light is very essential, and if the rate is doubled or tripled at that time, as it is by companies using this system, it will mean a reduction of lighting of business places or the adoption of a light other than electric, either of which is undesirable from the station standpoint.

While the amount of power used, the time of its use, the location of the consumer, etc., make an absolutely equitable charge difficult to obtain, the systems which are being adopted approximate this to a reasonable degree, and with the experience of a few years of actual use we may expect the details to be worked out to a refinement which will greatly improve the business conditions of central stations and give the consumer the fairest treatment possible.

Discussion.

H. J. Gille, St. Paul: I would like to take issue with Mr. Shuster on one point. He says the only apology for mentioning the flat rate is that it is in existence. I differ with him there. I believe that there is a large amount of business in every central station, be it large or small, that can be gotten on a flat rate better than it can in any other way. I refer to sign lighting and window lighting. That is a class of important business which you cannot get on meter rates, but you can get satisfactory compensation out of that class of business on flat rates. In a big city that class of business is very important.

I. P. Lord, Waupaca, Wis.: In reply to Mr. Gille, I will say that I have tried flat rates, and have tried meter rates; and I tried the flat rate on the window and sign lighting, charging so much a month; but the trouble with our customers was that they would go home and leave the lamps burning all night, and I could not get an adequate rate. But I realized that they should have a lower rate for that window lighting; so I simply connected my window lights and side lights on a separate meter, and I said, I will make you a special rate for your window lighting; that was done, and the plan proved successful.

Mr. Gille: In very large cities inspectors are employed for all-night service, and any man that burns his lights longer than his contract permits pays extra for it. The only advantage you gain by the flat rate is you get a specified number of hours' burning during the year; for instance, 12-o'clock service is 2,180 hours, and 10-o'clock service would be 700 and some hours less than that. So I think it is a very profitable proposition. There are quite a

1. Paper read before the Northwestern Electrical Association at Milwaukee, Wis., on January 22, 1903. Mr. Shuster is on the electrical engineering faculty at the University of Wisconsin.

number of time switches on the market at the present time. We are using quite a number of them, and I believe that the use of the time switch solves this question, as it throws the sign in and out whenever desired.

Mr. Shuster: As to signs, that question has been discussed by very many authorities, who have had a great deal of experience in station work, and they differ very much as to the advisability of giving a flat rate on sign work, or on giving a special rate, as has been suggested, and some of them are very much in favor of it, and some of them are just as much opposed, and it is hardly in my province, with my limited experience, to try to decide this question for the men who have had such a very great amount of experience in this way.

In regard to the flat rates, one of the objections has been mentioned as being due to the fact that they burn the lights longer than is specified in the contract, and the other objection is that there is quite a considerable objection to giving a special rate in cases of that kind, from the fact that when you commence giving special rates for any particular kind of service, there is no end to the number of special rates that you can make.

So I think it is quite generally conceded among station men that it is hardly a good policy to start in making a special rate, and that the fairest proposition in all cases is to make a fair, equitable rate, that is, the fairest rate possible, which, of course, is not uniformly fair to all consumers, but the fairest rate possible, and then stick to it. I think if that was adopted, that even the sign-lighting business, or a large part of it, and a great deal of other business which seems as though it would get away from us, would be taken on the meter-rate plan, and you will find generally that when a definite rate is adopted, and the consumer knows you are going to stick to that rate, if it is advantageous for him to have the light, he will pay the fixed rates; it will make less trouble in the long run.

Harold Almert, Oak Park, Ill.: I have found that the great difficulty with many of the small-store owners who would like to have electric signs is the first cost, and I have found it profitable to make a proposition similar to this, that the central station sell him an electric sign and make him a rate of so much a month, by which he pays for that sign, and also for the current consumed. Included in this is the cost of an automatic switch on the premises, instead of a meter, which is taken care of by an inspector who winds it every seven or eight days, and changes the time of the clock as the dusk hour changes. The charge is very much easier on the consumer, and while it may be a little bit excessive, apparently, he does not feel it so readily, and often accepts the proposition where he would not consider it if he had to pay $60 or $100 down for the sign.

J. S. Allen, Beloit, Wis.: I want to object seriously to putting out anything except on a meter. When we got meters we thought that we had solved all difficulties that we were heir to under the flat-rate system, but we are now finding, as this paper, and the Doherty rate, and the Fore-see system indicate, that there is something better than the meter. I believe a purely meter rate is just as far from the fundamentally correct rate as was the old flat-rate system. I believe that the Doherty rate or some application of the Doherty or Fore-see rate, is as far ahead of the meter rate, as the meter rate is ahead of the old flat-rate system. If we are going to put out a sign, I believe it ought to be put out on a meter, because we are doing business on a meter basis. In my business I have a few old flat-raters, but I have a meter on them too in the station; and I believe it is absolutely necessary in a town of 10,000 inhabitants or over, to have a meter on the station showing the station output, and a meter on every light in the city, except perhaps one or two here and there.

Large Isolated Plant for Pittsburg.

An extension of the usual scope of office-building power plants is to be tried in Pittsburg under the direction of Henry Phipps. A group of office buildings will be erected in lower Pittsburg, in the neighborhood of Fifth Street and Duquesne Way, and one plant will furnish light, heat and power for the entire group of five or six buildings, including the Bessemer Building, corner Sixth Street and Duquesne Way. The power equipment has already been partly contracted for, and will include two 1,500-horsepower Westinghouse-Corliss engines, which are now under construction and will be ready for delivery in about six months. These engines are of the horizontal, cross-compound type, and will operate non-condensing, the exhaust steam being used for heating purposes. On account of the difficulty of high river water, universally experienced in Lower Pittsburg, the engines will be placed upon the ground floor, instead of the basement, while the boilers will be located on the second floor of the plant, and supplemented by suitable coal and ash-handling apparatus. The machinery will be installed by Westinghouse, Church, Kerr & Co.

Robert Miller of Pittsburg, promoter of the New Martinsville, Sistersville and Middlebourne (W. Va.) electric railway, says that the financial requirements of his enterprise are fully met, and that the active work of construction is now waiting upon the arrangement of minor details.

Peat Possibilities in Russia and Ireland.

In a recent interview with Dr. Henri Wolters, a Belgian mining engineer of note, a correspondent of the Western Electrician secured some interesting and valuable data regarding the fuel question in Russia and the opportunities for the investment of American capital in the land of the czar. It is well known that peat bogs cover immense areas in different parts of Europe, and, while coal and wood are high, little or no use is made of this valuable fuel on the Continent, even in the locality where it abounds.

To be sure, there are several factories for making briquettes, but the machinery is primitive and the output is small, so that they are not factors in the question of the fuel supply of Europe. An exception to this rule is Belgium, where peat briquettes constitute over half of the fuel used.

Probably the largest peat bog of the world is in Russia, lying in the territory bounded by a line connecting Petersburg, Smolensk, Orel, Karan, Nisni, Novgorod, Archangel and St. Petersburg, and covering an area of several hundred millions of acres, the peat being from 10 to 30 feet thick and of the best quality. The government railroad from St. Petersburg to Moscow runs through the heart of this region, and over 800 wood-burning engines are in use on this line alone. Wood has been used almost exclusively on the Russian railroads, but this form of fuel is becoming more and more expensive every year. Some of the new engines are equipped for burning naphtha residium, but this must be brought from the Caucasus by ship around Europe to St. Petersburg, and is, of course, very expensive, costing in the neighborhood of $12 a ton. Many of the manufacturers in and around St. Petersburg burn English coal, costing, on an average, $8 a ton, and last year over $45,000,000 worth was imported. This same coal is also used by many of the steamers and tugs plying on northern waters. Wood is the common fuel for heating residences, but it is becoming very scarce, and coal is being adopted.

It thus appears that openings for briquette factories in this region are very numerous, and only American energy and ideas are needed to turn this neglected portion of the Russian Empire into a veritable gold mine.

A small briquette factory located near St. Petersburg is unable, it is said, to furnish the one-hundredth part of the orders it receives yearly, and the statement was recently made by one of the railroad officials that a contract would be made with any factory that could supply fuel in sufficient quantity for use on the Moscow road. The same conditions apply, of course, to the steamship companies.

Dr. Wolters emphasizes the fact that it is American enterprise and American machinery that is necessary to do this work on a paying basis. The immense scale on which industrial projects are conducted in America is, as yet, inconceivable to the Russian manufacturers; they are content to carry on even a well-paying business on a small scale, and do not seem to have the ability and foresight to enlarge their factories and increase the production in the face of an almost unlimited demand.

The little factory mentioned is without dry-houses, and the peat is dug and spread on the ground to dry in the sun. It is then carried in baskets to the press house, where it is compressed into briquettes. Of course, no work can be done during the winter, and the whole process is very crude and would not be tolerated in America. The manual labor is all done by women, who are paid about 10 to 15 cents for a day of 12 to 13 hours, and this only from the middle of April until the end of September.

A more comprehensive scheme for the manufacture of these briquettes involves the use of large dry-houses, equipped with a system of ventilation, so that the peat contained therein may be subjected to a temperature of about 100° Fahrenheit until dry. It is then put into presses and compressed into small briquettes, about six by four by one inch. The presses should be very simple in construction, and a good plant should turn out about 200,000 briquettes a day. The system of drying should be such that the moisture is extracted from the peat in the shortest possible time, and there is every reason to believe that a factory of this kind could be kept running day and night. Both drying houses and press houses should be movable, in order to eliminate the transportation of wet peat from the diggings.

The demand for this form of fuel seems to be almost unlimited, and the Russian government will make a very reasonable concession to persons taking the initiative in this matter. The calorimetric value of the briquettes corresponds very closely to that of good soft coal. In the factory above mentioned the cost of production of these briquettes is about $3 a ton, but with large drying houses equipped with artificial means for removing the moisture from the peat, efficient presses and American methods for doing business, this cost could probably be reduced to about $2 a ton. In St. Petersburg the briquettes are now selling for about $7 a ton in such quantities as they can be obtained.

This interesting phase in the problem of the world's fuel supply has received considerable attention abroad, and briquettes made from every form of combustible dust have been used with success on railroads, steamers and in private residences. It remains, however, to put the peat briquettes upon the market in large quantities, as there seems to be a great demand for such a product.

In a paper read before the Cork Exhibition Conference in Ireland by Lieutenant-general Sir R. H. Sankey, R. E., on the "Utilization of the Peat Bogs of Ireland for the Generation and Distribution of Electrical Energy," some interesting facts were presented. Professor Johnson, in his pamphlet on "The Irish Peat Question" (1899) showed that, while freshly dug peat may contain as much as 90, the air-dried turf will still have from 15 to 30 per cent. of water, and, further on, expressed the opinion that "ordinary air-dried turf has about half the heating power of good coal." Hausding, in his "Industrielle Torfgewinnung" (1887), stated that air-dried machine-made turf with at most 10 per cent. of ash, had two-thirds the heating power of superior coal, while ordinary turfs were equivalent to only one-third. In the "carbonized peat-fuel" process of Messrs. Sahlström and Carmichael (in a private memorandum of the year 1902), the assumption was that while dry peat, according to the amount of ash, had from 6,000 to 10,000 heat units, good coal had 14,800, and their carbonized peat fuel from 12,000 to 16,000. From this the author drew the general inference that, as a rough assumption, the calorific value of 10 tons of ordinary bog stuff, as freshly dug, should at least equal that of one ton of fairly good coal. On this basis, the paper sums up the total calorific value of the bogs of Ireland, assuming an area of about 2.8 million acres, varying in depth from 16 feet to 30 feet. This works out at an equivalent of 5,104 million tons of coal. Taking two tons, or less, of coal as the annual quantity required per indicated horsepower by a modern high-class engine, the peat of Ireland would suffice for 1,250 years, with an annual output of 100,000 horsepower. In addition to this, it is confidently asserted that the bogs would become more or less replenished from time to time. Peat fuel prepared by the Schlickeysen process might, to judge by the costs given in a pamphlet by Mr. Ralph Richardson, be prepared at $1.68 a ton in selected positions in Ireland, and this preparation would, it is expected, be equal in calorific value to coal. The author then briefly referred to the various power schemes afoot in England and other countries, and said that, although the river Shannon in Ireland drained an area of 4,500 square miles, only 10,000 horsepower would be obtained from it. This would assuredly create a doubt as to the amount of energy stored up in other Irish rivers, which would be insignificant compared to that available in the peat.

Lightning Phenomena.

Professor John Trowbridge, Cambridge, Mass., in a recent issue of the Monthly Weather Review, calls attention to the fact that low-lying clouds heavily charged may possibly sometimes discharge electrically to the surface of the large body of water like the sea; but he believes that his experiments show that at the average altitude of thunder clouds the tendency is to discharge from one region of cloud to another in preference to discharging to the sea. The testimony of persons who claim to have seen lightning strike the sea is not very reliable, since most persons are ignorant of the phenomena of irradiation; they are confused by the blinding flash and mistake reflection in the water for the flash itself.

He adds: "By means of a battery of 20,000 small cells a voltage of about 6,000,000 is obtained, which is at least comparable to that of lightning. With this large battery, I was able to obtain an electric spark about seven feet long and found that instead of striking the water a spark of six or seven feet in length invariably jumped to some adjacent object in preference to striking the liquid surface. A spark of only a few inches in length, however, will strike the water, but such a spark is not comparable to lightning. Beyond a million volts the initial resistance of atmospheric air to electrical discharges becomes less, and the discharges, therefore, are shunted through the air instead of upon the water, and strike some object adjacent to the water."

Rapid Transit in the Future.

This is from an English paper: "Scene.—A roof-garden restaurant in the thirtieth story of a London hotel. Time.—An afternoon in 1922. 'I'm off to Liverpool after luncheon.' 'By the electric?' 'Rather! I'm not enough of an antiquarian to take the steam railway. I wonder why they keep it going.' 'That's what we wondered about the 'bus lines in the Strand 20 years ago.' 'I'll be back in town before dinner; I'm stopping in Liverpool only an hour. Can you dine with me?' 'Yes, if I'm not kept in Paris. I'm running over this afternoon.' 'Take the Channel Tube and you can easily be back by dinner time.' 'Easily. I'll send you a Marconi if I'm delayed. I may go on to Rome, and then I shan't be back before to-morrow.' 'I hear they are going to run the Edinburgh electric through to Paris next year.' 'Yes; how slowly we are getting real rapid transit.'"

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephone Association of Wisconsin.

A very successful convention of the Independent Telephone Association of Wisconsin was held at the Hotel Pfister, Milwaukee, on February 11th and 12th. President Richard Valentine called the opening session to order at noon on Wednesday and read his annual address, in which he showed the great progress made during last year in the Independent telephone business in Wisconsin. Some 42 new companies were organized in the state last year, with a total capital of over $1,000,000. There are to-day 200 Independent telephone companies in the state, with 1,000 toll stations, 200 exchanges and 30,000 subscribers. The president called attention to copper long-distance trunk lines, stating that there were very good assurances that these would be built this coming year. After the appointment of some committees the convention adjourned to afternoon.

At the opening of the afternoon session James E. Keelyn presented the report of the memorial committee regarding the death of William Lohmiller of La Crosse and C. A. Colonius of Portage. The report was adopted, and then A. L. Hutchinson of the Interurban Telephone Company, Weyauwega, read a paper on the subject of "Uniformity of Toll Rates." This was followed by a paper on "Generators," by C. W. Farr of the Farr Telephone and Construction Supply Company, Chicago, and a talk on "New and Odd Telephone Problems," by James E. Keelyn of the Western Telephone Manufacturing Company, Chicago. A committee, consisting of James Cavanaugh of Kenosha, C. B. Lloyd of Green Bay, A. M. Ferdinand of Milwaukee, J. M. Baer of Appleton and James E. Keelyn of Chicago, was appointed to report on a plan for interesting citizens of Milwaukee in an Independent telephone plant in that city. This committee did not report during the convention.

On assembling for the second day's session Mr. Taylor of the Standard Telephone and Electric Company, Madison, Wis., read a paper on "The Comparative Merits of the Central-energy and Magneto Systems." S. A. Densmore, as chairman of a committee to consider the advisability of publishing an association magazine, reported that it would be inadvisable at present for the association to issue a publication. The advisability of selecting one of the many telephone magazines as the official organ of the association was discussed, but no conclusion in regard to this was reached. The report was accepted.

Joint Toll Rates.

A. L. Hutchinson, chairman of the committee on joint toll rates then presented his report, which is as follows:

"We, the committee appointed to revise the toll rates for joint service and basis of division of fees, do hereby report as follows:

"That the schedule of joint rates adopted at the June (1902) meeting of the association be amended so as to read as follows:

"Rates—Toll rates shall be determined by the zone system, whereby the rate is governed entirely by the air-line distance. To find the rates from a given point, with the point as a center, draw a circle with a seven-mile radius, and to all places within the circle the rate will be 10 cents. With a 15-mile radius draw another circle, and to all points beyond the first circle and within the second circle, the rate will be 15 cents. With a 25-mile radius, the rate to all places between last two circles will be 20 cents. The width of each succeeding zone shall have an increase of two miles in width over the next preceding zone, and the increase in rate for each zone shall be five cents.

	Cents.
Thus for 7 miles charge	10
7 to 15 miles charge	15
15 to 25 miles charge	20
25 to 37 miles charge	25
37 to 51 miles charge	30
51 to 67 miles charge	35
67 to 85 miles charge	40
85 to 105 miles charge	45
105 to 127 miles charge	50

"The above rates are for a communication of three minutes' duration or less. For each additional minute or fraction, charge five cents on all messages, the initial charge for which is 50 cents or less, and 10 cents for each additional minute or fraction on all messages where the initial charge exceeds 50 cents.

"Between the hours of 6 p. m. and 6 a. m. a night or half-rate schedule shall be in effect for all messages of 15 cents or over. To determine the night rate, divide day rate by two, and if result is not divisible by five, add to it till it becomes so divisible.

"And your committee further reports that the division of tolls between the connecting companies should be as follows: Combination tolls shall be divided on the basis of the air-line distance between the receiving and transferring points on the lines of each company transmitting the message. Switching stations shall receive two cents per message and terminal stations shall receive three cents per message. Originating stations shall be allowed the following percentage of fees, in addition to their pro rata of mileage: Toll stations and exchanges of less than 100 instruments, 15 per cent.; exchanges of 100 to 500, 20 per cent., and exchanges of over 500, 25 per cent.

"We further report and recommend that if this report be adopted, the foregoing schedule shall be put into effect by all members of this association on March 1, 1903, and that the secretary of this association give all Independent companies in Wisconsin notice of the adoption of such schedule."

This report provoked by far the most spirited and valuable discussion of the convention. An abstract of some of the remarks follows:

A. W. Lawson, Wausaukee, Wis.: The rates ought to be such that you can go into any telephone station in this state and figure out the rates yourself, when you know the distance, based upon what ought to be the fact that the rates are alike all over the state for equal service.

Julius Thielman, Merrill, Wis.: These rates may be fair, just and equitable in a developed country, but we who live in the northern part of the state, in a timbered region, find that the expense is so much greater in setting up our lines that rates which would be just and equitable in a well-settled country like the central and southern parts of this state, do not seem to be fair as applied to us. It is quite expensive to maintain toll lines with us, and while we are members of the association, and if the association would adopt rates, we would naturally be expected to live up to them, yet the schedule submitted by the committee, if adopted, may retard the building of our lines in the portion of the state from which I come.

C. B. Lloyd: I think that a company ought to be formed similar to the United States Telephone and Telegraph Company in Ohio, which has built a long-distance line connecting with all the exchanges in Ohio.

H. C. Hackney, Delavan, Wis.: I am not in favor of a different rate to be paid to different-sized exchanges for their commission, but I believe the rate should be absolutely uniform.

President Valentine: The point that the committee made is that it has been found by experience that the large exchange handles a great many more incoming messages from a small town than it handles of outgoing business—that is, that the connection with the larger city is of far greater importance to the little fellow than his connection is to the larger company.

J. J. Nate, Chicago: The vital point in the telephone situation is the toll-line proposition. If the Bell people have any ground whatever to claim a natural monopoly on, it is the toll-line work and the service which they can perform, and as fast as they can build up that system and cement the Independent systems to their own by giving them toll-line service over their wires, they handicap and hold the Independent people down. I believe, sooner or later, in the Independent field, the toll-line business will be operated and controlled by one consolidated company, and then your troubles will be at an end.

President Valentine: I think Mr. Nate has stated it just exactly as it is, and that is the reason I say that, rather than not have the toll lines, we can better afford to give the toll-line service free.

E. A. Croll, Iron Mountain, Mich.: Between Marinette and our place we can furnish you connection with about 3,000 telephones and are anxious to furnish the toll-line service covering 150 miles, absolutely free.

H. G. Slater, Waupaca, Wis.: I believe the report of this committee, if adopted, will meet with universal satisfaction, because it not only gives the operator a chance to tell exactly what the toll is, but the subscriber himself will eventually learn it, and can tell just the toll to any point. Another nice point about it is that no matter what point of the state you are in you can figure your toll to any other point, just as you can from your home office. I agree with all the talk on this matter in regard to some company building and owning the whole toll-line business. It may be a monopoly, but it is better to have two monopolies than one monopoly, and if one company could connect up all the 30,000 Independent telephones in the state of Wisconsin, I believe the difficulties of the toll-line question would be eliminated beyond a doubt; but until that time comes we should adopt the best possible plan.

Others taking part in the discussion were H. A. Fehland of Wausau, M. D. Larson of McFarland, A. W. Bryant of Grand Rapids, J. C. Crowley of West Superior and W. J. Bell of Portage. The report was so amended as to read that 20 per cent. of the outgoing tolls be paid to all exchanges and toll stations, and then it was adopted.

The following resolution was passed: "Resolved, That it is the sense of this association that if capital can be induced to build first-class copper toll lines for long-distance work, that this association is willing to handle the local business for such toll lines at a reasonable commission, not exceeding 15 per cent."

A House Organ Criticized.

H. C. Hackney of Delavan read articles from Sound Waves, a house organ of the Swedish-American Telephone Company of Chicago, and objected to one on farmers' telephone lines, on the ground that it placed the cost of construction and maintenance too low, thus encouraging the building of poorly constructed lines. This worked out to the detriment of the Independent company, with its well-built lines. Articles favoring cheap and worthless construction cause great injury to the Independent telephone people. In defending the paper Mr. Overshiner said that his company had no desire to encourage cheap construction. He wanted to know what electrical paper had requested the gentleman to bring the matter up before the convention. Mr. Hackney replied that no one asked him to present the matter; he acted on his own initiative. The discussion then proceeded thus:

Mr. Overshiner: In regard to our advocating putting up cheap stuff, I will admit that that article is rather bad, but I do not want to offer any excuse to the association for it. But this paper is a house organ, and during the month of December we borrow the man from Sedalia, Mo., to edit the paper, and that is one of the results. (Great laughter.)

M. D. Larson, Macfarland: Personally, I am very much opposed to seeing any firm engaged in pushing its own particular products, or coming out with anything that means an advertisment, in that style. When I got the first copy of Sound Waves sent to me, I supposed that it was a journal of general information impartial to all; but I was soon convinced that it was not, and as soon as I found that it was not I threw it into the waste basket. The particular copy that the gentleman has quoted from I preserved, for the reason that I thought there was a good deal of untruth in it, and it showed that the man that wrote the article either prevaricated knowingly, or was not capable of writing the article properly. Therefore, I am going to cherish that copy as a souvenir as long as I am in the electrical work.

Mr. Overshiner: It is a strictly legitimate way of advertising. The Deering Company and the McCormick Reaper and Harvester Company do the same thing, and no one thinks of criticizing them for it. We do not charge for the papers. If those who receive them do not want to read them, they needn't.

Mr. Larson: We pay the postage. It is taking advantage of the laxness of the postal laws.

Mr. Overshiner: We put two cents first-class mail-matter postage on each copy, and I think your criticism is not well founded.

Mr. Larson: I did not know that.

Legislation.

J. C. Harper, chairman of the committee on legislation, reported that two bills have been introduced into the Legislature. One of these, introduced by Senator O'Neil, eliminating from the statute the protection of trees by property owners, the committee thought should be defeated. The other bill had been introduced by Mr. Barker of Milwaukee, apparently for the purpose of relieving the people of his city of the high rates of the Bell company. The bill sought to arrange and regulate the maximum price which shall be charged in different cities. In cities of over 100,000 inhabitants the maximum charge would be $6 a month for business and $3.50 for residence telephones. In cities over 20,000 and less than 100,000, the charge would be $4 and $3, and in smaller cities $2. A rate of 50 cents a month for six-party lines or over in all cities was provided. Mr. Harper thought that if the rates provided in this bill were properly regulated, he could not see that it would be harmful to the Independent interests, but the bill as it is, should it pass, would almost entirely do away with the possibility of building rural lines and other party lines in the suburbs of cities remote from exchanges.

Mr. Harper said the question should be looked into of introducing in the Legislature a bill which shall provide that all cities having about the same population and the same number of telephones shall be entitled to the same rate, or that a telephone company having exchanges in all cities of the same population and about the same number of telephones shall charge the people of those cities the same rate. The report was accepted and the committee continued.

Resolutions.

Resolutions of thanks to the Milwaukee press and officers of the association were then passed and also resolutions to the effect that the association request its members to refuse to patronize companies who sell apparatus to another Independent company entering into competition with an Independent telephone company already established, and also that no individuals or companies who connect with or use Bell apparatus shall be eligible to membership in the association.

Secretary A. C. Winter read his annual report for the last year, showing the financial condition of the association. It was decided that an assessment of one cent per instrument and two cents per mile of toll line be levied to meet the expenses of the association.

Election of Officers and Concluding Business.

The following-named officers were then elected for the ensuing year: President, Richard Valentine of Janesville; vice-president, H. G. Slater of Waupaca; secretary and treasurer, H. C. Winter of Mad-

ison; executive committee, C. W. Twining of Monroe, John M. Baer of Appleton, N. F. Smith of Hixton, J. C. Crowley, Jr., of West Superior, J. Thielman of Merrill, W. F. Goodrich of La Crosse and W. J. Bell of Baraboo, Wis.

After some discussion of the tactics employed by the Bell company in Madison and other portions of the state it was decided to hold the summer meeting in that city in June next. The question of suitable signs for Independent toll-line service was discussed and Mr. Burch and Mr. Henry Retter were appointed a committee to find out how much signs could be bought for. It was decided to hold the next annual meeting in Milwaukee next February and then the association adjourned sine die.

MEMBERS IN ATTENDANCE.

The following is an alphabetical list of the exchange companies (with their delegates) represented at the convention:

Badger State Long Distance Telephone Company, E. E. Heath, Nielsville, and John K. Fish, Janesville; Beloit Telephone Company, J. E. Carr, Beloit; Broadhead Telephone Company, J. C. Murdock; Central Wisconsin Long Distance Telephone Company, W. J. Bell, Portage; Citizens' Telephone Company, William Van Middlesworth and C. M. Smith, Racine; Citizens' Telephone and Telegraph Company, James Cavanaugh, George A. Yule and J. A. Pitts, Kenosha; Clinton Telephone Company, C. E. Gosselin and A. V. Peters, Clinton, Iowa; Dane County Telephone Company, J. C. Harper, H. C. Winter, Madison; Dane County Rural Telephone Company, J. C. Harper; Eastern Wisconsin Telephone Company, H. B. Greve, G. A. Kraemer, A. A. Paulson, Elkhart Lake; Edgerton Telephone Company, F. H. McKinney, M. H. Shelley; Fox River Valley Telephone Company, J. M. Baer; Interurban Telephone Company, Charles Schernecker, A. L. Hutchinson, H. E. Kepler; Interstate Telephone Company, A. W. Troost, Winona; Kirchayne and Cedarburg Telephone Company, William Tischer, W. P. Jochem, Cedarburg; La Crosse Telephone Company, W. F. Goodrich, La Crosse; Little Wolf River Telephone Company, F. H. Sweet, Fond du Lac; Mazomanie Telephone Company, D. L. Bestor, Mazomanie; Macfarland Telephone Company, M. D. Larson, Macfarland; Menominee Range Telephone Company, E. A. Croll, Iron Mountain, Mich.; Merrill Telephone Company, J. Thielman, Merrill; Mineral Point Telephone Company, R. J. Penhallegan, Jr., Mineral Point; Monroe Telephone Company, William P. Bragg, L. A. Hodges, P. J. Weirick, Monroe; Monroe County Telephone Company, H. Teasdale; Mount Horeb Independent Telephone Company, F. E. Bell, Mount Horeb; Merrill and Wausau Toll Line Company, H. R. Fehland; Northwestern Telephone Company and Electric Company, A. B. Ferdinand, W. H. Burke, Milwaukee; Pardeeville Telephone Company, F. H. Smith, Pardeeville; People's Telephone Company, J. L. Farrington, Rio; Perkins' Telephone Company, F. N. Perkins, Medford; People's Telephone Company, J. C. Crowley, West Superior; Portage Telephone Company, W. J. Bell, Portage; Platteville, Rewey and Ellenboro Telephone Company, P. H. Jeardeau, Platteville, Wis.; Plymouth Telephone Company, C. Pfeifer; Prairie River Telephone Company, H. R. Fehland, Merrill; Rock County Telephone Company, Richard Valentine, Janesville; Rock River Valley Telephone Company, J. R. Mansfield; Sheboygan County Telephone Company, W. H. Burke, A. B. Ferdinand; State Long-distance Telephone Company, H. C. Hackney; Telephone Toll Line Company, A. W. Bryant, Grand Rapids; Theresa Union Telephone Company, William Frings, Nat Haessly; Troy and Honey Creek Telephone Company, J. C. Kuoni and John E. Bonham, Prairie du Sac; Union Telephone Company, E. M. Pease, Richland Center; United Telephone Company, P. J. Weirick; Valley Telephone and Telegraph Company, C. B. Lloyd, E. M. Hagerty and Phil. Sheridan; Walworth County Telephone Company, H. C. Hackney, Delavan; Wausaukee Telephone Company, A. W. Larson, Wausaukee; Wood County Telephone Company, A. W. Bryant, Grand Rapids, Wis.

The manufacturing and supply houses of Chicago and vicinity were represented.

New Telephone Cable Across the Ohio.

A new telephone cable was laid across the Ohio River, connecting Evansville, Ind., and Henderson, Ky., last week by the Cumberland Telephone and Telegraph Company. The cable is over 3,000 feet long, weighs 32,000 pounds and contains 50 wires. It is encased in a marline covering and anchored against bridge piers. The laying of the cable was a perilous undertaking because of high water, but it was successfully accomplished, despite the swift current, by the barge Ingleside, in charge of Captain Hornbrook.

MANUFACTURERS AND DEALERS.

The Central Electric Company of Chicago has recently published a new telephone catalogue. It contains a complete line of the products manufactured by the Williams-Abbott Electric Company, for whom the Central is sales agent. In addition to the Williams-Abbott material, the catalogue contains a list of wires, insulators, tools, batteries and all other supplies used by telephone companies.

The Automatic Electric Company of Chicago has recently shipped to the Mutual Automatic Telephone Company, Albuquerque, New Mexico, a switchboard of 1,000 ultimate capacity, with 400 telephones and switches for present installation. The city of Albuquerque has had automatic-telephone service for seven years, the local company having purchased one of the early types of Strowger switchboards. The new equipment was purchased to meet the demand for service beyond the capacity of the switchboard which has been in use.

The directors of the Home Telephone Company of Bowling Green, Ky., have chosen the following-named officers: President, E. H. Stout; secretary, W. B. Mays; treasurer, J. W. Porter. It is thought the plant will be ready for operation in May.

Ohio Telephone Notes.

A report comes from Cincinnati that the Independent interests are gaining headway there. The right of the Independents, if they gain a foothold, will be based upon the acquisition of three franchises, the Fitzsimmons, the Lawton and the Beattie. The second was secured only a few days ago, but not much has been heard of the third. The first was discussed in the Western Electrician some months ago. It is said that the plan contemplates only service for druggists and physicians, but this will give the United States Telephone Company an opportunity to install its long-distance service.

The Kidron Telephone Company of Kidron has been incorporated with a capital stock of $15,000 to build an exchange. V. M. Gerber, J. P. Sommer and others are the incorporators.

The Independent Telephone Traffic Company of Cleveland, the company that was planned by the managers last week, has been incorporated with a capital stock of $10,000, by Jerome Penn, C. C. Curtis, Frank L. Beam, H. H. Robinson, G. P. Thorpe, W. G. Thompson and S. S. Henkle.

Ex-Governor Asa S. Bushnell of Springfield has purchased the controlling interest in the Springfield-Xenia Telephone Company, originally an Everett-Moore property. It is said that Governor Bushnell will push the matter now and that the plant will be completed as soon as possible. Mr. Bushnell has become greatly interested in all electrical propositions and is investing much money in them.

The large stockholders of the Federal Telephone Company have signed an agreement pooling their stock. The agreement provides that no holdings shall be sold except through a pooling committee of five. This action has been taken for the purpose of keeping the control of the company in the hands of the Everett-Moore syndicate until the company is financed and out of all danger.

The Hannibal and Round Bottom Telephone Company of Hannibal has the following officers, recently elected: President and general manager, Charles Roth, Round Bottom; secretary and treasurer, J. A. Fraley, Hannibal. Several lines will be built through the country about Hannibal, and it is said they will be connected up with the National Telephone Company's lines.

The Bradford Telephone Company of Bradford has been incorporated with a capital stock of $20,000 by Z. T. Myers and others.

The Zanesville Telephone and Telegraph Company now has about 1,635 telephones in service in Muskingum County, where one year ago the Independent system was not known and the Bell had only about 800. Lines running through the county serve about 400 farmers, and half of these are connected with the Zanesville exchange and have free service with the city subscribers. The free limit extends from eight to 16 miles from the city. The Bell company's last directory shows that it has 1,400 subscribers in the county, including duplicates, but claim is made that it serves 2,300 people. If this is the case, then the people of Muskingum County are about as well supplied with telephone service as any place in the country. O. M. C.

Indiana Telephone Items.

The annual meeting of the Delaware and Madison Counties Telephone Company was held in Anderson on February 9th. The company ordered a hundred miles of telephone wires erected in the counties of Madison, Delaware and Blackford. N. A. Johnson of Muncie is the general manager of the company.

Representatives of half a dozen or more construction companies were in Evansville last week making plans and estimates for the proposed municipal telephone system. Mayor Covert says that only $16,000 remains to be subscribed. When this amount is secured the Board of Public Works is to grant a franchise. Then the mayor will advertise for bids.

The trial of a test case of considerable interest to telephone companies has been going on at Columbus during the last week. The state's attorney brought suit against the American Telephone and Telegraph Company for alleged unlawful obstruction of the public highway with poles and wires. The company contends that the poles alleged to be obstructions were placed in the public highway in good faith; that they are of public utility and necessity, and cannot reasonably be deemed obstructions. On the other hand, the state's attorney argued that there is no law permitting of such use of the highway; that no person or corporation has a right to obstruct the highway, whether in good faith or not. The court has taken the matter under advisement, and the decision is awaited with considerable interest. If the state is sustained in its attempt to rid the public highway of telephone poles, it will prove a severe blow to the telephone business in this state.

The directors of the Home Telephone Company of Bloomfield have been working successfully toward a reorganization. The plan is to enlarge the system so that every postoffice and every farm in the county may be reached. It is the purpose to reincorporate with a capital stock of $100,000. It is thought the reorganization will be effected in a few days. John F. Slinkard and John Davidson have the work in hand.

The Lafayette and Clarkshill Telephone Companies are said to have signed an agreement under which farmers east and south of Lafayette will have free connection with all the telephones in the city.

Telephone companies were incorporated last week as follows: Farmers' Co-operative Telephone Company of Wilkinson; capital stock, $10,000; to operate in Hancock County; President, Samuel M. Overman; secretary, B. H. Cook. Hannah and Jackson Telephone Company of Greenfield; capital stock, $10,000; directors, Coleman Pope, J. W. Jackson and others. Harrison Township Telephone Company of Clay City; capital stock, $5,000; to construct an exchange in Clay City, with lines extended into Clay and adjacent counties; incorporators, J. H. Horton, John Willen and E. R. Oberholtzer. Home Telephone Company of Hancock County; capital, $170, with exchange in the residence of William Wilbert, who may be addressed at Greenfield, Ind. F.

Telephone News from the Northwest.

The annual meeting of the Minnesota Central Telephone Company of Willmar, Minn., showed gross earnings for 10 months ended December 31st of $73,960 and expenses of $44,098, leaving a profit of $29,862. During the same time improvements and additions have been made costing $100,617. The value of the plant is now $722,464.

The Iron Range Telephone Company refused the reduction in rates asked by subscribers of Ada, Minn. The citizens secured 15 more subscribers and renewed their request, which was again refused. Then about half the subscribers in town ordered their instruments out, and threaten a new local company unless the company gives the same rates that surrounding towns receive.

The housemovers and the Northwestern Telephone Exchange Company of Minneapolis have come to conflict. The former have been in the habit of moving buildings up to the company's wires and serving notice to have the way cleared. The company now refuses to clear the way by cutting its wires. The state law protects the company, as the housemovers recently found in having to pay a fine for cutting telephone wires. The housemovers hold that the City Council gives them the right to follow a certain route, and that they have the right to have the way cleared.

Trautmann & Robinson have sold the Wabasha telephone exchange at Wabasha, Minn., to the Dwelle Telephone Company of Lake City, Minn.

Arrangements have been made with William Thompson, proprietor of the Hills (Minn.) telephone exchange, for the various rural lines to enter his central office. The rural lines objected to his charge of $5 a year per subscriber for switching service. A compromise was reached on the basis of $2.50 a year for the farmers.

The Gibbon Independent Telephone Company of Gibbon, Minn., has been incorporated. The capital stock is $10,000.

T. A. Thompson, William Milchrist, George C. Call and other residents of Sioux City, Iowa, have made application to the council for a franchise to conduct a local telephone exchange. The Tri-state Telephone Company has been after a franchise, but this move will probably prevent that company from securing entrance to the city.

The Sloan Telephone Company of Sloan, Iowa, has been incorporated with $4,000 capital stock.

A large rural telephone company is being formed at Cedar Falls, Iowa, to have a continuous service at 50 cents a month to farmers. All the smaller towns are to be connected, and the central office is to be at Cedar Falls.

The Harlan and Avoca Telephone Company expects to build from Avoca, Iowa, to Council Bluffs, Iowa, and to South Omaha, Neb. R.

Southern Telephone Developments.

An Independent telephone company, headed by Nerge Clark, E. H. Stout and others, is putting in a new telephone system at Bowling Green, Ky. The capital stock of the company is placed at $100,000.

Long-distance connection between Jacksonville and Miami, Fla., will probably be built by the Southern Bell company at an early date.

It is reported that the Southern Bell Telephone Company has bought a 21-mile Independent line between Charlotte, N. C., and Gastonia. L.

Bills Affecting Rates.

Rates for exchange telephone messages in New York city are affected by a bill recently introduced in the New York Legislature. It provides that no telephone company shall demand from its regular subscribers any extra toll for messages sent, not exceeding five minutes, over its own lines within any borough, nor more than 10 cents for like messages from public telephones, nor more than 15 cents for like messages within the city boundaries.

A bill has been introduced in the Illinois Legislature by Representative Werdell to regulate telephone charges. The bill provides that the monthly rental for a telephone connected with other telephones within the limits of any city shall not exceed $3.50 a month, and if the same person uses more than one telephone, the rate shall not exceed $3 each. All contracts at these rates shall be for not less than six months. Where two or more cities are connected, the rate shall not exceed 15 cents for the first five minutes' use of the telephone, and not exceed five cents for each additional five minutes.

Electric Power in the United States.[1]

Part I.

The most notable phase of the application of power to industrial uses during the decade, 1890-1900, is the use of the electric current for the transmission and subdivision of power. This form of power transmission and distribution is almost wholly a development of the last 10 years, although the principles involved were known and their practical utility demonstrated at a much earlier period. Prior to 1890 the census returns did not state separately the number of motors in use or the amount of electric power utilized in manufacturing establishments, such power being merged in the group of "other power."

In 1890 the number of motors in use was not reported, and the only information on this point was embraced in the quantity of electric power used, which amounted to 15,569 horsepower. In 1900 the amount of electric power reported was 311,016 horsepower, showing an increase of 295,447 horsepower, or nearly nineteenfold. The number of motors reported in 1900 was 16,923, giving an average of 18.4 horsepower per motor. In 1890 electric motors represented only 0.3 per cent. of the total power, while in 1900 they constituted 2.7 per cent. of the total.

Electric motors have been known for three-quarters of a century, and at least 70 years ago were applied experimentally to the propulsion of boats and cars and to the operation of machinery. But as they depended for their supply of current upon primary batteries consuming zinc, costly chemicals, etc., they could make no place in the industries of the world. The perfection of the dynamo and the discovery of the fact that the dynamo was reversible —i. e., that if current were supplied to it, it would run as a motor—released electric power from the trammeling conditions that had hindered its development, and the art made an immense stride forward, particularly in America, so that when the first electrical exhibition in the United States was held at Philadelphia in 1884, the electric motors shown compared in number, efficiency and commercial practicability with the arc and incandescent lamps, telephones, telegraphs, and other devices.

When the Eleventh Census was taken, such motors were beginning to appear upon the circuits of electric-lighting companies, and hopes were entertained that independent power plants for mills and factories would multiply. The returns for New York show that in 1890 there were 360 motors in use in New York city in isolated plants of a total of 310 horsepower, and that in all of the state outside there were only 99 motors of 862 horsepower. In the central stations of the state, outside of New York city, there were 1,178 motors of 1,276 horsepower, and in the city of New York (Manhattan Island) there were 1,185 motors of 1,678 horsepower.

No statistics that would indicate growth are available as to the state, but in New York city (Manhattan Island) the New York Edison Company reported for 1900-1901 a total of 50,634 horsepower of motors connected to its circuits, showing a motor capacity in 1900-1901 more than 30 times as great as in 1890, considering only the figures of one company.

A corresponding increase is observable in most of the other large cities in the Union. In the city of Boston alone there are now connected to central-station power and lighting mains not less than 4,470 motors of a total capacity of 16,059 horsepower, which, in proportion to population, is larger than can be claimed for New York city.

Power Transmission.

The development of electric motors in this country has been accompanied by a corresponding development of the art of power transmission. But for the higher perfection of the electric motor since 1890, it may be doubted whether the transmission of electric energy would have been undertaken on anything like so large a scale as was witnessed at the close of the century. During the 10 years preceding 1890 the development of motors and of power-transmission work was chiefly by means of direct current, but the last decade has seen a remarkable change in methods of current generation, enabling the creation of new centers of manufacture around waterpowers and permitting the transmission of electricity over distances which were previously deemed utterly prohibitive.

The great bulk of electric-motor work is still done with direct current, there being no alternating-current motors in use for railway work; and in stationary work, that is, in mills, factories, mines, etc., the utilization of alternating-current motors, measured by their number and value, is only about 25 per cent. as large as that of the direct current.

Niagara Falls.

The development of electric power transmission at Niagara Falls has been the largest and the most conspicuous of its kind, and the work done there is in many respects typical of that done in other sections of the country, where waterpower is abundant, although as to the length of transmission and the voltage at which the current is sent over long distances, it is by no means the best example that can be found.

The utilization of Niagara has, in fact, gone on for some time, and there are at the present time two separate and distinct enterprises on the American side—one above and the other below the Horseshoe Falls. The plant below the falls has the water of the Niagara River brought to it by a long canal which taps the Upper Niagara River, runs through the city of Niagara Falls, and then discharges the waste water at the cliff just below the first suspension bridge. Here there is a fall of about 215 feet, considerably more than at the plant above, but there is the disadvantage that the turbines and dynamos are located in the gorge, which the buildings disfigure, and that the conditions are not so favorable for the operation of machinery as in a plant at the surface.

It is the plant above the falls, developed by the Niagara Falls Power Company, the current of which, while used locally in large amounts, is also transmitted to Buffalo, 26 miles distant, that has attracted the greatest public attention. This includes a short service canal, 250 feet wide at its mouth, 1¼ miles above the falls, the intake being inclined obliquely to the Niagara River. The canal extends inwardly 1,700 feet, with an average depth of 12 feet, and holds water adequate to the development of over 100,000 horsepower. On each side is a power house, the ultimate capacity of each being 50,000 horsepower, one of which is in full operation and the other in course of equipment with machinery.

The electric generators are at the surface, and the waterwheels which drive them are in a wheel-pit 150 feet underground, being connected by a steel shaft; the water reaches the wheels through steel tubes. After the water has delivered up its energy, it is carried off by means of a tunnel 7,000 feet in length, with an average slope of six feet in 1,000. This tunnel, which has a net section of about 386 square feet, empties just under the first suspension bridge, where the waste water rushes out with a speed of nearly 20 miles an hour.

The Niagara Falls Power Company has under its charter the right to take sufficient water from the upper river to develop 200,000 horsepower, and has large franchises also on the Canadian side. The development of its work has gone on without in anywise marring the beauty of the spot, while the diversion of water is obviously too small to make any perceptible difference in the amount passing over the crest of the Horseshoe or American falls; the potential power of the main stream is estimated to be equal to at least six or seven million horsepower.

The first power house of the company, which has now been in operation for some time, contains 10 dynamos of 5,000 horsepower each. Between this and the other is a large transforming station, at the end of the canal, where huge transformers are grouped for raising the current of 2,200 volts to a pressure of 22,000 volts for transmission to Buffalo, and to 11,000 volts for utilization on the company's own factory land, and by a large variety of industries already concentrated along the bank of the Niagara River toward Tonawanda.

These are the leading features of the generation of current above the falls on the American side, but the American company has already given out contracts for a large plant on the Canadian side, where the current will be developed by the largest dynamos in the world, built in the United States, and can, if necessary, be brought across the river for use in this country. The dynamos, three in number, will each deliver 10,000 horsepower to the circuits, returning 98 per cent. of the shaft horsepower in the form of current generated at a potential of 12,000 volts, thus dispensing with transformers, which otherwise would be required to raise it to that voltage for transmission.

A large amount of Niagara current is employed in electrochemical and electrometallurgical operations. This work, however, is far from exhausting the possibilities of Niagara development by electricity. In the immediate vicinity of the falls, the current is now used for electric lighting, and about 1,000 horsepower is also delivered to the street-railway trolley system. Factories on the spot working up raw material into food, textile fabrics, etc., utilize several hundreds of horsepower, and the current is also used for the manufacture of "merry-go-rounds," as well as for operating ventilating blowers in the public schools.

It is the transmission to Buffalo, however, which more particularly justifies the utilization of the energy of the great cataract and illustrates the remarkable manner in which electric power is modifying the methods of American manufacturing and mechanical industries. The current from Niagara to Buffalo is carried over aerial circuits and delivered to transformer stations which lower the pressure for local distribution. The Buffalo street-railway system has five of these sub-stations, so that at all hours of the day and night, Niagara is transporting the public of a great city more than 20 miles distant

There are a number of miscellaneous industries and manufactures in which blocks of Niagara current are used at prices which compete so favorably with those of steam, oil and natural and artificial gas, that the demand is rapidly increasing. Among these may be mentioned large flouring mills and a plaster-making plant.

Not only is grain ground to flour by electrical power, but it is handled by electricity in some of the largest grain elevators for which Buffalo is famous, one of them, the Great Northern, having 20 induction motors of an aggregate capacity of 1,200 horsepower. Another large utilization is at the plant of the Buffalo Dry Dock Company, where 40 motors of upward of 500-horsepower capacity are employed in the process of building some of the largest steel steamships that ply the Great Lakes.

At one of the branches of the American Agricultural Chemical Company are employed 15 motor units of a total capacity of 300 horsepower, and at the New York Car Wheel Works four motors of about 200 horsepower, driving air compressors, blowers, lathes, boring mills, grinding machines, presses, etc. The proprietors of the Curtiss Malt Mills use a motor capacity of about 300 horsepower for manipulating malt; the American Bridge Company has motors aggregating 125 horsepower engaged in the manufacture of structural steel; the Oliver Manufacturing Company, manufacturer of jewelers' supplies, etc., employs 50 horsepower of Niagara current, while the Pratt & Letchworth Company, manufacturer of heavy steel and malleable-iron castings, utilizes 300 horsepower.

One of the most interesting utilizations, however, is that of 20 horsepower in a bread bakery. In another building, three motors operate ice machines 24 hours a day, to furnish refrigeration for a market place on the other side of the street. Last, but not least, is the supply of current to the Buffalo General Electric Company, which, prior to 1900, was operating two large and distinct stations driven by steam power. These have been consolidated and the operating department thus reduced one-half, while the displacement of steam power and steam engines has further diminished the amount of labor necessary, as the large motors driving the generators which feed thousands of lamps and motors need few attendants.

The Pacific Coast.

An advance beyond the utilization of the power of Niagara Falls is that developed during the census year, and more recently perfected, by means of which electric current is transmitted from the Sierras, in Eastern California, as far as San Francisco and other cities adjacent to the Pacific seaboard. This constitutes the longest electric-power transmission in the world, the distance being nearly 10 times that on the American side of Niagara Falls. A further striking difference is that, whereas the development at Niagara is due to the falling of water in huge volume under a head of only from 150 to 200 feet, in California large enterprises depend upon the utilization of relatively small bodies of water, but with heads of from 500 to 1,500 and 1,800 feet. In that state, where fuel is still scarce and dear, a great many mining plants have been brought within the sphere of feasibility by this electric-power transmission, and a large amount of miscellaneous work throughout the state is now tributary to these long-distance transmissions, which excel in daring, in number, and in commercial success anything attained elsewhere in the world.

The transmission of the power of the North Yuba River, in the Sierras, to San Francisco, above referred to, effected by the Bay Counties and Standard systems, stretches across and ramifies through no fewer than 16 counties, containing property to the amount of three-fifths of the assessed valuation, and about one-half of the population of the state. The systems have two sources of supply, one at Colgate, over 200 miles from the Golden Gate, and the other at Electra, about 150 miles distant, these systems meeting on San Francisco Bay, at Mission, San Jose and at Oakland.

The power plant at Colgate is situated at the base of a 1,500-foot hill, down the side of which extend five steel pipes, each 30 inches in diameter, delivering water to the turbines. Water is brought to these pipes from the impounded river and from a remote water shed by means of a timber flume over seven miles in length, with a capacity of carrying 23,000 cubic feet of water per minute. The turbines drive three generator-dynamos of 3,000 horsepower each and four of 1,500 horsepower each, these being of the "three-phase"-current type. The current is generated in these dynamo machines at 2,400 volts pressure and is then raised by transforming apparatus to a pressure of 40,000 and 60,000 volts, even 80,000 volts having been reached, while the lowest pressure named is normal. This current is delivered to two circuits of three wires each, one being composed of copper and the other of aluminum. The wires are carried upon Oregon cedar poles, averaging from 25 to 60 feet high, upon which are screwed porcelain and glass umbrella insulators, 12 inches in diameter.

The transmission current is carried across the well-known Straits of Karquines, in an enormous span of 4,448 feet, supported 200 feet above the rapid waters, emptying into San Pablo Bay, by means of steel latticed towers, the circuits being composed of stranded plow steel to obtain the requisite tensile strength.

The efficiency of the transmission system is such that 1,000 horsepower at the Colgate waterwheels nets about 750 horsepower at San Francisco, six per cent. being lost in the generators, two per cent. in the step-up transformers, two per cent. in the step-down transformers at the receiving sub-stations, and 15 per cent. in regulation and in the line.

The employment of the current is not less varied than at Niagara, ranging from the operation of street cars in Oakland to the running of a flour mill at Stockton, and from use in mines in various parts of the state to use in miscellaneous industries at

1. Abstract of United States Census Bulletin on "Power Employed in Manufactures."

Sacramento, Benicia, San Jose, and elsewhere. The plants must be maintained in regular and systematic operation, and as their initial base of dependence is the water supply, storage reservoirs have been provided in the high Sierras, in Alpine County, 6,000 to 8,000 feet above the sea level, furnishing a supply equal to 150 days, which is the maximum dry period of the state as recorded in its annals.

The third type of power-transmission plant which deserves mention is that at the Snoqualmie Falls, Washington, where the dynamo room with 10,000 horsepower of electrical apparatus is situated 250 feet below the surface in a large whitewashed cavern, blasted and hewn from the solid rock. This unique location is due to the fact that the spray from the falls rendered it impossible to locate any power house at the surface. The current is transmitted across the Cascade Mountains through dense forests to the cities of Seattle and Tacoma, where electric lights, railways and motors are operated; and, here again, it is to be noted that aluminum is used for transmission circuits.

SAULT SAINTE MARIE.

The St. Marys River, which flows from Lake Superior into Lake Huron, and separates the Upper Peninsula of Michigan from Canada, has been utilized for power development upon an extensive scale during the last few years. The conditions here are somewhat different from the illustrations previously described, as instead of a comparatively small flow of water at great head, an enormous volume of water with a comparatively small head is used. The difference in the levels of the two lakes is about 20 feet, most of the fall occurring in the rapids known as St. Marys Falls, or Sault Ste. Marie, at the outlet of Lake Superior. On the Canadian side of the river a power canal has been in use for several years, yielding about 20,000 horsepower, a large portion of which is used direct from the turbines for driving wood-pulp grinders. The remainder is electrically transmitted to various industries.

On the American side of the river a much larger power development is approaching completion. A canal about 2¼ miles in length, from 200 to 250 feet in width, and of an average depth of about 20 feet, has been cut from Lake Superior to a point on St. Marys River below the rapids. A massive power house of steel, stone and concrete, over 1,300 feet in length, will contain 320 horizontal turbines, capable of developing about 50,000 horsepower. All of this power will be transmitted by electricity to industries in the vicinity on both sides of the river.

A third canal of similar proportions is to be constructed on the Canadian side of the river, paralleling the one now in operation on that side.

A unique feature of this great development is the precaution taken to prevent possible lowering of the level of Lake Superior or interference with the vast steamship traffic which passes through the locks at the rapids. Lest the increased outlet afforded by canals should lessen the flow of water through the steamship locks and their approaches, compensating works are being constructed at the head of the rapids for the purpose of reducing, by means of movable gates, the outflow over the falls in proportion to the increased outlet created by the power canals. It is designed, by this means, to maintain the flow of water from Lake Superior as a fixed quantity, regardless of the new outlets afforded by the power canals.

[To be concluded.]

Large Engines for New York Edison Company.

The New York Edison Company has recently placed a contract with Westinghouse, Church, Kerr & Co. for another 6,500-horsepower Westinghouse vertical three-cylinder compound engine of the same size and construction as the eight already in operation and being installed at its Thirty-ninth Street Water Side station. This contract includes an independent steam-driven air and circulating-pump condenser equipment, and is the third order received from the New York Edison Company for these engines, the first covering eight units, the second two, and the third one, a total of 11 units, aggregating 71,000-horsepower normal, or 100,000-horsepower maximum capacity. The engines are of the vertical type, with a middle high-pressure cylinder 43½ inches diameter, and two outside low-pressure cylinders, each 75½ inches diameter, the stroke being 60 inches. The engines are approximately 40 feet over all in height. They are direct-connected of 4,000-kilowatt, revolving-field generators, supplying high-tension polyphase current to the various local sub-stations throughout Manhattan. Steam is supplied at 175 pounds, and a vacuum of 27 inches is maintained by the condensing system. The air and circulating pumps are mounted upon a common bed-plate, together with the actuating Corliss cylinder, forming a pumping unit of great compactness.

The Parkersburg (W. Va.) and Ohio Valley Railway Company contemplates the construction of an electric road from Parkersburg to Pittsburg. It is stated that a preliminary survey will probably be started at once, and at its conclusion the task of securing necessary franchises and rights-of-way will be commenced.

BOOK TABLE.

HANDBOOK OF TELEPHONES OF THE SIGNAL CORPS, UNITED STATES ARMY. Prepared under the direction of Brig.-Gen. A. W. Greely, Chief Signal Officer, U. S. A., by Lieut.-Col. Samuel Reber, U. S. A. Washington: Government Printing Office. 1903. Pp. (six by nine inches) 66, with 49 illustrations and diagrams.

Colonel Reber, who is well-known to the electrical fraternity for his technical accomplishments, has prepared, under General Greely's direction, this thin volume for the instruction of the Signal Corps. The telephone is daily becoming of more importance in the army, and nearly all of the apparatus described was designed by the officers of the Signal Corps. The book is divided into six chapters, and in non-technical language the author describes the appratus used, and gives means for locating and eliminating trouble. The work is well done and should be of great service to the soldier-electricians for whom it was undertaken.

THE HOW AND WHY OF ELECTRICITY. A Book of Information for Non-technical Readers. By Charles Tripler Child. New York: Electrical Review Publishing Company. 1902. Pp. (five by 7½ inches) 125, with 40 diagrams. Price, $1.

For the purpose for which it was written this little book is in every way admirable. The only criticism one can make is to express the wish that there was more of it; and as every writer, technical or non-technical, wishes to leave the reader in that gratified frame of mind where the ending is regretted, the desire that Mr. Child had been able to leave more of his clearly written descriptions of electrical methods and apparatus must be taken as a compliment. In truth, the author of this book, whose untimely death is still lamented, was just the person to write it, for he not only possessed the requisite knowledge, but—what is rarer—he had the ability to set forth in language concise and easily understood the principles of the science and the methods of the art of electricity. In the work under review only the art of electricity is considered. The author explains how a familiar electrical apparatus is operated, and he does it with close adherence to technical truth, without the aid of a single mathematical demonstration and so that any person of average intelligence can assimilate the text. That this accomplishment requires ability of no mean order will be admitted by anyone who has essayed to write on technical subjects. Mr. Child has left a good book—one that we can heartily commend to the non-technical readers for whom it was written; they will not be led astray by platitudinous nonsense, but will receive solid, exact information, if simply expressed. The work should have a large sale, and, as a large share of the proceeds will go to the widow and children of the author, we hope that it will.

A GRADUATED COLLECTION OF PROBLEMS IN ELECTRICITY, COMPRISING ALL BRANCHES OF ELECTRICAL SCIENCE. By Robert Weber. Translated from the third French edition by Edward A. O'Keeffe. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1902. Pp. (4¾ by 7¼ inches), xv., 351, with 34 diagrams. Price, $3.

This is an excellent collection of problems for use in the classroom and also for all students in practical electricity. The problems have been selected with care and with a view to impress on the memories of students "the laws and electrical formulæ, the numerous applications of which tend every day to take a greater place in our lives." They are arranged under the heads of Mechanics and Heat, Static Electricity and Dynamic Electricity, the greater part—555 out of a total of 746 examples—being under the last-mentioned head. The problems are solved in brief form, but by the use of such formulæ and laws as appear in standard works on physics and electricity and with which the student is supposed to be familiar. They cover a wide field, ranging from illustrations of the different electrical units, through current, resistance, electromotive force, capacity, to arrangements of batteries and problems in series and shunt dynamos, motors, incandescent and arc lamps, and telegraphy and telephony. Besides the treatment of the problems, the author gives an explanation of the electrical units as adopted at the International Congress of Electricians in 1884 and 1889, and at the end of the book includes 16 valuable tables of electrical and mechanical units, physical and other constants, specific inductive capacity, resistance of insulators and liquids, etc. The author being a French scientist, naturally all units of measurement are expressed only in the metric system, and only this system is used in the problems. This is Dr. Weber's third addition of his work, which was originally brought out some 17 years ago. A large number of new and up-to-date problems have been added, and the book's value is still further increased by the addition of an alphabetical index. The diagrams are used to help explain some of the more complex problems.

ELECTRICAL AND MAGNETIC CALCULATIONS. By Professor A. A. Atkinson, M. S. New York: D. Van Nostrand Company. 1902. Pages (five by 7¼ inches), vii., 310, with 45 diagrams. Price, $1.50.

The need of books that contain the solutions of practical everyday electrical problems, such as might be used by the student in connection with his textbooks or by the practical engineer, has long been felt. Recently, however, several books of this nature have been published which more or less supply the want, and Professor Atkinson's work is one of the best of them. The author's experience in teaching has enabled him to present his matter in such form that it can be readily mastered by anyone well grounded in the fundamental principles of electricity and magnetism. In each case the law has been clearly developed and has been given the most concise, easily remembered and convenient working form. Then a series of examples is worked out illustrating the application of the principle and giving familiarity with its processes. At the end of each chapter are given several original problems for drill in the mastery of the principles and their application.

In the first chapter an explanation of the electrical and magnetic units is taken up, and the relation of quantities, as expressed by Ohm's law, electromotive force, capacity, power, work, etc., is treated in the following chapter. The general laws of resistance, electrical energy, and alternating currents are the subjects handled in the next three chapters. Chapter VI. is devoted to wiring for light and power, and is probably the most valuable chapter for the electrician or engineer. Two incandescent-wiring tables for 110 and 50-volt lamps are very useful. Other chapters follow on batteries, magnetism, relation of magnetic quantities, the electromotive force of dynamos and motors, calculation of fields and elements of dynamo designs. The examples worked out for the different chapters are extremely practical and in some cases cover several pages. Some portions of the book will appeal more to one class than to another, but the work, considered as a whole, will be found a valuable guide for the use of "electrical engineers and artisans, teachers, students and all others interested in the theory and application of electricity and magnetism," for whom it was written.

Chicago City Railway.

According to reports made at its annual meeting on February 16th, the Chicago City Railway Company carried 183,891,361 passengers in the year 1902. Of these 128,097,799 paid cash fares, while the remaining 55,793,562 had transfers. The transfer business was equal to 43.56 per cent. of the people who paid and was over 30 per cent. of the entire traffic. With this great volume of business, the gross receipts of the company increased $512,910 over the previous year, the income being $6,413,181. To accommodate the traffic the number of cars operated was increased to such an extent that the profits applicable to the stock were less than 1901. Last year the company earned 10.53 per cent. on its $18,000,000 capital and paid nine per cent. in dividends. In 1901 the earnings on the stock was 11.09 per cent. The company has 34.75 miles of track operated by cable and 183.96 electrically operated. The totals of miles run during the year are as follows: Electric, 18,333,862; cable, 14,244,190; horse, 93,882. The percentage of expenses to income was 67.22. The officers elected are: President, D. G. Hamilton; first vice-president, Joseph Leiter; second vice-president, George T. Smith; general manager, Robert McCulloch; secretary and auditor, C. N. Duffy; treasurer, T. C. Penington.

The following facts are taken from President Hamilton's report: Large sums have been expended in thoroughly maintaining the road and equipment, which are in good condition, as well as increasing the temporary power capacity in order to meet the traffic demands. A large expenditure has been made for betterments and additions, as well as to prepare for the installation of the proposed new railway, the construction of which a franchise may warrant. The new car house has been completed. Large repair and machine shops have been erected; the construction of an additional 77 miles of underground electric-duct conduits for feed wire has been finished; additional land bought for the site of the new proposed power station; all of which additions and betterments are needed in anticipation of an ideal railway system. Since the last report the 125 large electric cars have been placed in service, and within a few days 80 will be added to the present equipment on the Halsted Street line, and 5.81 miles of track on new extensions have been built. A complete power plant, boilers, engines, and electric apparatus of 2,000-horsepower capacity has been installed at the corner of Twenty-first and Dearborn Streets, and during this month has been put into operation, to assist in handling the increased traffic of the electric lines; and yet, if the traffic increase still continues, there must be still further additions along that line. The management has used every endeavor to settle the franchise question during the year. It did not feel warranted, pending its settlement, to contract for apparatus and construction costing millions of dollars, but has exerted itself to render the best and most efficient service possible under present conditions.

There are rumors of a strike on the City Railway system, but the difficulties between the men and General Manager McCulloch may be settled by arbitration. The men, in a somewhat indefinite way, say that the company wants to crush the union and is not living up to the spirit of the recent agreement.

International Congresses at World's Fair.

The board of directors voted on February 10th to organize an International Congress of Arts and Science in connection with the exposition, in accordance with the recommendations of the administrative board appointed in January to formulate a plan. The sum of $200,000 was set aside for the Department of Congresses. This sum will cover the expenses of the International Congress of Arts and Science and the publication of the proceedings thereof and all other expenses connected with the promotion of other congresses and conventions. The administrative board of the International Congress of Arts and Science now consists of President Butler of Columbia University, President Harper of Chicago University, President Pritchett of the Institute of Technology, Boston; President Jesse of the University of Missouri, Mr. F. J. V. Skiff, director of the Field Columbian Museum, Chicago; Mr. Herbert Putnam, librarian of Congress, Washington; Mr. Frederick W. Holls, New York, member of The Hague Tribunal. The appointment of Professor Simon Newcomb of Washington, the eminent astronomer, as president of the International Congress of Arts and Science, was confirmed, as was that of Professor Hugo Muensterberg of Harvard University and that of Professor Albion W. Small of the University of Chicago as vice-presidents of the congress. The president and vice-presidents were created a scientific committee, to make detailed arrangements for the congress, subject to the general control of the administrative board and the director of congresses. The plan recommended by the administrative board was adopted by the directors of the exposition.

There will be one general congress of arts and science, to begin September 19, 1904. The congress shall have one definite task, namely, to bring out the unity of knowledge and thus to bring harmony and interrelation into the scattered scientific work of the day. Leading scholars from the whole world will be invited to discuss every theoretical and practical science in its definite position, to trace the development of each science during the last century, and to state the open problems of to-day. An honorarium and a sum for traveling expenses will be allowed to all who submit a paper in response to an invitation and who contribute a definite piece of work to the uniform plan. The plan also provides for the active participation of men of affairs. For example, the group on commerce, or on finance, or on labor, will attract business men. Groups on colonial policy, or arbitration, or municipal government, will attract politicians. The plan further provides for the participation of independent associations, national or international congresses of specialists, and scientific or popular meetings.

The provision for the publication of the proceedings of the International Congress of Arts and Science which is made in the appropriation above mentioned will form a lasting contribution to the scientific literature of the country, and be a permanent memorial to the work of the St. Louis Exposition.

Chicago Street-railway Situation.

The negotiations between the City Council committee and the traction companies, which have for their end the settlement of the Chicago franchise-extension question, seem to have been abruptly checked for the time being. The traction companies at a meeting on February 16th insisted on having their claims under the 99-year act passed upon by a body of arbitrators to be agreed upon. The aldermen answered that this would mean years of negotiating and that all such claims should be passed upon at once and settled in connection with the matter of compensation. After this announcement the traction representatives suggested that the meeting adjourn, and adjournment was accordingly taken. When the negotiations will be renewed is uncertain, but no further action is expected before the election. It is possible that further conferences may be delayed indefinitely and the companies continue running their present plants without improvements until the value of their claims under the 99-year act is determined by the United States Supreme Court. A report was in circulation in the City Hall after the conference that aldermen are considering the advisability of granting other companies rights to parallel existing lines; this also is said to have been discussed in the executive meeting of the local-transportation committee.

A system of constructing the subways in Chicago has been suggested by John Meiggs Ewen, consulting engineer for the George A. Fuller Company, which it is believed will greatly simplify the construction and by which no block in a street will be closed more than six weeks. A new solution of the subway problem has been offered by Harold Rountree, who suggests eight distinct and independent loops, all coming to a central point at the new postoffice building.

Representative J. M. Patterson of Cook County has introduced in the Illinois Legislature a bill to authorize cities to own and operate street railways. The bill is similar in many respects to the Mueller municipal-ownership bill, introduced in the Senate by Senator Mueller.

Electric-power Distribution in Great Britain.[1]

By Frank W. Mahin.

The use of electricity in everyday affairs is developing enormously in Great Britain. Parliament offers every encouragement by readily granting large powers to responsible bona fide companies. The first of the "power bills" was introduced in 1898, but the opposition was so strong and the favorable sentiment so little developed that it was not until 1901 that the grants were made under which the present companies, described below, are generally organized. The Newcastle company is the only one fully at work, though the County of Durham company has its enterprise in partial operation. Several companies are nearly ready to operate, others are at work upon the necessary buildings, while the remainder are still in embryo.

Power-supply Companies Organized or Organizing.

Newcastle-on-Tyne Electric Supply Company; capital, £500,000 ($2,433,250).—The first electric-power-supply company to begin work in this country, starting to furnish power in 1898 on a small scale, which was greatly enlarged in 1902. It covers a short strip of country along the north bank of the Tyne, but it is the intention to take in a much larger territory.

South Wales Electrical Power Distribution Company; capital, £750,000 ($3,649,875); covers the coal and iron-working portion of that region.

Shannon Water and Electric Power Company; capital, £360,000 ($1,751,940); covers a 30-mile circle about Limerick, Ireland.

Lancashire Electric Power Company; capital, £3,000,000 ($14,599,500); covers the Lancashire coal fields and extends to the sea on the west.

County of Durham Electric Power Supply Company; capital, £500,000 ($2,433,250); covers 250 square miles, bordered on the north by the Tyne and on the east by the sea.

North Metropolitan Electric Power Supply Company; capital not yet announced; covers 325 square miles to the north of London.

Cleveland and Durham County Electric Power Company; capital, £1,000,000 ($4,866,500); covers 820 square miles adjoining the Durham County territory on the south.

Clyde Valley Electrical Power Company; capital, £900,000 ($4,379,850); covers the industrial region of the Lower Clyde, in Scotland—an area of over 700 square miles.

Yorkshire Electric Power Company; capital, £2,000,000 ($9,733,000); covers 1,800 square miles in South Yorkshire.

Gloucestershire Electric Power Company; capital, £250,000 ($1,216,625); covers 326 square miles along both sides of the Severn.

Cornwall Electric Power Company; designed to revive decaying mining industries by supplying cheap power; covers all of Cornwall—1,356 square miles.

Leicestershire and Warwickshire Electric Power Company; capital, £750,000 ($3,649,875); covers the two counties—1,699 square miles.

Kent Electric Power Company; capital, £750,000 ($3,649,875); covers 1,520 square miles between London and Dover—south of the Thames.

Midland Electric Corporation for Power Distribution; capital, £200,000 ($973,300); covers 100 square miles a short distance west of Birmingham.

Derbyshire and Nottinghamshire Electric Power Company; capital stock, £1,800,000 ($8,759,700).—This corporation, whose territory covers a portion of this consular district and embraces all of this county and most of Derby, an area of over 1,500 square miles, is in certain material respects the most extensive in its aims of all the companies formed. The project was started in 1898, when the contemplated area was much larger than now. Then the promoters were associated with American electrical interests; now they are local manufacturers who want cheap electric power. The act of Parliament in behalf of this company was passed July 26, 1901. It confers liberal powers, such as the right of compelling the sale of necessary lands, the construction and use of all requisite or convenient buildings or apparatus, and the like. The only material restriction relates to the compulsory purchase of houses occupied by the laboring class, which is not permitted unless new buildings are provided for the dispossessed tenants. The act excludes the cities of Nottingham and Derby from the territory covered by the grant, in compliance with their objections that their own electric plants would suffer loss.

On some computations, the coal-bearing areas within the scope of the scheme are the richest in the world, and the mines themselves would justify the promotion of a wholesale system of electric-power supply. Several did put down electric plants, but it was found that this made the cost of electric power too great. Besides the advantage to the mines, it is believed that many local industries in villages or the country will be greatly stimulated by the advantages of cheap power. Some of the largest lace, shoe and hosiery factories are outside the cities. In addition, various old-established concerns using hand power and in a decaying state, will receive new leases of life.

One avowed object of the cheap-power schemes is to check the exodus from the villages to the towns by supplying power as cheaply in the former as in the latter. It is expected that manufacturers will take advantage of the cheap land and low taxes in the country and villages to erect factories there. The tendency will be to check the growth of Nottingham, which has been pronounced in recent years.

Within the area of the project there are 564 works of importance, 159 of which are coal pits. Some 400 firms, representing a capital of about £20,000,000 ($100,000,000 in round numbers), supported the bill before Parliament. It was at first intended to have four generating stations and a total horsepower of 60,000, but the applications for power have now so far exceeded the estimates that two, and perhaps more, generating stations will be added, with a proportionate increase of horsepower. These stations will be distributed as evenly as possible within the area, near enough to coal mines to secure an easy fuel supply, but not too near to interfere with competition in the buying of fuel. It is obvious that much expense will be saved by the use of but six sets of engineers, firemen, etc., and only one office staff, where hundreds of men are necessary in the case of individual power supply. Of equal economic importance is the saving to be effected by the use of larger engines and dynamos. The smallest unit the company will put down is one of 3,000 horsepower, whereas the average individual unit is perhaps of 200 horsepower. The difference in cost of running units of such contrasting capacity is estimated at 33 per cent., and while two men are required to run a 200-horsepower unit continuously, six are sufficient for one of the larger size. The company contends that if a manufacturer can buy coal for as little as 5s. ($1.21) per ton, he will even then find the use of electricity considerably cheaper than steam. It is calculated that in the case of a 250-horsepower engine there will be a saving of 36 per cent. Another material advantage is that when once installed the electric motor is ready at a moment's notice, day or night, by the mere turning of a switch. A peculiar inducement to maintain low charges is found in the parliamentary act, which provides that the dividends receivable by the stockholders of the company are dependent on the prices paid by the consumers, increasing as the charges decrease. The company cannot, no matter what the agreement may be with a consumer, charge him more than the lowest price paid by any other consumer whose circumstances are similar. Variation of price is, of course, allowed where the supply varies. Thus, for less than 100,000 units (kilowatt-hours) per annum, the company will charge 1¼d. (2½ cents) per unit, but for 1,000,000 units the charge will be 1d. (two cents) per unit. That these charges are relatively very low appears from the fact that, according to published statistics, the average selling price of the 97 municipally owned electrical-supply undertakings in this country is 5½d. (11 cents) per unit. These, however, work at a disadvantage as respects low charges, as they depend for their revenue mainly upon supplying electric lighting, required for only a few hours each day.

The Generating Stations.

The fitting of all being essentially the same, a general description of one will suffice. Twenty-four water-tube boilers are provided. Each will evaporate 1,400 gallons of water per hour when fired with slack coal, and will generate this steam at a pressure of 200 pounds per square inch, after a test pressure of 300 pounds. The fuel, brought direct from the mine, will be raised by automatic elevators above the level of the boilers, and will be shot into hoppers, one above each fire-hole door. The ashes and clinkers will drop through another set of hoppers into trucks in the basement beneath the grates. Instead of huge chimneys, forced draft, created by means of electrically driven fans, will be employed, and will permit the use of the very cheapest coal, which is often a waste product at the mine, and, it is understood, will cost the company only 1s. 6d. (36 cents) a ton. The feed pumps supplying the boilers with water will also be driven by electric motors, and each will be capable of supplying 10,000 gallons of water per hour, and, in addition, injectors will be provided to supply the boilers should any accident happen to the pumps. From the boilers to the engines the steam will be conveyed by a system of piping, so arranged that any engine can be supplied from any boiler. The engines to be first installed will be of 3,000 horsepower each and of the vertical, triple-expansion, three-crank condensing type, with the cranks of the crank shaft set at angles of 120 degrees apart. The engines will work at about 160 revolutions per minute. The condensers will each be capable of turning 22½ tons weight of exhaust steam back into water per hour, while the water-circulating pumps for the condensers will each be capable of delivering 160,000 gallons per hour against a head of 40 feet. The main generators will be coupled directly to the crank shafts of the engines, and will therefore run at the same speed—160 revolutions a minute. They will generate a three-phase alternating current at a pressure of 10,000 volts and with a low periodicity. Such an enormous pressure allows the energy to be transmitted long distances with small loss and permits of very small conductors being used to convey that energy to its work, capital outlay on the mains and general working expenses being thus both reduced. Each generator is so designed that it can be satisfactorily worked in parallel with all or any of its

1. From Advance Sheets of Consular Reports. The author is United States consul in Nottingham, England, and this report is dated January 12, 1903.

fellows—that is, should three out of five be working, and should another be required, it can be started, run up to its right speed and pressure, and then attached to the load without any danger of itself "jibbing" or of making any of the others inclined to "jib."

The buildings for the installation of the plant will each be about 750 feet long, 280 feet wide, and 55 feet high.

From the station to the consumer, the current is to be conveyed by properly insulated and protected copper conductors. The three-phase current requires a three-core cable, each core being made of strands of the purest obtainable soft copper wire. Each of the cores is insulated with paper wound around it to the thickness of at least a quarter of an inch. The cores are then placed in a vacuum to be thoroughly dried; then the insulator is soaked with bitumen oils and the cores are next stranded together into one rope, this being made into circular form by more paper impregnated with bitumen oils. The cable is then passed through a bitumen and wax compound, and afterwards has drawn upon it by hydraulic pressure a lead sheath, jointless and one-eighth of an inch thick. A double ring of steel wires is tightly wound over and around the sheath to protect against mechanical injury. The cable is laid some two feet underground, in earthenware troughs, which are filled in with molten bitumen that sets—not too hard to be got out again if required—all around the cable. The troughs are covered by earthenware tiles set fast in the hot bitumen. Before leaving the works, the cables, which have to carry energy at a pressure of 10,000 volts, are tested at a pressure of 25,000 volts, after they have been immersed in water 24 hours. In cases where a lower pressure is required, the 10,000-volt current is passed through a static transformer, which can alter a small current of high pressure into a larger current of lower pressure.

In the company's plans all the best features of English, American and continental practice have been embodied.

Work on the plant has been underway for the last nine months and will be completed in another three months, when the supplying of power will at once begin.

Economic and Financial Advantages of Electric Power.

The numerous collieries are likely to be among the principal customers of the electric-power companies. Taking as a basis the fact that about seven per cent. of the coal raised is consumed in obtaining the 93 per cent. sold, it has been estimated that by the use of electricity in the mines, 10,000,000 tons of coal might be saved annually. In addition, by the ease and rapidity with which it can be taken wherever required, electrical energy scores over either steam or compressed air. An electric cable large enough to convey 500 horsepower, with its copper conductors, insulation, lead sheathing keeping out all moisture, and steel covering protecting it from mechanical injury, will be only 1¾ inches in diameter, and can be readily wound around a drum and unrolled into place. On the other hand, a steam main for the same power would have great weight, absolute rigidity, troublesome couplings, joints and bends, and columns, hangers, etc., for support. Underground pumping and the ventilating plant on the surface can also be advantageously operated by electricity.

The possibilities of these electric-supply plants are enormous, providing, as they do, a power which can be adapted at will to the driving of a one-twelfth horsepower ventilating fan in one's office or to a 4,000-horsepower rolling mill.

The experience of the Newcastle company, which has been operating for the last four years, proves the cardinal fact that the cost of generation per unit of electricity rapidly decreases as the load on the station is increased. Power can be profitably supplied to various large works at a little over 1d. (two cents) per unit.

To illustrate inner financial workings, an example is given of a supposed power undertaking costing £500,000 ($2,500,000) for generating station and transmission mains. The station would have a capacity of about 12,000 kilowatts, which would supply about 23,000,000 units per annum, with a load factor of 25 per cent. An appreciable amount of electricity being lost in transmission and "transformation" to various pressures, which is allowed for in all calculations, 20,000,000 units is taken as actually sold in the present case. The cost of generation and transmission is itemized as follows, distance of transmission being 16 miles:

Description.	Cost.		Cost per Unit Sold.	
			Pence.	
Coal	£14,231	$ 69,255	17	$ .34
Oil, water, waste, etc	3,500	17,033	4	.08
Repairs, maintenance, etc	19,800	96,357	23	.46
Wages	9,594	46,689	11	.22
Rents and taxes	3,400	16,546	4	.08
Management, engineering, etc.	9.500	46,232	11	.22
Total	£60,025	$292,112	70	$1.40

Should the 20,000,000 units be sold in bulk at 1¼d. per unit, the result is—

Revenue	£104,169=$506,924
Expenses	60,025= 292,112
Profit	£ 44,141=$214,812

This shows nine per cent. profit on the capital expended, at the lowest charge per unit—the bulk rate—and with a liberal estimate of expenses. The Newcastle company has, in fact, already got below these figures as to the cost of generating. Taken as they are, the figures form the basis of a belief that a large power company will be able to supply not only factories with cheaper power than they can otherwise obtain, but also electric-lighting companies with electricity in bulk at lower rates than they themselves can reach with the strictest economy and the best management.

Although overhead cables are freely used on the continent and in America, tending considerably to the cheapness of transmission, at the present time nearly all electrical-transmission work at extra high pressure (such as is required in power transmission) is done by underground cables in this country. There is hope that a more general use of overhead cables may be permitted, in which case the cost of transmission will be sensibly less than is contemplated in the foregoing table.

Storage Batteries.[1]

The secondary battery in central-station work has been used as a store to equalize the load, and to reduce the running plant at the times of heavy load. Owing to the high full-load station pressure with feeder systems, the station battery is generally for use at light loads only. But the secondary battery has for a long time been on the border of success for traction work, both on tramways and on the road, and a further improvement in batteries may be expected to produce very great changes in important branches of engineering.

The first question asked is, Why do we stick to lead? The answer is that the case is very special and other things will not do. We are practically limited to lead, at any rate in acid cells. Take, first, the plate that oxidizes on discharge. It should not dissolve in the electrolyte, as if it does the deposition and solution will be uneven, and the plate will grow trees and come to grief. This puts zinc out of court, unless some electrolyte is used which gives some insoluble salt of zinc, which does not attack zinc on open circuit, and which gives a good electromotive force with it. Iron is out of court for the same reason; there is no suitable electrolyte. The strong organic acids, such as trichloracetic or oxalic, are apt to have their positive radicles split up by electrolysis, even if a strongly positive metac can be found with an insoluble salt. Lead is thus the only metal practically available in an acid electrolyte. Silver in hydrochloric acid would give no pressure, and the acid would be decomposed at the anode. On the other plate we need an insoluble depolarizer, else a two-fluid cell must be used, involving a porous diaphragm, diffusion, and impracticability. Not only must the depolarizer be insoluble, but it must be converted into an insoluble body on discharge. The coating must be a conductor in one state or the other, or there will be no proper contact. In the lead cell there is always enough peroxide and metallic lead in the coatings to secure electrical contact, though the discharge product is an insulator. The depolarizing coating must be connected to a conducting plate which is not attacked by local action. Lead and silver are the only available metals, and sulphuric, and perhaps phosphoric, the only acids, for the nitrate of lead is soluble and hydrochloric acid is decomposed by lead peroxide. Lead is protected by its coating of sulphate, or peroxide, as the case may be. It thus seems as if we were limited almost absolutely to lead and sulphuric acid. It is wonderful that we have the lead cell at all. We owe it to the chance observation of Planté. The theory was not understood for a long time. For many years it was thought that the pressure was due to the PbO_2 and Pb changing into PbO. The acid was merely put in to make the electrolyte conduct, and sulphuric was used because people used it in gas voltameters, and they never thought that it ought to be as strong as practicable to give the pressure and output. The formation of lead sulphate was regarded as a difficulty to be overcome.

In the lead cell we want lightness, large capacity, cheapness, rapid discharge, efficiency and mechanical strength and durability. These qualities are mostly antagonistic. Large capacity means rapid deterioration. Mechanical strength means weight. It is thus no use testing a cell for capacity without testing the efficiency and durability, too, and so on. Published battery reports are often misleading, because they omit essential information.

In an alkaline electrolyte, such as caustic, such metals as iron, nickel, cobalt and copper form oxides which are insoluble. The metals are thus electronegative in caustic, like gold or platinum in acid. The electrolyte here acts merely as a conductor, as the dilute acid was supposed to act in the lead cell. The pressure is thus chiefly due to the change from metal to oxide on one plate less the reduction on the other, and is small. There may be a Gibbs-Helmholtz temperature coefficient pressure in addition. Though the pressure is smaller, the metals admit of light plates or grids, and the coatings may conduct in both states, instead of only one, as in lead cells, so that a larger proportion of the coating may be active. The future of this type of cell is uncertain, as very little has been published as to results. Our limits in secondary batteries thus seem to be settled by the need of having insoluble electrodes and insoluble coatings.

1. From the presidential address of James Swinburne before the British Institution of Electrical Engineers, delivered in London in December last.

Electric Power Equipment for the Osaka Military Arsenal, Japan.

One of the most complete and up-to-date electric power plants recently installed in Japan is located at the Osaka Military Arsenal. This installation was made for the purpose of operating the electric cranes and blowers for the cupolas in the new foundry just completed. The foundry is built of red brick, with a corrugated-iron roof, the inside dimensions being 86.3 by 33.4 meters. It is equipped with four 10-ton, one 25-ton and one 20-ton Morgan cranes, also four four-ton and six seven-ton cupolas, two being made by the Whiting Foundry Equipment Company and the others in the arsenal itself. Four Root blowers, each driven by a Westinghouse 40-horsepower induction motor, supply the blast for these cupolas.

The power house is equipped as follows: In the boiler room are two Sulzer-Frere Cornish shell boilers, center-fired, each having heating surface of 62 square meters and a grate surface of 1.8 square meters. Each boiler is complete with its own heater, consisting of two plain cylinders, each of 600 millimeters diameter and of the same length as the boilers. These heaters are mounted over the boiler shells and suspended from the angle irons supporting the brickwork. One Worthington duplex pump and one restarting injector are provided for supplying feed water to the boilers.

In the engine room there are two Sulzer-Frere vertical, tandem-compound, single, balanced-crank engines, with high-pressure cylinders, 325 millimeters in diameter, low-pressure cylinders 475 millimeters in diameter, and stroke 300 millimeters, operating under a steam pressure of eight atmospheres at 257 revolutions per minute. The low-pressure cylinders have a fixed cut-off and the high-pressure cylinders a variable cut-off. Each engine is provided with a heavy flywheel, by means of which the angular variation of the engine speed is reduced to a minimum. The condensers are a part of each engine, operating from the crank-shaft by eccentrics.

Direct-coupled to each engine is a Westinghouse 100-kilowatt, 220-volt, three-phase, 3,600-alternation, composite-wound generator of the two-bearing, revolving-armature type. The armatures are of the slotted-drum type, the cores being built up of laminated sheets of steel, pressed on the cast-iron spider and held in place between two end plates. The armature windings consist of strap-wound coils, formed and insulated before being placed in the slots, the coils being held in the slots by retaining wedges of hard fiber, thus requiring no bands. Two 11¼-kilowatt, 125-volt, multipolar exciters are driven by belt from the main engines. There are two three-phase feeders, of No. 0000 gauge each, leading out from the power house to a distribution panel located at a convenient point in the foundry, from which the circuits of the various cranes and blowers are supplied. Before any load was put on the generators they were synchronized, and it was noted, from the ammeters and tachometers, that there was no perceptible angular variation in the engine speeds and no cross currents flowing between the armatures. As it was not possible to get a steady motor load, the generators were given a trial run on a non-inductive load. This load was obtained by rigging up three water barrels with iron-plate terminals, three plates being fastened at the bottom of the barrels and the other three lowered into the water by pulleys overhead. The artificial load thus secured provided an excellent means for properly adjusting the compensating field for perfect parallel operation and for taking care of the full range of the machines. After this test a full-load run of two hours was made with the cranes and blowers working. The cranes are all equipped with Westinghouse variable-speed induction motors and crane controllers.

The design of the power house and foundry, together with the layout of all machines in the latter, came directly under the supervision of Mr. G. Kuwada, the mechanical engineer of the arsenal. The foundry is a model of completeness in every detail and reflects great credit upon Mr. Kuwada, who is one of the most clever engineers in Japan. All of the electrical apparatus, as well as the cranes, blowers and two cupolas, were supplied by Takata & Co.

Cheap Power Offered Toronto.

A straight offer of electrical power from the Niagara district, has been made to the mayor of Toronto, Ont. The offer is to deliver the energy in Toronto at $20 per horsepower per annum, for as much over 30,000 horsepower as the city wants, or to provide energy at Jordan, Ont., at $10 per horsepower. The proposal comes from the Hamilton and Lake Erie Power Company, and is made by W. Pierson Judson of Oswego, N. Y., who is the company's engineer. The scheme has the merit of novelty, for the plan is not to utilize the waterpower of Niagara Falls, but to create an artificial Niagara Falls by connecting the Chippewa River and the Jordan.

The Transmission of Fire Alarms.[1]

By E. B. Ellicott.

The wonderful progress in the science of extinguishing fires has been materially aided by the improved and increasing facilities that have been devised for the purpose of notifying fire departments of the location of the fire with the least possible delay. In the days of volunteer departments the only means of notification was the clamorous ringing of a centrally located fire-bell, which method meant, at least, a considerable delay, and was not always efficient. The fire losses of to-day would be multiplied many times if the existing departments were required to depend upon the old system of alarms. But inventive genius has supplied many different means—both automatic and manual—for the purpose of indicating the existence and location of fires, thus placing important and necessary information before the responding fire department in the shortest possible time. Without exception, electricity is the agent which is adopted in the transmission of alarms. Varied forms of apparatus have been designed, but the modern and most commonly used system of today is only an evolution of the first electrically operated system of 1852. Our present mechanically and electrically perfect street box, so simple in construction and operation that a child can operate it perfectly, was represented in the earlier days by a box containing a large wheel, upon the periphery of which were teeth representing numbers or characters, arranged to make and break the circuit as rapidly and often as the wheel was turned. If the individual sending in the alarm was excited and turned the wheel rapidly, the reproduction of the characters in the engine houses was more than apt to be unintelligible. The present boxes are speeded to send the signals, which represent numbers, at a uniform rate, and when the box mechanism has been once actuated it will complete its signal without further attention. The manner of receiving the signals thus sent differs somewhat in various cities, but as a rule the signals are printed in ink on a paper tape.

Actual records of alarms received and transmitted show the average time required to receive an alarm from the box and transmit it over two lines to engine houses requires but 24½ seconds, and with short-number boxes has been less than 15 seconds. This speed cannot be obtained with any automatic repeating or transmitting device in service at the present time, and it is doubtful if such apparatus will ever reach the state of perfection that will permit it to equal these records.

To keep such a system as this in perfect operating condition requires a force of men who are highly intelligent and can be relied upon to give their best efforts to the work. Trouble must be anticipated, not awaited, and careful inspections must be made constantly. When it is considered that the apparatus is distributed in nearly 150 locations within an area of 180 square miles, and that three different circuits of wire must be maintained between each group of engine houses and the central offices, involving the maintenance of over 5,000 miles of wire, some idea is conveyed of the magnitude of a system in a large city.

The perfect fire-alarm system must be exceedingly rapid in the transmission of alarms, in order that a number of alarms following each other may not cause delay by blocking the system. The system [in Chicago] has the facilities for transmitting 60 complete alarms an hour, repeating each one for comparison, to prevent mistakes, and reporting to the department the time of return to quarters of each engine company that might be engaged at each of the 60 fires. After a recent large fire, at which 31 different pieces of fire apparatus and six commanding officers were engaged, the time required to report the companies and officers back to quarters was computed, and it was developed that while their returns were distributed over a period of two hours and 18 minutes, the actual time the circuits were in use was six minutes, divided into 37 different signals, which average a fraction less than 10 seconds for each.

During the time inventors have been perfecting the ordinary fire-alarm system other inventors have been at work upon automatic means of discovering fires, as well as sending an alarm. Many ingenious appliances have been devised and several have been extensively used. It would require considerable time to describe each one, but the following descriptions of those most commonly used will convey some idea of what has been done in this direction.

The mercurial system was probably the first system to be extensively used, and in its original construction and design was of little value. It was based on the principle of the ordinary thermometer, though differently constructed. Two wires were run through a certain section of a building, and at intervals of about 10 feet were placed the thermostats or circuit-closers. This device consisted of a specially shaped thermometer, the ball of mercury being connected to one of the two wires by means of a platinum wire extending through the glass, and the second wire was connected into the glass tube, where the column of mercury, when subjected to sufficient heat, would rise and cause the circuit to be closed, and a current from batteries maintained on the two wires would flow through an annunciator, which indicated the section of the building in which the circuit had been closed. An alarm was also sent to a central office, and from there to the fire-alarm office, from which latter place the fire department received its first notification of an alarm. The principle seemed good, and the details of installation, as well as recording and indicating apparatus, were much improved and enlarged upon. It developed in actual practice, however, that the thermostats could not be constructed in such a manner that continual jarring would not affect them, and as they had to be made somewhat delicately, it was difficult to construct a standard thermostat that could be relied upon when subjected to the varying conditions of practical service. As an open circuit was used, no test of the entire wiring could be relied upon, and much of the system might be out of service at a time when it might be called upon to operate by the presence of fire.

This system was subsequently modified and improved by placing in the circuit sections of metal, fusible at comparatively low temperatures. The presence of high temperatures fused the metal sections subjected to it, and the circuit was opened, thereby actuating certain apparatus designed to indicate the location of the fire. This system has proved of sufficient merit to warrant the insurance companies to adopt their present practice of allowing a certain rebate in insurance rates where such a system is installed and maintained.

The multiphase-cable system is similar in operation and in some respects more desirable. The cable is constructed of a number of strands of copper wire wound around a fusible-metal wire, with a thin braid, saturated with an insulating compound of low-melting point, placed between these two conductors. Around the two is a thin braid, saturated with a compound of low melting point. The two conductors thus form a circuit insulated only by a medium that is ruptured by the application of heat. Excessive heat melts the compound and special metal, thus forming a circuit for the flow of current which actuates the indicating apparatus, similar in form and effect to that of the mercurial system. This system is practically a continuous thermostat, and becomes operative upon the application of excessive heat at any point.

A thermostat constructed with an aluminum diaphragm, adjusted to expand and close or open an electric circuit and thereby actuate indicating apparatus similar to that employed in the other systems, has been tried, but not extensively used, although the principle is good and does not possess some faults to be found in other systems.

Another form of thermostat was devised, consisting of an expanding metal diaphragm, made in the form of a push button and used normally as such. In event of its being subjected to excessive heat, the diaphragm automatically expanded and closed the circuit, causing a continuous ringing of the bells, which were ordinarily operated by pushing the button. As it was impossible to use any particular indicating apparatus with this style of thermostat, it has not been used in actual installation.

No less than 20 different styles of thermostats have been devised in which the breaking of a circuit and the consequent actuating of indicating apparatus was accomplished by the melting of a special fusible metal used to close or hold closed some part of the circuit. In general, they have proved unsatisfactory on account of the inability of manufacturers to secure a fusible metal that could be depended upon at all times to fuse at a given temperature.

The principle of the expansion of certain classes of metals when subjected to increase in temperature has been used in the construction of thermostats for automatic fire-alarm purposes, but has not as yet proved entirely satisfactory.

Another class of thermostat, in which the circuit is held open by a plug of highly volatile material which, upon application of heat, becomes easily compressed by the pressure of a spring and thereby closes a circuit, has been tried, but does not meet the requirements, the most important of which is absolute reliability.

With all these different classes of thermostats one has not yet been designed which fully meets the requirements under all conditions.

Probably one of the most ingenious systems ever invented was recently exhibited, and under ordinary tests operated satisfactorily. The system comprises a half-inch pipe run through a certain section of a building and terminating in an annunciator of special construction, which, instead of operating by the application of an electric current through a magnet, responded to an increase of air pressure in the pipe. This increase of air pressure was obtained by means of an explosive cartridge inserted in the pipe at frequent intervals. The head of the cartridge was exposed, and upon application of a certain temperature exploded and thereby increased the air pressure within the pipe, throwing the drop on the annunciator. The drop on the annunciator not only indicated the section of the building in which the excessive heat existed, but was also arranged to set into operation a transmitting device which terminated in a central station, where a register could be employed to record the alarm. In one instance this transmitting device was connected to a central telephone system, and the operator obtained the alarm by the flashing of the signal lamp. No changes were required in the telephone circuit, and it was used for commercial business as well as a fire-alarm line. Eventually, there will be many possibilities for a system of this or similar character in which the telephone lines may be used for the two purposes. The excessive cost of connecting lines will be avoided, likewise the cost of operators, which should bring the total cost of the service down to a point where it will be within the means of small manufacturers and business concerns.

Manual fire-alarm boxes connected directly in circuits terminating in the central fire-alarm office afford the very best means of reporting fires. The nearest approach to the manual system (which, of course requires the presence of someone to pull the box) is the connection of some approved automatic system to the fire-alarm lines, through a regulation street box, set to operate automatically upon being released by the automatic system. No perfect system of this character has yet been devised, and much work remains to be done before the different city departments will allow such connection to be made to circuits operated by them. Means of testing without sending in a distinct fire alarm, and freedom from false alarms are the two most important features to be eradicated from the existing automatic systems before they can be thoroughly relied upon for connection direct with the fire-alarm lines. When some perfect automatic system has been devised and is placed in general use, it will greatly aid the extinguishing of fires in general, and many fires that are now beyond control at time of discovery will be extinguished with a nominal loss. In the words of Fire Marshal Musham, "Any fire can be put out with a pail of water if it is discovered soon enough." It is therefore reasonable to assume that most fires could be well handled with one or two engines if some automatic fire-alarm system is perfected whereby an alarm will be sent in before the fire has progressed to a point where a deluge of water would not save anythig of value.

Discussion.

Mr. Ellicott: When Mr. Stein of Australia was in the city a short time ago he told us what he saw in New York. He said that, on investigating their system, he found that it took about a minute and a half to send out an alarm. I told him we did considerably better than that, that our records on the 4th of July, when we had a number of alarms, were reduced to an average of 21 seconds for receiving and transmitting each alarm. He said: "That is pretty good, but I can beat that." He then asked me what our best record was. I told him it was a fraction less than 15 seconds. He said he had a record of 13 seconds, so I did not see any chance to get ahead of him. But without trying to minimize the time used in transmitting alarms, I think the tendency is to reduce the actual time in notifying the fire department of the existence of a fire. We are coming, before very long, to a system of fire-alarm boxes to be placed throughout buildings. That is, in every section of a building will be placed a box connected either to the city system or to a system of its own. The firemen throughout the country are recognizing every year the value of saving a few seconds of time, and all energies are directed toward saving those few seconds.

E. P. Warner: I notice that Mr. Ellicott, in describing the lines as they enter the station, mentions them as passing through safety appliances. That would indicate that there were many things in connection with the system that placed the system in jeopardy to some extent. I would like to hear from Mr. Ellicott as to these safety devices, their application and the success attained.

Mr. Ellicott: Here in Chicago we have tried no less than four different devices for protecting the office instruments from crosses with high-tension trolley lines and lightning discharges, but we have not been able to find anything that could be relied upon to operate quick enough. We finally devised a circuit-breaker which works magnetically, and which, up to the present time, has not failed in a single instance. It is not complicated. We had a cross last Friday with the West Division street railway, and it operated perfectly. We also had a cross two or three days before that with the Commonwealth Electric Company (3,000 volts), and saved our instruments in the office and kept the line open, showing the cross was still on until a repairer reached the point. We have tried safety devices in other places, but the discharge of lightning is liable to burn out the safety devices and leave the circuit open.

There was one storm in 1898 when a number of wires were broken down across trolley wires, and in one hour the damage done to our system cost us $2,200 to repair. Besides, it was quite a serious matter. There were a number of lines out of service, in addition to the amount of money expended.

Mr. Warner: I would like to ask whether there is any one device that has been found capable of giving complete protection.

Mr. Ellicott: We have two different devices; the circuit-breaker, which opens the circuit on the presence of an excess of current on a line, and ordinary lightning arresters. These are the only two devices we use at the present time for the protection of the instruments on a line during these crosses and lightning storms.

1. Abstract of paper read before the Western Society of Engineers. Mr. Ellicott is the city electrician of Chicago.

The municipal electric-light plant of Wilmington, Ohio, has been sold to the United Water and Light Company for $12,000. It cost $30,000.

CORRESPONDENCE.

New York Notes.

New York, February 14.—The alleged inadequacy of service provided by the elevated and surface street-railway companies of the city continues to be the chief topic for discussion, and interest has centered in the report made yesterday by the State Railroad Commission. The report was upon the complaint made by the Merchants' Association of New York city against the Interurban Street Railway Company and the Union Railway Company for failing to supply proper and adequate accommodations to the public. The commission lays the blame for the complaint of conditions upon those who have been in charge of the city's affairs rather than upon the transportation companies. It is charged that the officials of the city have treated the transportation companies as if they were public enemies, and that every plan for the relief of traffic congestion and the improvement of transportation facilities has been tardily undertaken and slothfully carried out. The commission finds that little can be done to bring about immediate relief. The only way in which existing conditions can be improved without costly improvements, which it would take years to complete, the commission holds, is for the city authorities to find a way to bring about a better regulation of vehicular traffic. The board asks for a code for the regulation of vehicular traffic, recommends a larger terminal for the Brooklyn Bridge and the railway lines centering there, and for more tunnels and bridges across the East River. A subway at Broadway, Sixth Avenue and Thirty-fourth Street is also recommended, and various other suggestions are made to the city and the company to afford the public better accommodations. The board recommends that the Interurban company add to its main lines equipment 250 closed cars, exclusive of 175 open cars now under construction. It finds that the company has ample car equipment and electrical power capacity, but wishes to provide for the future. "With respect to the cleaning and ventilation of cars," the report says in conclusion, "the board has investigated the methods employed by this company in cleaning its electric cars, and finds that due attention is given to the subject. It is a matter of great difficulty to both heat and ventilate a street car at the same time, to suit the desires of a number of passengers. The subject properly belongs to the health authorities." A report with especial reference to the Bronx is soon to be made.

The West Side Citizens' Transit Reform Committee of One Hundred has sent to the attorney-general of the state a report and letter signed by many prominent citizens, stating that he has the power under the Manhattan Railway Company's original charter to force the company to provide a seat for every passenger between rush hours, to make the stations sufficiently large for the comfortable accommodation of travelers, and to equip every platform with adequate roofs.

As another chapter in this traction investigation a bill has been introduced in the Legislature at Albany which provides for the creation of a board of railroad commissioners of the city of New York. It is stated by the framers of the bill that the state board, however able, is incapable of dealing with home transit problems, while an efficient city railroad commission would take up these problems and not wait for pressure of public opinion.

The Citizens' Union is preparing a bill for the Legislature which shall amend the rapid-transit act so as to permit the construction of roads without at the same time compelling the letting of contracts for their operation. The union also believes that the city should have authority either to operate them itself or to contract for their operation for a period not exceeding 10 years if equipped by the city, or not more than 20 years without such equipment.

The bill which provides for the $25,000,000 terminal improvement plan of the New York Central Railroad Company in New York city has been introduced at Albany. It authorizes the Board of Estimate and Apportionment to make to the railroad company the necessary grants for the depression of its tracks. The company is to prepare plans for the building of viaducts which will reopen to traffic the cross streets from Forty-fifth Street to Fifty-sixth Street, inclusive, and is to bear all of the expense of the construction of these viaducts, excepting the Park Avenue viaduct, in excess of $600,000. The city is to pay to the company $600,000 as its contribution to the cost of these improvements, and the railroad is to pay to the city $25,000 annually for the use of the sub-surface of the streets. The use of steam below the Harlem River is forbidden. The company is required to substitute for steam electricity, "or any motive power other than steam which does not involve combustion in the motors themselves." The work on the improvement is to begin within 30 days after the grant of permission to proceed, and is to be completed within five years.

The Brooklyn Rapid Transit Company has entered into an agreement with the Edison Electric Illuminating Company by which it will receive enough additional power to operate elevated trains on all roads, except in the Ridgewood division, by electricity instead of steam. The new system will be in operation after to-morrow, but at first the electric trains will not be operated during the rush hours. As soon, however, as sufficient power is obtained steam as a motive power will be given up completely. For several months the Brighton Beach, Bay Ridge, and West End trains have been operated by electricity.

J. R. Bibbins of the Westinghouse Companies' Publishing Department of this city delivered an interesting address at the last annual banquet of the New York Physics Club upon the subject of "Recent Developments and Use of Electric Power." The speaker dwelt upon the present trend of engineering practice in the field of power utilization. Late inventions were also touched upon in the address, prominent among them being the Hewitt vapor lamp and converter and recent single-phase traction systems. Mr. Bibbins' address formed the closing number of an excellent programme of short addresses by guests of the club upon questions pertaining to proper methods of education in physical science. Prof. J. M. Jameson of the Pratt Institute, Brooklyn, occupied the chair.

At the annual meeting of the New York and New Jersey Railroad Company in Jersey City Wednesday, these directors were chosen: David Young, G. Tracy Rogers and Charles W. King. This is the company that is building the tunnel under the Hudson River, from Fifteenth Street, Jersey City, to Morton Street, Manhattan. W. G. McAdoo, president of the company, said the work on the tunnel was progressing favorably. It is expected that trolley cars will be running through the tunnel within a year. Senator Depew, from the committee on commerce, has reported favorably to Congress the joint resolution granting to the New York and New Jersey Railroad Company the privilege of constructing an underground railroad under government property in New York city. O.

New England News.

Boston, February 14.—The Pittsfield Street Railway Company has effected a settlement with the heirs of William Craig, the United States secret-service guard who was killed in the collision with President Roosevelt's carriage, September 3d, 1902. The amount paid by the company has not been made public.

The Woodbury and Waterbury Street Railway Company has asked the Connecticut Legislature for authority to build an electric railway in Woodbury, Middlebury and Waterbury, to connect with the Connecticut Railway and Lighting Company's system. The company stock will amount to $200,000.

A company of Bangor (Maine) capitalists has raised $50,000 for the building of a large dam at Thirty-mile rips on the Sebasticook River, a few miles from Pittsfield, Maine. The dam will be begun in June and the company proposes to install an electric plant capable of generating 1,000 horsepower. The current will be transmitted to Pittsfield, to be used for manufacturing purposes.

Leroy W. Baldwin and other New York capitalists are planning to build a combination electric and steam road between Rutland and Randolph, Vt., via Mendon, Chittenden, Pittsfield, Sherbourne, Stockbridge and Rochester. They propose to run way trains by electricity and through trains by steam. These people have obtained control of the Rutland Street Railway Company, the Chittenden Power Company and the People's Gas Light Company.

A Hartford trust company has asked the Connecticut Legislature to grant it articles of incorporation. It is thought that the trust company is to be formed for the purpose of financing a company to build a third-rail railroad between Hartford, Middletown and New Haven, to parallel the New York, New Haven and Hartford Railroad Company. The capital of the railroad company is to be not over $1,000,000.

The East Lyme (Conn.) Street Railway Company has organized, with Richard C. Morris as president and treasurer, and Calvin S. Davis as secretary. The company has a capital of $100,000, all subscribed, and it will build an electric railway between New London and East Lyme, Conn.

It is reported that the Edison Electric Illuminating Company has acquired the Newton and Watertown (Mass.) Gas Light Company, the Framingham (Mass.) Electric Company and the Natick (Mass.) Gas and Electric Company. The company is preparing to petition for authority to issue new stock with which to capitalize its purchases.

The Fair Haven and Westville (Conn.) Railroad Company has begun extensive double-tracking and remodeling its tracks. The work will require the labor of 400 men for the next four months. The company will straighten the tracks on its Woodmont division, thereby saving 15 minutes' running time between New Haven and Woodmont. The company has awarded the contract for building bridges over the Cove River at West Haven and the Oyster River at Woodmont.

The Bryant Electric Company has acquired land adjoining its Bridgeport (Conn.) plant and will build an addition to its factory.

South Norwalk, Conn., will soon ask for bids for the improvement and enlarging of its municipal electric-light plant, on which it will expend $15,000. Two additional dynamos and a new switchboard will be installed.

The Rockville, Broad Brook and East Windsor (Conn.) Street Railway Company has been organized. Its charter provides a capital of $300,000.

The Connecticut Railway and Lighting Company will soon begin the construction of an electric railway between Seymour and Ansonia, Conn. The company is seeking a franchise for an electric railway from Seymour to Naugatuck, where it will connect with the Waterbury system, but the New York, New Haven and Hartford company will oppose this, as the line will parallel its Naugatuck division. O.

Canadian Intelligence.

Toronto, February 13.—The Ottawa Electric Railway Company met with the loss of about $12,000 on February 8th, through the collapse of one of its large car sheds, which, on examination, was found to have been structurally weak, and when so many tons of extra weight was thrown upon it by the extraordinary fall of snow, it succumbed, and in its fall destroyed two of the large Britannia cars and badly damaged a number of others.

The Hamilton Cataract Power, Light and Traction Company has been incorporated to take over the business of the Hamilton Light and Cataract Power Company, which already controls the electric street railway. It is the intention of the new company greatly to increase the business. The first thing it intends to do is practically to double the power of the plant at the power house at DeCew Falls, some 20 miles away. As soon as the frost is out of the ground, the work of extending the radial electrical railway from Burlington to Oakville will be commenced and pushed to completion. There is no intention of extending it to Toronto, as it is expected that one of the suburban electric railways running out of Toronto will be extended to meet it. H.

From the Buckeye State.

Cleveland, Ohio, February 16.—Henry A. Everett, E. W. Moore and other prominent members of the Cleveland syndicate are arranging for the formation of a securities company, which will take over all the roads in which these men are interested on long leases, and will operate them on a guaranty of so much profit to the stockholders and the interest in the outstanding bonds. The roads which would pass under the control of the new company, if its organization is completed, are the Detroit United, Toledo Railways and Light Company, Cleveland, Painesville and Eastern, Northern Ohio Traction and Light Company and the Lake Shore.

Cars have been put in operation on the Steubenville-Toronto line, which ceased operation for a time on account of the destruction of the power house of the Steubenville Traction and Light Company by fire.

It is reported that the Cincinnati, Lawrenceburg and Aurora Electric Street Railway Company is preparing to furnish light to the villages through which its line passes. In that case the company will install lighting machinery sufficient for its purpose, and the lead wires will be carried on the overhead structure of the road. The installation of the service in the villages will also call for material of that kind and lamps, as they will be needed.

The report comes from Cincinnati that arrangements will be completed within a short time to operate a direct line between Cincinnati and Cleveland. This will be accomplished by uniting the interests of the Cincinnati, Dayton and Toledo Traction Company, the Dayton and Troy Traction Company, owned by the Clegg-Winters syndicate, and the Toledo, Bowling Green and Southern, owned by George B. Kerper and others, and the Western Ohio Traction line, which is also owned by the Mandelbaum people.

The employes of the Little Consolidated Railway, Cleveland, gave Superintendent George G. Mulhern a pleasant surprise last Monday evening, the occasion being the anniversary of his birth—the sixtieth milestone. About 300 of them marched to his residence, headed by a band, and when they were admitted, Conductor F. W. Hoyer, in behalf of all, presented Mr. Mulhern a large cut-glass bowl and 18 glasses to match.

The Ohio Valley Electric Railway Company of Parkersburg, W. Va., has been incorporated for the purpose of building an electric line from Williamson to Sistersville, through St. Marys and Friendly. Attorney V. B. Archer of Parkersburg represents the incorporators.

Marietta men have secured the right-of-way for an electric line from that town up the Muskingum River to Lowell, with the ultimate intention, it is said, of extending on to Zanesville.

At a meeting of the stockholders of the Lake Shore Electric Railway Company held to-day it was decided to finance the company along the lines explained in the Western Electrician some time ago. The entire bond issue will be $11,000,000. The general mortgage is for $7,000,000, and of this only $1,000,000 has been issued. There will be $4,000,000 to retire underlying liens and $2,000,000 held in the treasury to improve the properties. The preferred stock issue will be increased from $1,500,000 to $3,000,000 and common stock to the amount of $4,500,000 has already been issued. The stockholders have agreed to take this preferred stock at 60. The American Trust Company of Cleveland is at the head of a syndicate of banks which will underwrite $1,750,000 of the bonds, and it is said that it will form a pool or voting trust, to continue for five years, in the hands of which will be placed the control of the property.

The Appleyard syndicate has asked the State Board of Public Works to consider an application for a lease of the waterpower at Roscoe, where the

Tuscarawas and Walhounding Rivers converge, and form an excellent place for power. In case the lease is made, the syndicate will use the power for generating electricity for its electric lines.

The Toledo, Columbus, Springfield and Cincinnati Traction Company has been granted a 25-year franchise to operate an electric line in the town of Marysville.

The agents of the Bullock Electric Manufacturing Company held a meeting at the offices of the company in Cincinnati last week. They tendered a banquet to their employers one evening, and the menu was made up of the choicest collection of eatables that could be gathered up in the various localities where the gentlemen reside, each one bringing with him an ample supply for the purpose. As they come from all portions of the United States and Canada, this formed a rather unique feast.

The Cincinnati Traction Company is making a large addition to the Hunt Street power house, and will put in seven new 300-horsepower boilers, removing two of the old ones. The plant will be 10,000 horsepower when completed.

F. G. Lette and H. C. Hart are at the head of a movement to build an electric road in Ironton, with branches up and down the river from that point.

It is stated that the Youngstown and Southern Railway Company is ready to award contracts for its line between Lisbon and East Liverpool, and that a contract will be given the Westinghouse people for electrical equipment sufficient to operate heavy freight trains. This will include several electric locomotives.

The stockholders of the Norwalk Electric Light and Gas Company have transferred the property to the Cleveland and Southwestern Railway Company. The owners of both are practically the same people, the Pomeroys and Mandelbaums. O. M. C.

Michigan.

Detroit, February 16.—Work on securing options for the private right-of-way for the Black-Mulkey Detroit-Monroe-Toledo electric line is progressing rapidly.

At a recent meeting of the Common Council of the village of Pentwater, a Chicago syndicate made application for a franchise to operate an electric railroad through the village. The syndicate proposes to build an interurban line from Ludington through Pentwater to Hart. The line will place the fruit belt of Oceana County in direct connection with two good shipping points, Pentwater and Ludington.

At the annual meeting of the Grand Rapids, Holland and Lake Michigan Electric Railway Company at Grand Rapids the following-named directors were elected: B. S. Hanchett, Jr., of Grand Rapids, S. Hendrie of Detroit, L. J. Ringe and Willard Kingsley of Grand Rapids, and W. H. Beach of Holland. B. S. Hanchett was elected president, L. J. Ringe vice-president, S. Hendrie treasurer and manager, and W. H. Beach secretary.

Engineer P. W. Keeting has let contracts for the Trenton electric-lighting-plant building to L. C. Buhl. The plant is expected to be in operation by March 1st.

A large force of workmen is busy finishing up the electrical equipment of the Lansing-St. Johns railway, as the line must be in operation by March 1st, or the franchise will be forfeited.

Two companies have asked Hillsdale for an electric-railway franchise. One company proposes to enter from the east going out west, and is known as the east and west road. This road is projected to run between Hillsdale and Adrian. The other comes in from Bryan, Ohio, on the south, and goes on north to Jackson.

The Greenville Gas, Electric Light, Power and Fuel Company of Greenville, with capital of $150,000, has been incorporated.

At the annual meeting of the Detroit, Ypsilanti, Ann Arbor and Jackson Railroad, J. D. Hawks was elected president, S. F. Angus vice-president and treasurer, and F. D. Hinchman secretary. The condition of the property is such that no large amounts will be required for betterments or equipments. C. G. W.

Southern Developments.

Charlotte, N. C., February 14.—The High Point (N. C.) Electric Company has been incorporated, with $50,000 capital, by W. S. Thompson of Greensboro and others. The plant is now owned by C. M. Richardson.

Thomas McClelland of Jackson, Miss., is at the head of a new company proposing to put in an independent lighting plant.

An amendment to the sundry civil appropriation bill has been adopted in Washington which is of much importance to southern waterpower development. The amendment increases to $200,000 the appropriation for gauging and measuring the water streams of the country. The original appropriation was only $100,000.

Col. T. C. Duncan of Union, S. C., is interested in a big scheme to harness the waterpower of Broad River and bring electric power to Union for commercial purposes.

The Greensboro (N. C.) Electric Company may build a miniature electric railway at Lindsay Park. A complete electric plant for lighting has been installed at Guilford College, near Greensboro.

A movement is on foot at Raleigh, N. C., for a large electrical combination to include the street-railway system, the gas and electric-lighting plant and the big power plant at Milburnie on Neuse River. The combination, it is said, will probably be effected. L.

Northwestern Notations.

Minneapolis, February 14.—The St. Paul City Railway Company has effected a settlement with the city of St. Paul on the suit for damages for electrolysis to the water pipes. The company agrees to repair all damages to water mains caused by return currents and to adopt measures which will prevent further damage and pays the city's costs in prosecuting the case thus far, amounting to about $8,000. The company has employed experts to examine the tracks and ascertain the loss of return current. These experts, with the city's experts, will make additional tests and file a report recommending additional appliances and changes in the system as shall prevent further injury to the mains. If, after the changes are made, the current still escapes, the water board is free to renew its suit for damages.

The Duluth-Superior Traction Company announces that its plans for the coming season include the expenditure of $250,000 in improvements in Duluth and Superior. Most of this will go for rebuilding the tracks and for new cars, etc.

Hord & Keator, who have a franchise for a street-railway line at Mankato, Minn., have been granted a franchise through the county toward St. Peter. They now seek admission to St. Peter, and will build an interurban line between those cities.

The Oelwein and Northwestern Iowa Interurban Street Railway Company has filed articles of incorporation at Oelwein, Iowa, with $200,000 capital stock. The company proposes to build from Oelwein to Points in Fayette and other counties.

The city of Mitchell, S. D., has taken steps toward abrogating a 20-year contract with the electric-light company. It was entered into 13 years ago and gave the company an exclusive franchise and contracted for eight arc lights at $11 a month. Five years ago an attempt was made to break the contract, but without result. Now the council thinks that the service has been so poor that it ought not to be a difficult matter to annul the contract.

A new suit has been filed against the city of Winona, Minn., to prevent the entering into a contract for the construction of a municipal electric-light plant, on the ground that bonds cannot be issued except in violation of the city charter.

The State Electrical Contractors of Minnesota held a semi-annual conference in St. Paul last week. They considered various subjects of interest, and interspersed their sessions with social engagements. A banquet wound up the affair. The next meeting will be held in Minneapolis in July.

A bill to substitute the electric chair for hanging has been offered in the state Legislature of Minnesota.

The La Crosse and Northern Electric Railway Company has been formed at La Crosse, Wis., to build a line to Galesville, Wis. Power will be obtained from Black River, if a bill now in the Legislature, allowing a dam across the river, is passed.

Fertile, Minn., has voted to install an electric-light plant.

The John U. May Electric Railway Company has been formed at Clinton, Iowa, to build an interurban line to Davenport. The company has been working to secure a right-of-way for some time. R.

PERSONAL.

H. T. Paiste of Philadelphia, one of the well-known electrical men of that city, was in Chicago this week on a business trip.

David Lachaine, late of the Montreal Street Railway Company, has been appointed foreman of the Paris Traction Company, France.

W. D. Robb, superintendent of motive power for the Grand Trunk Railroad, has appointed W. D. Hall electrical engineer over the entire system.

President T. J. Carling of the Macon (Ga.) Electric Light and Railway Company, has tendered his resignation, and E. L. Bemiss of Richmond, Va., has been elected to succeed him.

The Employes' Benefit Association of the Seattle Electric Company recently gave a smoker and reception in honor of Howard D. Grant, the new general manager of the company.

William D. Ray announces his association with the Westinghouse Traction Brake Company for representation in the central states, with headquarters at 716 Union Trust Building, Detroit, Mich.

Luke Robinson, who was formerly superintendent of the Montreal Park and Island Railway of Montreal, Que., has been appointed assistant superintendent over the entire Montreal Street Railway and the Montreal Park and Island systems.

Sir George Gabriel Stokes, master of Pembroke College, Cambridge University, and Lucasian professor of mathematics in the same institution, died on February 1st in his 84th year. He was an Irishman and an eminent scientist. He was appointed to his chair of mathematics as far back as 1849. From 1885 until 1890 he was president of the Royal Society, and in 1889 he was created a baronet in recognition of his work in the interest of science. For several years he was a member of Parliament from Cambridge University.

Charles L. Lewis has been appointed superintendent of the newly created district of the Postal Telegraph-cable Company embracing Southern California, Arizona and New Mexico. Mr. Lewis is but 30 years of age, but has been a telegrapher for 16 years. He was promoted from the position of assistant manager of the Postal office in Los Angeles.

Dennis J. Swenie, for 22 years head of the Chicago Fire Department, died on February 16th at the age of 68 years. For the last two years he had been president of the Chicago Fire Appliance Company, agent for Kilfyre, the fire-extinguishing compound, and it is believed that an indirect cause of his death was due to exposure at a demonstration of this compound made on February 7th on an old horse car belonging to the Chicago Union Traction Company.

Several changes in personnel have been made recently on the engineering staff of the New York Central and Hudson River Railroad Company, following the promotion of W. J. Wilgus to fifth vice-president of the company. Mr. Wilgus has been succeeded by H. Fernstrom as chief engineer. V. Spangberg has been appointed designing engineer, vice G. R. Wadsworth, transferred. Arthur J. Slade has received the appointment of mechanical engineer, with office in New York, in charge of the designing and construction of heat, light and power plants, water and fuel supply stations, vice Edwin B. Katte, recently promoted to electrical engineer. John D. Keiley, formerly assistant master mechanic of the Brooklyn Rapid Transit Company and well known for his work in electrical car equipment, has been made assistant electrical engineer.

Colonel Henry G. Prout, so well known from his 16 years' work as editor of the Railroad Gazette, has returned to commercial life, accepting the position of vice-president and general manager of the Union Switch and Signal Company. Colonel Prout's military title was received from his connection with the Egyptian army. He entered that service as major of engineers and was a colonel on the general staff when he resigned after 4½ years' service. He served before that time in the Civil War and was graduated from the University of Michigan in 1871 with the degree of civil engineer. He has had a varied engineering experience and is a member of the American Society of Civil Engineers, Engineers' Club of New York and several other associations. As a technical journalist, he has displayed conspicuous ability and a consistent adherence to dignified ideals.

ELECTRIC LIGHTING.

Dexter, Mich., will vote upon a municipal-lighting proposition on March 8th. The estimated cost of the plant is $8,000. It is thought that the proposition will be carried.

The Morrison Electric Lighting Company of Morrison, Ill., has been incorporated with a capital stock of $40,000 by A. V. Viner, Luther R. Ramsay and Samuel M. McCalmont.

J. W. Cassidy is president of the new light company, incorporated at Quincy, Ill., with a capital stock of $200,000. The company will spend $175,000 in the construction of the plant, and will go into the light and power business on a large scale.

The license committee of the Chicago City Council has recommended for passage an ordinance requiring the elevated railroads of the city to equip their stations with electric signs, one for every 40 feet of platform, stating plainly the name of the street.

A deal has been consummated whereby a syndicate of eastern capitalists headed by W. F. Sheehan of New York has acquired control of the Louisville Electric Light Company and the Citizens' General Electric Company, controlling nearly all the electric-lighting contracts in Louisville, Ky. Nearly $1,000,000 is involved.

J. A. Gaboury, president of the Greenville (Miss.) Light and Car Company, has returned from a business trip to Chicago. He says that arrangements have been completed for the construction at once of a new electric-light plant in Greenville for his company. A new location will be secured, a new building erected and new machinery put in.

Anthony N. Brady and his associates are said to be seriously considering the formation of a holding company to take over and consolidate the Louisville Electric Light Company with the Citizens' Lighting Company of Louisville and also the Louisville Gas Company. It is arranged to consolidate the gas company with the holding company having the management of the two electric-light companies.

ELECTRIC RAILWAYS.

The City Council of Dixon, Ill., has granted a franchise to the Sterling, Dixon and Eastern Electric Railway Company. The franchise protects the interests of Dixon people in every particular, and is for a period of 20 years.

The property of the Albany and Hudson Railway and Power Company was sold at Troy, N. Y., on February 11th, to a representative of the Colonial Trust Company of New York, holder of the mort-

gage of $2,500,000. This sale includes all of the company's property in Columbia and Rensselaer Counties, the gas plant in Hudson, the electric power house at Stuyvesant Falls, Electric Park, and the Hudson Railway. The company had been unable to pay interest since the accident two years ago, in which several lives were lost. The road will be reorganized and continued under new management.

Numerous experiments, so far unsuccessful, have been made with a view to discovering some method of reducing the noise due to the trains on the Berlin electric elevated railway. In one case a length of 100 meters was laid with a layer of felt between the rails and the ties, but the reduction of the noise thereby was insignificant. In another case hollow iron ties filled with sand were tried. This method had, on a small scale, given good results, but in actual practice on the elevated railway proved of little use. In other cases the substitution of longitudinal for cross ties has been tried, as has also the introduction of a lead sole-plate between the rail and the tie. Still another plan under test is the filling in of the car wheels with wood. The problem is, however, still unsolved.

TRADE NEWS.

The H. T. Paiste Company of 3105 Ludlow Street, Philadelphia, is offering $50 in gold until March 10th for the best suggestion of a name for its new "P-K" shade-holder lamp socket. The shade-holder is made inseparable from the socket shell.

At a recent meeting of the directors of the Dickinson Hard Rubber Company, Springfield, Mass., P. M. Taylor was elected general manager and treasurer, succeeding Carl F. Siemon. This company is now doing a large business in insulating blocks, receiver shells, mouthpieces, switch keys and other composition goods, insulating material and specialties for electrical trade.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 16th, for the installation of a conduit and electric-wiring system for the United States postoffice at Wilkesbarre, Pa., in accordance with the drawings and specifications, copies of which may be obtained from the supervising architect, or at the office of the superintendent of construction at Wilkesbarre, Pa.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 19th, for the enlargement, including plumbing, heating apparatus and electric conduits and wiring, of the United States Postoffice, etc., at Minneapolis, Minn., in strict accordance with drawings and specifications, copies of which may be had at Washington, or at the office of the custodian at Minneapolis.

Proposals will be received by the city of Muscatine, Iowa, until March 10th for arc street lighting and commercial lighting. Bids may be made on lamps operated in series and on both alternating and direct current. The successful contractor will be awarded a 10-year franchise. Bids should be addressed to A. K. Roff, city recorder, Muscatine, Iowa.

The Fostoria Incandescent Lamp Company has been awarded a contract by the New York Central and Hudson River Railroad Company for the entire supply of standard and train-lighting lamps of that company, as well as of the Boston and Albany, and various other lines leased and operated by the New York Central. This contract, along with a number of other large ones, such as the treasury contract for all government buildings, etc., seems to indicate that the Fostoria product is at least holding its own, and Sales Manager Geary is to be congratulated. The New York Central order involves about 75,000 lamps.

The Westinghouse Machine Company says that, although upon the market less than four years, there is already in successful operation 4,000 kilowatts of steam-turbine machinery and 75,000 kilowatts have been contracted for. A new turbine-building shop has recently been put into service by the company mentioned. The steam-turbine equipment of the Hartford (Conn.) Electric Light Company is to be duplicated. The present Corliss-engine equipment will be replaced by two 1,000-horsepower turbines, direct-connected to revolving-field polyphase generators. These units will operate in parallel with the 1,500-kilowatt unit installed one year ago. The turbine plant will operate upon superheated steam, with 150 pounds pressure and a high vacuum.

The Allis-Chalmers Company will on May 1st remove its general offices from the present location in the Home Insurance Building to the New York Life Building, corner of La Salle and Monroe Streets, Chicago. This move is another indication of the progressive spirit which prevails in the management of this strong industrial. The company has for the last two years been expending large sums of money in betterments at its various works in Milwaukee, Chicago and Scranton, so as to give its customers the best possible service in point of economy and quick deliveries. The new offices of the Allis-Chalmers Company will provide ample space for the various sales departments and general business offices. During the last two months orders for either engines, mining machinery, rock-crushing machinery, sawmill machinery or flour-mill machinery were booked from England, South Africa, Mexico, Canada, Chile, Central America, Brazil, West Australia, Turkey, Finland, Yukon Territory, Belgium, British Columbia, Bolivia, Hawaiian Islands, Peru, Alaska, China and Philippine Islands.

BUSINESS.

The Beardslee Chandelier Manufacturing Company of 253 and 255 S. Canal Street, Chicago, has among other contracts now under way the furnishing of the gas and electric-lighting fixtures for the new Carnegie Library at Greencastle, Ind., which it is furnishing through the Greencastle Electric Light Company. It also has the contract for manufacturing the fixtures for the Decatur Plumbing and Heating Company of Decatur, Ill., for the new library building at that place. The company is getting out some new and tasty designs for its spring trade.

The Reynolds Electric Flasher Manufacturing Company, 221 Fifth Avenue, Chicago, manufacturer of the improved Reynolds flasher for flashing electric signs, etc., reports a large business during the last month. This flasher is driven with the smallest type of electric motor and operates automatically. It is made of very few parts, and the liability of its getting out of order is slight. The Reynolds company has placed its device in all parts of the country, and as the number of electric signs is constantly increasing new adaptations are constantly presenting themselves.

Among the engine sales of the Allis-Chalmers Company for January were the following: St. Louis and Suburban Railway Company, St. Louis, Mo., one 30 and 50 by 60 cross-compound Reynolds-Corliss engine and two 32 by 60 cylinders; Hunter Milling Company, Wellington, Kan., one 16 and 30 by 42 cross-compound horizontal engine; Gunther Foundry, Machine and Supply Company (for Alamo Cement Works), San Antonio, Texas, one 20 by 42 girder-frame, horizontal engine, with boiler and heater; William H. Patterson, Smithville, Mo., one 12 by 30 girder-frame horizontal engine, with boiler and heater; W. S. Typer Company, Cleveland, Ohio, one 22 and 36 by 42 vertical cross-compound engine; E. H. Dyer & Co., Cleveland, Ohio, two 10 by 30, two 14 by 36 and two 12 by 30 1890 engines; Georgia Iron and Coal Company, Chattanooga, Tenn., one 44 and 84 by 60 long-crosshead blowing engine; United Engineering and Contracting Company (for Imperial Hotel), New York, two 18 by 42 1890 horizontal engines; Penn Allen Portland Cement Company, Allentown, Pa., one 20 and 40 by 42 cross-compound Corliss engine, one 14 by 36, one 12 by 30 and one 18 and 36 by 42 cross-compound engine.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 10, 1903.

719,983. Electric Railway. Frank M. Ashley, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 26, 1898.

Means for automatically changing the connection of a load from one source of current to another when the strength of the first source diminishes are described.

719,984. Electric Railway. Frank M. Ashley, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 26, 1898.

The system consists of a feeder, a sectional service or working conductor, the sections of which are normally disconnected from the feeder, switches for closing the connection between the respective sections of the working conductor and the feeder, magnet armatures mechanically connected with the switches, an electromagnet carried by the car having a continuous polar face adapted to attract two successive armatures simultaneously, and two sets of batteries carried by the car adapted to be connected alternately to the actuating coil of the electromagnet and the main source of current supply, whereby the magnet can be energized when the working conductor is disconnected from the feeder. (See cut.)

719,987. Guard for Speech Receivers or Transmitters. Samuel J. Ballard, Los Angeles, Cal., assignor of three-fourths to Calvin W. Brown, Los Angeles, Cal. Application filed July 2, 1901.

A leaf-holder is described.

719,991. Electric Controller. Roy W. Brown, Chicago, Ill. Application filed August 30, 1902.

In the controller are a number of resistance bodies connected to an electric circuit, a number of contacts connected to the resistance bodies, a number of switches for shunting the resistance bodies, and a manual means for operating one upon each successive movement of the means.

719,998. Telephone System. Edward E. Clement, Philadelphia, Pa. Application filed June 4, 1901.

In the signaling system described are two stations and a connecting circuit between them, a responsive device at one station and a source of current at the other, a sensitive resistance device at the first station normally holding the responsive device out of operative connection with the circuit, and a source of energy at the second station to alter the condition of the resistance device to bring the magnetic device into operative connection with the circuit, and to operate the same.

719,999. Signaling Apparatus and System. Edward E. Clement, Philadelphia, Pa. Application filed June 13, 1901.

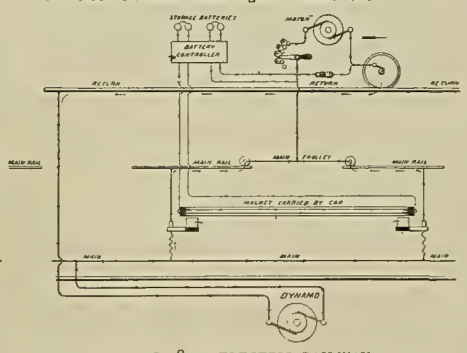
One claim reads: In a signaling system, a transmitting and receiving station, a line circuit interconnecting them and having two branches, a coherer in one branch, a self-induction in the other branch, a source of current, and a signal connected to the line, together with means to produce variations in the current on the line, such variations passing to and lowering the resistance of the coherer, to permit the actuation of the signal device. (See cut.)

720,004. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed March 18, 1901.

See page 147.

720,020. Medicinal Battery. Fred Grimshaw, Northeast, Pa. Application filed July 10, 1901.

The battery comprises a box, an electric coil and a battery arranged within the box, a removable cover on the box, plates arranged on the cover of the box and insulated from each other, and an electrical connection between the plates and the battery arranged to permit the opening of the cover without breaking the connection.



NO. 719,984.—ELECTRIC RAILWAY.

720,023. Electric Cable. Roderic F. Hall, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed March 10, 1902.

Twisted wires constituting a pair of conductors are combined with the paper strip having a backing inclosing the wires to prevent their separation, and a separating piece formed in loops and attached to the backing, the edges of the paper forming the loops being interposed between the conductors to maintain the wires at a uniform distance apart, while affording air-spaces between them.

720,024. Electric Furnace. John F. Hammond, New York, N. Y. Application filed February 1, 1902.

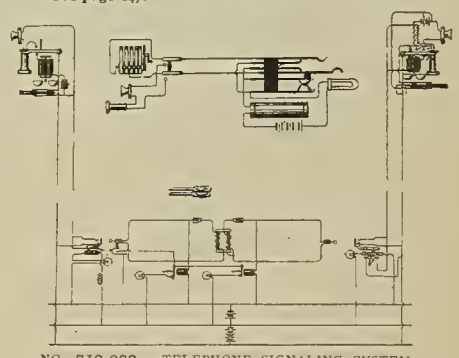
In the furnace are a turn-post, curved plates attached to the turn-post and forming electrical terminals, and means whereby constant electrical contact is made with the plates and the rest of the circuit.

720,029. Controller for Electric Motors. Otto Holz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 4, 1901.

The controller is provided with a rotatable contact-carrying member and a series of fixed contact fingers for engagement therewith, a blow-out coil common to a number of the fingers, and a movable member for supporting the coil in close proximity to the contact fingers.

720,068. Art of Communicating Language for Deaf Mutes and Blind Mutes. Jacob Reese, Sharonhill, Pa. Application filed August 11, 1902.

See page 147.



NO. 719,999.—TELEPHONE SIGNALING SYSTEM.

720,073. Electrical Fuse Head and Fuse. Nikolaus Schmitt, Kupperstey, and Johann Krannichfeldt, Cologne, Germany. Application filed September 10, 1900.

The fuse comprises a short, thin, flat and flexible strip of non-conductive material, a short, thin, flat and flexible strip of conductive material attached to each face of and carried by the non-conductive strip and a mass of priming composition connecting the two conductive surfaces.

720,076. Attachment for Range Finders. Robert J. Sheehy, New York, N. Y. Application filed December 21, 1899. Renewed June 7, 1902.

An indicating element is adapted to be moved in two directions by electromagnets.

720,082. Magneto Bell. Chester H. Thordardson, Chicago, Ill. Application filed March 8, 1902.

The bell combines with electromagnets and the permanent magnet, a supporting plate having lugs or ears, an armature pivotally supported upon the plate between the

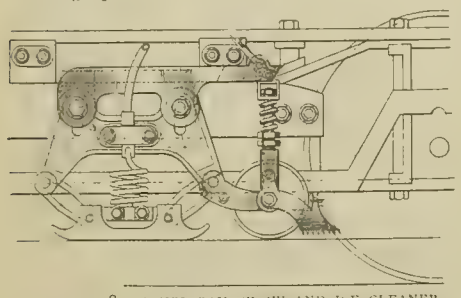
lugs, an internally threaded supporting stem for the plate and an adjusting split screw tapped into the threaded end of the support.

720,085. Telephone Transmitter. Frank S. Tucker, Boston, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed July 5, 1902.

The transmitter has a casing with an upturned part adapted to support a diaphragm, a groove upon the upturned part of the casing, a bridge-piece having its extremities adapted to slide in the groove, a slot in the upturned part to admit one end of the bridge to the groove, a diaphragm resting in the casing, a carbon receptacle retained between the diaphragm and bridge-piece, and means to hold the diaphragm in position.

720,087. Electric Fuse Box. Tycho Van Aller, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 1, 1901.

The box contains a fuse having a part of its length of relatively small heat-dissipating capacity, and a chamber around this part in communication with a part extending over a discharge vent, the latter being slower to heat, whereby pressure is delivered to cut the fuse at the discharge opening.



NO. 720,208.—THIRD-RAIL SNOW AND ICE CLEANER.

720,093. Coil for Electrical Apparatus. Edward L. Aiken, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed December 5, 1898. Divided and this application filed January 31, 1901.

A helical electromagnet coil has turns of large cross-sectional area, the turns being separated from each other by spaces just sufficient to maintain them out of contact, whereby the coil produces a greater magnetizing effect than a coil having its turns separated by spaces of considerable extent.

720,095. Automatic Regulator for X-ray Tubes. William S. Andrews, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 5, 1897.

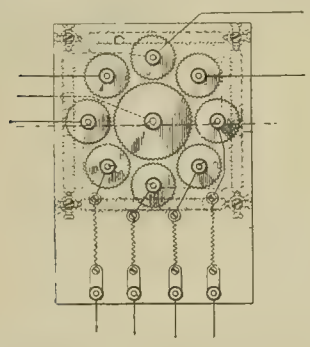
An adjustable vacuum tube has a chemical bulb, with an electric heating device suitable for high potentials connected in a shunt circuit around the tube and consisting of a number of conductors supported by insulating material in series-circuit relation, and insulated from one another by short air-gaps, the heating device serving to heat the chemical bulb.

720,103. Telephone-protecting Device. George R. Bonham, Empire Prairie, Mo. Application filed May 6, 1902.

The device comprises a socket member secured to and supported by the main line wire, a local wire connected to the telephone or other instrument within the building, a spring clip secured to the local wire and adapted to engage in the socket, and a flexible cord secured at one end to the clip and extending within the building.

720,152. Commutator Meter. John F. Kelly, Pittsfield, Mass. Application filed October 19, 1901.

In the meter are combined a field-energizing coil in series with the mains carrying the current to be measured, an armature having a number of armature coils with separate terminals and located in a shunt to the mains, a commutator having less than six segments, the segments being at the angles of a polygon and having their contact surfaces separated from each other by spaces several times as great as the width of each segment, each segment being connected to but one armature-coil terminal, and a brush wiping over the angles formed by the segments.



NO. 720,226.—LIGHTNING ARRESTER.

720,156. Magnetic Separator. John Kirschweng, Butte, Mont. Application filed August 17, 1901.

The separator comprises a chute, an electromagnet, an electric switch, and a swinging arm pivoted above the chute, its upper end being adapted to operate the switch and its lower end consisting of a separate piece hinged to the upper end and held normally in alignment therewith, the arm being so arranged that its lower end may be actuated by accumulating material, whereby when the chute becomes choked the circuit is closed to give an alarm, the alarm being absolutely continuous and without intermittence.

720,184. Insulator. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 28, 1900.

A hollow cylinder of insulating material is provided with a shoulder and with screw-threads, in combination with a ring adapted to engage with the screw-threads, and means in addition to the screw-threads for rigidly securing the ring into the position to which it may have been screwed.

720,186. Apparatus for Electro-endosmotically Freeing Materials from Fluids. Botho Schwerin, Berlin, Germany. Application filed April 24, 1902.

In the apparatus are combined with a source of electricity, a series of superposed positive electrodes which is movable up and down in its entireness and of which each member is movable individually, and a series of pervious negative electrodes for supporting the material to be treated, the members of the negative series being removably arranged between the members of the positive series.

720,208. Mechanism for Removing Ice and Snow from the Conducting or Third Rail of Electric Railways. Frederick V. Winters, New York, N. Y., assignor of one-half to John Scott McWhirter, New York, N. Y. Application filed August 5, 1902.

The snow and ice cleaner comprises horizontally arranged and pivotally supported arms, a crushing wheel journaled in the free ends of the horizontal arms, and a spring-pressing device to hold the crushing wheel down on the third rail. (See cut.)

720,226. Lightning Arrester. John P. Coleman, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 1, 1902.

In the arrester are combined one or more serrated electrodes for each conductor protected, arranged so that at least one electrode of each conductor lies adjacent to an electrode of one of the other conductors, and a serrated electrode connected to earth and arranged in juxtaposition to all the other electrodes. (See cut.)

720,233. Receiving Tape for Chemical Telegraphs. Patrick B. Delany, South Orange, N. J. Application filed May 29, 1902.

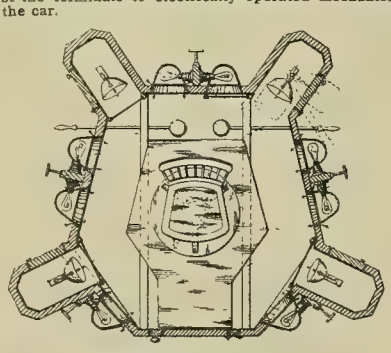
A recording tape for chemical telegraphs has regularly arranged corrugations.

720,235. Process of Recovering and Separating Metals from their Ores. Hans A. Frasch, Hamilton, Canada. Application filed November 2, 1900.

The method consists in providing an electrolytic bath with a soluble anode composed of comminuted ore bearing the metals to be obtained, circulating successively through a series of such anodes an electrolyte capable of dissolving the metals contained therein, and simultaneously circulating the electrolyte obtained from the whole series of anodes past the cathodes of one or more baths and thereupon depositing the least positive metal, keeping the other metals in solution.

720,273. Electric Railway. Thomas E. Murray and John Van Vleck, New York, N. Y. Application filed November 22, 1901.

In the railway are a track, a number of fixed circuit terminals in proximity thereto, a car adapted to travel on the track and a circuit-closer on the car adjustable to make contact with and so close circuit through any one of the terminals to electrically operated mechanism on the car.



NO. 720,357.—RADIANT HEAT BATH.

720,305. Current Regulator. James J. Wood, Fort Wayne, Ind. Application filed December 14, 1901.

The regulator comprises a coil and a core movable relatively to each other, combined with a movable member of the regulator, a counterbalance therefor arranged to move in substantially the same vertical line therewith, and a differential connection between the movable member and the counterbalance adapted in operation to vary the tendency of the movable member to separate from its complementary member so that the same shall increase progressively as the regulator departs from the position of maximum load.

720,306. Globe-holder for Arc Lamps, etc. James J. Wood, Fort Wayne, Ind. Application filed February 25, 1902.

The holder has a pendent portion for receiving the neck of the globe, and the globe has a neck fitting loosely within the portion. Means for suspending the globe from the holder comprise devices for exerting an inward pressure against the globe to hold it, and equalizing springs bearing at their ends against the neck of the globe, and loosely swiveled to such devices for yieldingly transmitting their pressure to the globe.

720,307. Armature Band. James J. Wood, Fort Wayne, Ind. Application filed February 26, 1902.

The band comprises a flat metal strip having ends aligned with each other and having symmetrical shoulders, and a locking member symmetrical with the strip and having corresponding shoulders engaging the shoulders on the strip to hold the ends together.

720,308. Armature-banding Device. James J. Wood, Fort Wayne, Ind. Original application filed February 26, 1902. Divided and this application filed July 12, 1902.

A device for applying armature bands is described.

720,312. Electric Arc Lamp. Henry Baggett, London, England. Application filed November 22, 1902.

A feed clutch for the carbon comprises two superimposed vertically movable members connected or hinged together by an elastic piece so that they may be opened and closed vertically on each other, the clutch members being adapted to engage the carbon loosely when closed on each other and when open to grip the carbon.

720,321. Secondary Battery. Frank Buchanan, Dayton, Ohio. Application filed March 18, 1901.

The electrodes consist of three or more concentric tubular lead electrodes, and are separate and disconnected, so that each containing electrode separates the solution from the next adjacent outer electrode, the outermost one of such tubular electrodes forming the main containing cell and constituting an electrode of single polarity.

720,326. Process of Preparing Storage-battery Plates. Rufus N. Chamberlain, New York, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed March 3, 1899.

The process consists in cleaning the plates by exposing them successively to electrolytic action as anodes in a solution capable of dissolving lead, thereby cleaning and roughening the plates and producing a solution of lead, redepositing the dissolved lead on a cathode, and removing the anode plates when properly cleansed and roughened and forming them.

720,327. Electric Switch. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed April 16, 1902.

Combined with an electric circuit are a switch connected thereto and having contacts adapted to break connection with the circuit dissimultaneously, and a dynamo-electric generator of counter electromotive force connected between such switch contacts.

720,333. Trolley and Brake for Aerial Railways. Martin J. Doner, St. Louis, Mo., assignor of one-half to John J. Dunnavant, St. Louis, Mo. Application filed August 18, 1902.

Combined with a carriage of the character named having a track wheel are a brake shoe adapted to be thrown into bearing with the track wheel, a brake lever arm, and a pull member suspended from the lever arm.

720,335. Means for Measuring Electric Currents. George N. Eastman, Chicago, Ill., assignor of one-half to Edward Schildhauer, Chicago, Ill. Application filed June 20, 1902.

Combined with the conductor carrying the current to be measured are a potential-indicating instrument and a high-resistance conductor forming a high-resistance shunt to the first-mentioned conductor, and including the potential-indicating instrument, the resistance of the high-resistance conductor being relatively great as compared with that of the instrument, and the conductor being closely associated with the current-carrying conductor.

720,350. System of Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to Charles M. Gould, Bayside, Long Island, N. Y. Application filed December 17, 1901.

For this and two succeeding patents see page 148.

720,351. System of Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to Charles M. Gould, Bayside, Long Island, N. Y. Application filed January 14, 1902.

720,352. Self-regulating System of Electrical Distribution. Albert S. Hubbard, Greenwich, Conn., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed September 19, 1902.

720,357. Radiant-heat Bath. Martin Joachimson, New York, N. Y., assignor of one-half to Sophie Rothschild, New York, N. Y. Application filed February 18, 1902.

A chamber has arc-lamps in extensions, and incandescent lamps are arranged at the outside of the chamber opposite openings. Pivoted mirrors are adapted to cut off the light from either the arc or incandescent lights at will. (See cut.)

720,475. Clip for Electrical Knife Switches. Clarence D. Platt, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed December 9, 1902.

The clip consists of a pair of plates riveted together at their middle and having at one end parts to receive the knife-blade, and at the other end angular jaws to embrace and grip an angular block for the wire connection.

720,483. Electromedical Apparatus. Granville S. Rider, New York, N. Y., assignor to Herbert E. Rider, New York, N. Y. Application filed April 17, 1902.

In the apparatus are combined a source of electric current of low electromotive force, electrodes connected thereto and adapted to make contact with a body, a periodically operated current-reverser interposed in the circuit between the electrodes and source of electric current, and means for maintaining an earth connection from the body.

720,508. Electrical Ship's Log Apparatus. Thomas F. Walker and Thomas S. Walker, Birmingham, England. Application filed January 25, 1902.

In the mechanism are a continuously rotating member, an impelled member rotating at intervals, an intermediately connecting spring, a detent device acting intermittently to restrain the rotative movement normally imparted by the continuously rotating member to the impelled member, and a making-and-breaking electrical contact device forming part of the impelled member and having a rotative contacting surface positioned in a plane at right angles to the axial line of rotation of the intermittently impelled member.

720,511. Drum Armature. Herbert A. Balcome, Jamaica Plain, Mass., assignor to the B. F. Sturtevant Company, Boston, Mass. Application filed April 23, 1902.

The armature has a core and a winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the ends of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils.

720,541. Chime-ringing Device. Hermann A. Wende, Buffalo, N. Y. Application filed August 1, 1901.

In the mechanism are a series of independent actuating levers having connection with chime-strikers, electrically controlled locking and releasing mechanism for the levers, a tappet-shaft, tappet-arms carried by the shaft, and means for moving the ends of the actuating levers, laterally into the line of movement of the tappet-arms.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, FEBRUARY 28, 1903 No. 9

Washington University Heat, Light and Power Plant.

Washington University, St. Louis, now located in several buildings scattered about the city, will, in 1905, come into possession of a magnificent group of 11 buildings already erected, or soon to be completed, on the new site, facing Forest Park, in the western part of the city. It is the purpose of this article to describe briefly the comprehensive scheme for lighting and heating this splendid equipment, devised and installed under the personal direction of Professor J. H. Kinealy, well known as an authority on the subject of heating and ventilating.

It may be of interest to the many readers of the Western Electrician who have seen or who will visit, in 1904, the Administration Building at the World's Fair, to know that the exposition authorities have leased all of the buildings on the new site for exposition use, and as a result, the administrative officials are installed in a building far more comfortable and perfect in every way than that housing the officials of any other exposition.

The buildings are uniform in style, the architecture being that of the Tudor Gothic period, red Missouri granite and Bedford stone being used entirely. University Hall, now known as the "Administration Building," stands upon a slight elevation, and the substantial and beautiful construction is well shown in the view (Fig. 3) on page 166.

The buildings form an immense quadrangle, a quarter of a mile wide and twice as long, and it is readily seen that the problem of heating the entire university from one central plant is not an easy one. The entire system, as devised and installed by Professor Kinealy, presented so many new and radical departures from the accepted standards, that the formal opening and test was viewed by a considerable number of professional men who had predicted failure.

The use of ventilating fans driven by induction motors presents an interesting problem for the electrical engineer, inasmuch, as there is a heavy lamp load on the same machines, but this, as well as the ventilating problem, has been admirably solved.

Figs. 1 and 2 show the steam and electrical equipment in the power house, located some 800 feet from the Administration Building, on the Colorado Railroad, and Fig. 4 gives a glimpse of the subway in which are carried the various feeder and pipe lines. This subway is 626 feet long, built of brick, and carries the following: Six lighting and power feeders, one 16-inch steam pipe, one six-inch return pipe, one six-inch water main, one two-inch exhaust pipe and one one-half-inch air line for thermostats.

The boiler room (Fig. 2) contains five Wangler fire-tube boilers, rated at 150 horsepower each, with space for two more of the same capacity. These boilers are 18 feet long, 66 inches in diameter, and contain 60 four-inch tubes, furnishing steam at 95 pounds pressure. The grate area is 30 square feet. The coal is fired by hand—a mine-run Brazil block being used. Two Sturtevant fans and engines of 10 horsepower each, elevated in front of the boilers, as shown in Fig. 2, furnish a two-inch draft. The stack is of steel, five feet in diameter and 18 feet high. A Cochrane feed-water heater, having a capacity of 600 gallons an hour, takes water from the drip return and delivers it to the boilers at 210° F.

Heaters in the various buildings are supplied with steam from the engine exhausts and through a seven-inch reducing valve from the boilers, the condensed steam being returned to the heaters through a six-inch main, to be evaporated again in the boilers. In this way, except to replace loss due to leakage, no water is added to the system from the city mains, after it is once in operation.

Two Deane duplex feed pumps, five by six by 7½ inches, are connected in duplicate, so as to prevent interruption to service. A 12-inch header extends across the boilers and delivers steam to a 16-inch main header in the engine room, from which three seven-inch taps are taken off to supply the engines. In such a system, with over a mile of steam piping, the condensation and loss of heat from radiation would be excessive unless the pipe is carefully lagged, and Figs. 1, 2 and 4 show the attention paid to this important detail.

The three generating units consist of General Electric generators, direct-connected to Ideal 15 by 14-inch engines, running at 260 revolutions per minute. The generators have a capacity of 90 kilowatts each and deliver two-phase current at 600 volts and 60 cycles. The revolving fields consist of 28 poles, and are supplied with current from five-kilowatt exciters, geared to the generator shafts, and running at 900 revolutions. Fig. 1 is a general view in the engine room.

Owing to the fact that both arc and incandescent lamps and induction motors are operated from one machine, a special winding was devised to meet the requirements, the operation of which is as follows: The main-line current is passed through a series transformer, the secondary of which is tapped into the armature winding of the exciter at points which have the proper phase relations. The exciter armature is geared to the main shaft so that it runs in synchronism with the alternator. If the main current is a lagging one, a lagging current is therefore introduced into the exciter armature, thereby strengthening the exciter field, and thus raising its voltage and the current delivered to the field coils of the alternator, and therefore finally raising the terminal alternating-current voltage.

This arrangement gives satisfaction, and, except when the motors are being stopped or started, the incandescent lamps throughout the building burn without fluctuation, whatever the proportion of inductive and non-inductive load.

Marble is the material used for the switchboard, which consists of six sections—three generator panels, one load panel, a light and a power panel. The generator panels are equipped with two Thomson ammeters, a voltmeter, synchronizing and ground-detector plugs and the usual generator and exciter switches. The load panel contains an ammeter and voltmeter for each phase, and, together with the

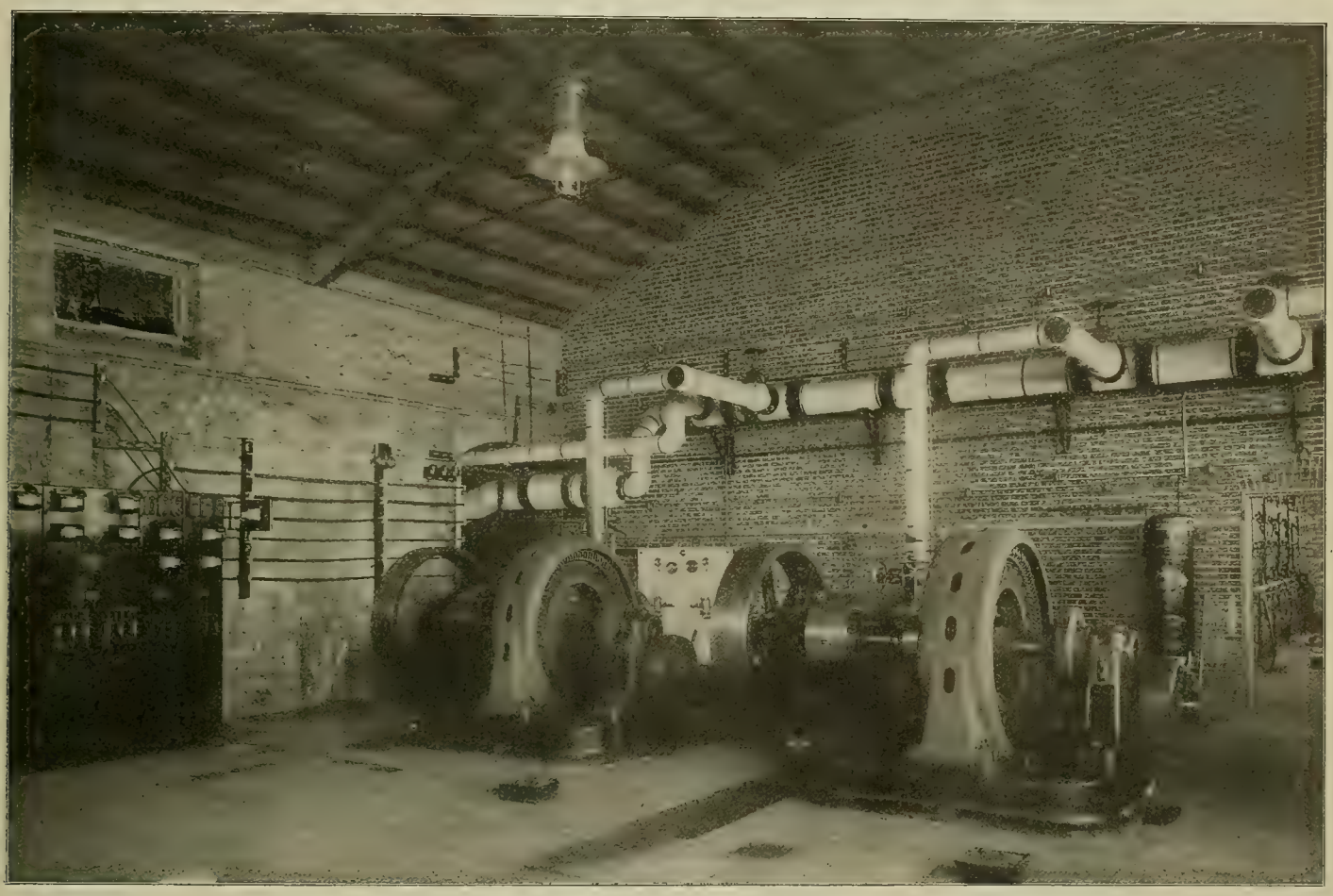


FIG. 1. WASHINGTON UNIVERSITY HEAT, LIGHT AND POWER PLANT.—GENERAL VIEW IN ENGINE ROOM.

power and lighting panels, is equipped with switches so arranged that one generator may be thrown on the motor circuit and another on the lighting line, or the two may be synchronized and carry both loads together.

From the switchboard the feeder lines are conveyed through the tunnel to the distributing points in the several buildings. These feeders are as follows: For light, one of 100,000 circular mils, and two of 300,000 circular mils for power, one of No. 000 and two of No. 00. There are, altogether, over 15,000 feet of these main feeders installed in subways.

FIG. 3. UNIVERSITY HALL, WASHINGTON UNIVERSITY.

Nine two-phase induction motors belted to fans are now in use, as follows: Busch Hall, four motors of five horsepower each; University Hall, two motors of 15 horsepower each; Cupples Hall, No. 1, one motor of 15 horsepower; Cupples Hall, No. 2, one motor of 15 horsepower; Laboratory, one motor of 7½ horsepower. These motors take current direct from the line, while the lamps are supplied by four transformers of 7½ kilowatts each, four transformers of 12½ kilowatts each, two transformers of 15 kilowatts each and two transformers of 25 kilowatts each. The transformers are of the General Electric make, oil-cooled.

Sturtevant fans, varying from three feet to nine feet in diameter and running at 120 and 210 revolutions per minute are used for ventilating, the fans being so selected and grouped as to deliver to each room an amount of air equivalent to 2,000 cubic feet per hour per person.

The Johnson system of heat regulation is used, involving pneumatic thermostats, the operation of which is as follows: The rooms are divided into groups of three or four each, with a thermostat in one room of each group. When the temperature of the air in a room rises above 72° a lever built up of two strips of brass and steel becomes warped, and opens a valve controlling a compressed-air pipe, leading to a regulating damper near the fan. This damper, acting on the cold-air inlet, varies the temperature of the air passing into the fans, and the result is that very close regulation is obtained. The heaters over which the air passes have heating surfaces varying from 36 to 120 square feet. It is a fact worthy of note that this equipment will, in zero weather, bring the entire 600 rooms to a temperature of 72° in less than an hour, and Mr. Blume, the engineer in charge of the plant, gives the following interesting statement bearing on this point:

FIG. 4. WASHINGTON UNIVERSITY POWER PLANT.—TUNNEL FOR PIPES AND WIRES.

"February 2d last was a very mild day, and less than one-third of the heating surface of the plant was in use. In some places the heat was cut out altogether in the afternoon, and as the fans do not run longer than 6 p. m., no heat enters the building after that time until 7 a. m. the next day. At midnight of the above date a cold wave swept over St. Louis, and I found the temperature at 18° above at 7 a. m. of the 3d of February, with the entire heating plant set for 60°. At 6:45 a. m. the engines were started, and five minutes later the nine motors driving the fans were in motion. At 7:30 a. m., 40 minutes after starting, the heat to the rooms with eastern and southern exposure could be reduced 33 1-3 per cent, and 22 minutes later every thermostat was shown to work at 70° and called for cold air—a triumph for the man who designed and laid out the plant."

FIG. 2. WASHINGTON UNIVERSITY POWER PLANT.—BOILER ROOM.

Electric Railway to Yosemite Valley.

Herschel F. La Motte, who is promoting the construction of the proposed electric road from Chinese Station, through Groveland, Cal., from Big Oak Flat to the edge of Yosemite Valley, says that the supervisors of Tuolumne County have granted his petition that the franchise of his proposed electric road be offered for sale. When the road is finished the shortest and most expeditious road to the valley will be from Stockton to Oakdale, over the Southern Pacific, thence to Chinese Station, over the Sierra Road, then over the electric road to its terminus, whence buses will take the tourists into the valley. If the government does not give the company a franchise to run a railroad through the park, it will be given a right-of-way by the owners of the timber land, which extends from the western boundary line some distance beyond Crocker's Station. This will bring the road within easy driving distance of the valley and will give facilities to market some fine timber. The capital is ready and as soon as a franchise is secured, a company will be organized and work will be commenced.

Electricity Direct from Coal.

James Swinburne, president of the Institution of Electrical Engineers of Great Britain, is incredulous of success with the coal battery. In a recent address he said: "For many years 'electrical energy direct from coal' has been the dream of the electrochemist. That is to say, he has dreamed of an electrolytic cell in which the consumed electrode is carbon. The best way to realize the difficulties of this problem is to consider it solved and see what it means. The carbon must be in contact with an electrolyte, and that electrolyte must either be in contact with a second electrolyte, which wets the other electrode, or must itself be in contact with that electrode. This second electrode must almost certainly be metal, as there are no other non-metallic conductors available. The electrolyte in contact with the carbon must be a salt of carbon or must contain a salt of carbon, or it must contain another salt whose positive radicle can be replaced by carbon. Such compounds as the hydrates, nitride, oxides, chloride, bromide, or the sulphide, or silicide of carbon, are not salts in the electrolytic sense. Carbon forms part of the electro-positive radicle in the organic radicles, and part of the electro-negative radicle in the cyanogen compounds, but it is never a radicle by itself. To sum up the matter shortly in the light of modern theory, carbon never forms ions, and has therefore no solution pressure, and can therefore give no electromotive force. At ordinary or moderate temperatures carbon is practically inert. Oxidizing agents will attack some forms slightly, and sulphuric acid will attack it. In this latter case the formation of water and its combination with the acid is the determining factor. At high temperatures, oxygen, sulphur, silicon, and, to some extent, nitrogen, and many of the metals, combine with carbon, but there is no dissociable salt of carbon formed. The carbon cell thus seems impossible. Such schemes as Mr. Reed's, ingenious as it is, is not a solution of the problem. It would be simpler to reduce the zinc oxide with the carbon, and then put it in a zinc cell."

More Stanley Talk.

Under date of February 20th the Boston correspondent of the Western Electrician writes: "The sale of the Stanley Electric Manufacturing Company of Pittsfield, Mass., to a syndicate of New York capitalists affiliated with the General Electric Company has been consummated. The sale includes the Northern Electrical Manufacturing Company of Madison, Wis., whose plant was owned by the Stanley Company. The Canadian patents covering the Stanley generator and other apparatus were also included. It is stated that the Stanley company will continue to compete with all large electric companies, including the General Electric and Westinghouse, the new purchasers to organize under the same name within a week. The Stanley company is to equip electrically a steam railroad 50 miles long and will manufacture steam-turbine apparatus."

McElroy Electric-lighting Systems.

James F. McElroy of Albany, N. Y., has invented recently several electric-lighting systems, with various modifications, some of them being adapted for railroad-train lighting, which are covered by a series of United States patents. One of these inventions pertains to an apparatus for controlling and regulating the transmission of electricity from a dynamo or storage battery to a lamp or other working circuit. Its objects are, first, to control automatically the electricity transmitted from a dynamo to a lamp or other working circuit in such manner that the voltage delivered to the working circuit shall remain

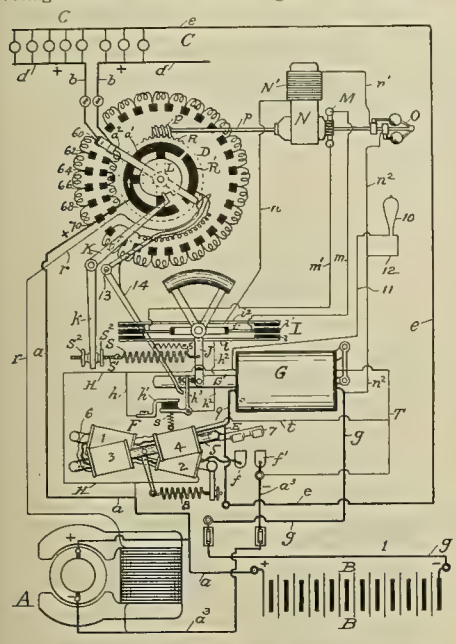


FIG. 1. M'ELROY ELECTRIC-LIGHTING SYSTEM.

constant, that delivered to the battery being higher than that delivered to the lamps; second, to provide a means for automatically regulating the flow of electricity from the dynamo to the lamp circuit in such a manner that when resistance is thrown in the rheostat arm will operate step by step and be held positively in position at each step, maintaining a constant flow of electricity to the working circuit at all times so long as the number of lamps therein and the charging current delivered to the battery remains unchanged; third, devices for supplying electricity to a working circuit from a dynamo and storage battery so arranged and connected up that as long as the dynamo generates sufficient voltage to do so it will both charge the storage battery and transmit a constant voltage to the working circuit. When the voltage of the dynamo falls below that of the battery, the dynamo is open-circuited and the storage battery maintains the constant-voltage supply to the working circuit. These objects are obtained by means of suitable mechanism, of which one form is illustrated diagrammatically in Fig. 1. Among the parts indicated are the dynamo (A), storage battery (B), lamp or working circuit (C), automatic series switch (F), potential solenoid (G), current-breaker (h'), current-director (I), rheostat (D), motor (N) to operate the rheostat-arm (a2), governor (O).

The operation of the regulating device is described by the inventor as follows: "I arrange a dynamo adapted when running normally to furnish 70 volts, for instance. I wish to supply a constant voltage to the lamp circuit of 60 volts and a charging voltage of 70 to the battery. The current will flow from the positive pole of the dynamo when the main switch is closed directly to the storage battery, charging the battery, and at the same time will flow to the rheostat contacts, and when the parts are in starting condition (shown in the drawing) to the plate (a') of the rheostat and the arm (a2) and to the lamp circuit. The potential solenoid (G), which is in shunt between the mains of the dynamo, will, when the speed at starting is sufficient to give the dynamo the lamp voltage—say, 60 volts—draw the plunger, allow contact to be made by the current-breaker (h'), cause the middle portions (i') of the current-director to meet their adjacent contacts, and operate the motor, which will throw in resistance by causing the arm (a2) of the rheostat to move to the next position (denominated 62). There will still be delivered to the working circuit 60 volts. The position of the plunger will be held positive, being regulated by the bell-crank lever arm (K) on the inclined edge of the plate (L), which adjusts the tension of spring (S), so that magnet (G) will only respond to 62 volts. When the dynamo picks up, so as to increase the voltage, the arm (a2) of the rheostat will move to (64), and the position of the plunger will be regulated as before, a constant supply of 60 volts being furnished the working circuit. This will continue until the rheostat arm has passed the 70-volt position, when further movement of the rheostat arm (a2) will throw in resistance in series with the field coils and prevent further rise of the voltage of the dynamo. When the speed of the dynamo decreases it is apparent that the operation of the motor will be reversed until the rheostat arm reaches the position shown in the drawing, denominated (60), when the switch will be opened and the storage battery will directly furnish the power for the working circuit.

"When the operation of charging a depleted battery begins, the voltage of the charging current drops to 58 volts with a flow of 20 amperes into the battery. As the charging operation continues the voltage continues to rise until it reaches 70 volts, when the battery is fully charged and the current flow to the battery drops to about eight amperes. At all stages of charging the rate of flow is maintained at the exact rate as prescribed by the battery makers for charging their batteries. With my apparatus this is done automatically, and in accordance with the ordinary working of the apparatus I have found in practice that with my apparatus, which thus regulates automatically the charging of the battery, as well as the flow to the working circuit, the life of the battery is materially prolonged and that I am absolutely free from the difficulties with batteries which others are subject to who use a regulator

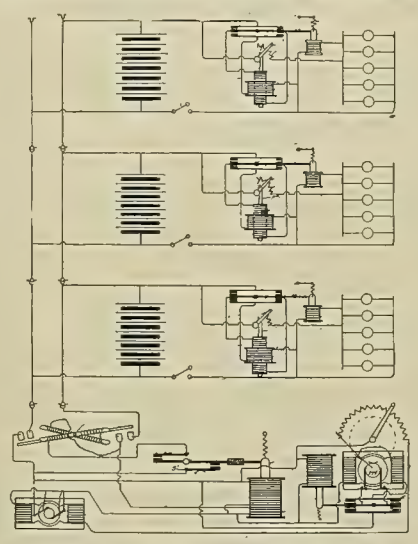


FIG. 2. M'ELROY ELECTRIC-LIGHTING SYSTEM.—ARRANGEMENT FOR RAILROAD TRAIN.

whose controlling coil is made of a shunt coil alone. By placing the series coil in the potential solenoid between the dynamo and the storage battery and independent of the lamp circuit I am enabled to operate the lamps without in the slightest degree affecting the rate of charging the storage battery. The described arrangement permits the dynamo to start at the lamp pressure, not at the battery-charging pressure. The lamps are thereby transferred from the battery to the dynamo without such flickering as would be caused if the potential applied to them were changed when the transfer is made."

An adaptation of the system described is that for train lighting, and relates to a system in which the electricity required for lighting a car or train is derived from a generator driven by one of the car axles, a storage battery being employed, which will be charged by the generator whenever the lamps are not in use and whenever the charge in the battery falls below the normal potential of the system and which will also serve to operate the lamps when the train is standing still or when for any other reason the electric pressure of the generator falls below the normal pressure of the system or the pressure of the battery rises above that of the dynamo. In this system there is employed, in connection with other features, a shunt magnet responding to the electromotive force or pressure of the system as the determining factor for the regulation and also for the bringing of the generator into action. Another characteristic of the system is the employment of a shunt generator as distinguished from a series or compound generator. The shunt magnet, which determines the regulation, is made to set into action (by means of a director) a motor, which in turn acts upon the field magnet of the generator. The shunt magnet also acts to maintain such motor in operation until the departure from normal voltage is corrected.

Means are provided for reversing the relations of the generator armature with respect to the field-magnet terminals, as well as with respect to the main lines, such means comprising a reversing switch, located in the main circuit of the dynamo between the brushes and the point at which the field-magnet shunt circuit is derived from the main circuit. When the battery becomes fully charged its connection with the dynamo remains unbroken; but if, for any reason, the pressure of the battery exceeds that of the dynamo, the connection will be broken automatically. The battery is automatically disconnected from the train wires terminating at the couplers whenever a car comes to a standstill. The system is one in which but one storage battery is employed, which is used only to supplement the generator. By far the greater portion of the electrical energy is thus supplied directly from the dynamo to the lamps, which avoids the loss that is characteristic of systems in which the lamps are supplied from the storage batteries alone, and the generator is employed only for charging the battery and not for operating the lights directly. Fig. 2 shows the dynamo, regulator and switching device placed on one car, with the local circuits connected with the lights connected therewith in separate cars in the train.

As constructed, the system will provide for supplying a train with an electric-lighting system in which the current from the dynamo shall be maintained constant in its voltage and delivered to each car in just sufficient quantities to maintain the lights at a constant degree of intensity and to keep the storage battery fully charged, the dynamo having an adequate current capacity for this purpose—to wit, a capacity sufficient for the normal lamp load plus the battery load. The governor for the dynamo is absolutely automatic in its operation, as is also that of the regulator of the light circuit placed between the storage battery and the circuit. Thus, in reference to the regulator, regardless of the number of revolutions made by the axle of the car, the current delivered to the train will be maintained at a constant voltage, and the device that is used for regulating the supply to the lamp circuit may be so adjusted that the lamps in circuit shall be kept at any desired degree of luminosity.

For a given fixed resistance in the lamp circuit the effect of such resistance will be changed with a change in the number of lamps and the consequent change in the amount of current in the lamp circuit.

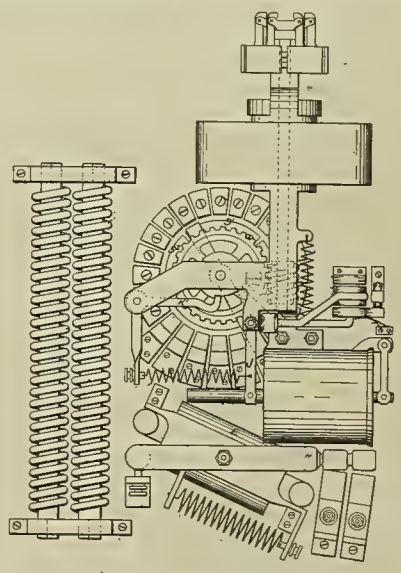
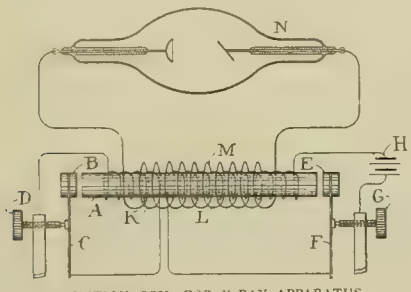


FIG. 3. M'ELROY ELECTRIC LIGHTING SYSTEM.

In other words, the drop in voltage produced by the resistance is denoted by the product of the resistance multiplied by the current, and hence must be different for different currents. In another invention Mr. McElroy does not vary the resistance to correspond with the number of lamps, but subdivides the lamps into groups and provides a separate resistance in series with each group. Then he varies the illumination by removing or adding groups of lamps each with its individual resistance. Such an arrangement is particularly suitable for coaches, but is not so well adapted to sleeping cars, where the lamps should be capable of control individually and not by groups. Fig. 3 shows the entire mechanism which he employs in the system outside of the dynamo, lamps and battery.

Induction Coil for X-ray Apparatus.

An invention that relates to X-ray apparatus and more particularly to induction apparatus for use in that connection has recently been patented by Eugene W. Caldwell of New York city and is shown in the accompanying diagram. The induction apparatus is indicated as having a magnetic circuit in the form of a core or bar (A). This magnetic circuit is provided with a primary winding (L), which may be disposed upon it in any desired manner, so as to produce the proper variations in the magnetic circuit. This primary winding is indicated as connected with a suitable source of electromotive force (H) and with the adjustable contact screw (G).



INDUCTION COIL FOR X-RAY APPARATUS.

This contact screw co-operates with the break spring (F), upon the upper end of which is mounted the armature (E) to co-operate with the magnetic circuit of the induction apparatus to be actuated thereby. It will be seen that in the position indicated the primary winding forms a closed circuit, so that current is allowed to flow through it to energize the magnetic circuit of the induction apparatus. This operates upon the armature (E) and breaks the primary circuit, so as to produce a periodic interruption therein in a well-known manner.

The auxilary winding (K) is also provided upon the magnetic circuit and is shown as disposed about the core (A) at one end of the same. As is indicated, this auxiliary winding is connected with an adjustable contact screw (D), co-operating with the auxiliary break spring (C) and the auxilary armature (B). The contact screws (D) and (G) are so adjusted and the break springs and armatures are preferably so proportioned that the auxilary circuit is broken very slightly before the break occurs in the primary circuit, and the auxiliary circuit is closed slightly before the primary circuit is closed, so that the interruptions in the auxiliary circuit occur at a slightly earlier phase than the interruptions in the primary circuit. The magnetic circuit of the apparatus is shown as provided with a secondary winding (M), which includes an X-ray tube (N) of ordinary construction.

In using this apparatus at the instant that the circuit is completed through the primary winding (K) current begins to flow through that winding, and the resulting variation in magnetism in the magnetic circuit tends to set up an electromotive force in the secondary circuit and to produce a make-spark in that secondary circuit, which is very undesirable. The auxiliary circuit is closed preferably slightly before the primary circuit is completed, to allow current to flow therein, and therefore it will be apparent that the variation in magnetism in the magnetic circuit will cause a considerable current to flow through this closed auxiliary circuit. This current acting in a well-known manner, retards the increase of magnetism in the magnetic circuit, and in this way reduces the electromotive force set up in the secondary winding, so as to reduce materially and practically obliterate the make-spark in the secondary.

Electrically Operated Gold Dredge for the Klondike.

A San Francisco construction company is about to install, in the territory south of the Yukon district, a power-transmission plant for the operation of a gold dredge which will be erected at Atlin, B. C., two miles distant from the power plant. This is a new development in the methods of mining in this region, which is a very important placer district, and much gold that would otherwise be lost will be saved by the use of electrically operated dredges. The work to be done there is similar to that carried on at Oroville, Cal., described in the Western Electrician of May 17, 1902, although the gold is coarser in the Atlin district, being found in nuggets from the size of a pinhead to that of an ostrich egg. The electrical equipment for this plant consists of the following Westinghouse apparatus: Two 180-kilowatt belted alternators, which are to be driven by waterwheels; two type-F, variable-speed induction motors with controllers; two standard type-C induction motors for driving the pump, one of 20 horsepower and the other of 50 horsepower, and a 15-horsepower, type-C motor for operating screens.

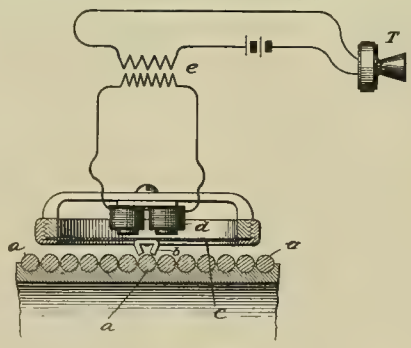
From East Pittsburg, Pa., the apparatus will be shipped directly across the continent to Vancouver, B. C., from which city it will be reshipped by steamer to Skagway; it will then be conveyed over the Chilkoot Pass to Caribou, by way of the White Horse Railway, carried by teams to Tagish Lake, where it will be reloaded on a small lake steamer and taken to a landing on the other side of the lake; then transported on a narrow-gauge road about six miles to another lake; reloaded on another steamer to be taken across this lake, and then freighted to Atlin. Although all of this work has to be done in a very short season, owing to the severity of the climate, it is expected that the machinery will be in operation in July of this year, and enough gold recovered during the season to pay the entire cost of the installation, which, including the hydraulic machinery, amounts to over $150,000. A gold dredge costs from $40,000 to $75,000, depending upon its capacity, and consists of the dredging machine proper and the pumping apparatus which supplies the necessary water for washing and sluicing.

Improved Poulsen Speech Recorder.

An apparatus for electromagnetically recording speech or signals represented by undulating or irregular currents of electricity has been invented by William A. Rosenbaum of New Rochelle, N. Y. The invention is in the same class with that of Valdemar Poulsen, and has special reference to means for recording speech, the Poulsen or any other approved method of reproducing the record being used in combination therewith. The plan described in the Poulsen patent for recording the electrical impulses consists in using an electromagnet in a circuit over which such impulses flow, the poles of the magnet resting upon a steel body, which is moved with respect thereto. The successive variations in the strength of the magnet are thereby imparted to successive parts of the steel body and are retained thereby for reproduction at any desired time. According to Mr. Rosenbaum's invention he records the impulses by means of a permanent magnet or an electromagnet of constant strength, and varies the effect which such magnet has upon the steel body by altering its distance from the body in accordance with or in proportion to the strength of the impulses representing the voice or signals. In other words, the poles of the recording magnet are not in contact with the steel body, and the effect upon the steel body is obtained by altering the air gap between the poles and the body. The electromagnet used by Poulsen for recording is utilized to alter the air gap.

The accompanying drawing is a conventional representation of the recording apparatus.

When the voice currents which are created in the primary circuit by speaking into the transmitter (T) flow by induction in the secondary circuit, including the magnet (d), the magnet will be energized successively thereby in accordance with the strength of such currents. The magnet will in turn attract the armature in front of its poles to varying extents, which will cause the poles of the permanent magnet to approach and recede from the steel body (a), or, in other words, will vary the air gap between the



IMPROVED POULSEN SPEECH RECORDER.

permanent magnet (b) and the steel body coincident with and in proportion to the impulses originally created by the voice. The result of this will be that the steel body (a), which is at the same time moving past the poles of the permanent magnet, will be magnetized at successive points to corresponding varying degrees, and such magnetism will be retained by the steel body for subsequent use in reproducing the voice currents in a telephone receiver. The magnet is not necessarily a "permanent" magnet, since an electromagnet connected in circuit with a constant source of electricity will serve the same purpose.

Midland Power Distribution in England.

An interesting example of a general electric power-distribution system, with the generating station practically at the mouth of a coal mine, is that of the Midland Electric Corporation for Power Distribution in England. The corporation's power house is situated at Ocher Hill, near Wednesbury, in the heart of the coal country. The district which the company has acquired for its operations forms roughly a semi-circle (see map, Fig. 1), with the power house at its center, and contains, in addition to a network of electric railways which takes its current from the company, numerous plants which before long will probably abandon their present uneconomical steam driving in favor of electric driving. The radius over which the company supplies is about seven miles, which may fairly be taken as the maximum over which underground electric power would be economical in view of the cheapness of coal all over the district.

The company's generating station is conveniently situated on the Birmingham Navigation Company's canal, from which a small basin has been diverted for the purpose of loading and unloading barges directly to the coal conveyor; this basin is large

FIG. 1. MIDLAND POWER DISTRIBUTION IN ENGLAND.—MAP OF DISTRICT SERVED.

enough to take eight barges of normal size, being 180 feet long by 32 feet wide. The arrangement and dimensions of the buildings are apparent from the cross-section shown in Fig. 2. Owing to the shifty nature of the ground, special attention had to be paid to the foundations, which are of cement, strengthened with old rails. In some parts it was necessary to go down 40 feet in order to secure reliable foundations.

The coal-conveying plant includes a Hunt chain conveyor and a coal and ash elevator. The coal is loaded directly from the barge by a skip, which is then lifted by a two-phase motor and automatically tipped into a large hopper. Thence it drops into a second hopper, just above ground level, and this feeds it into the ascending buckets of the chain, and it is carried to the bunkers over the top of the boiler. The buckets on their return journey pass through the ash tunnel beneath the boilers and carry away the ashes from the ash pits. The conveyor can handle 400 to 500 tons of slack per day, and the bunker capacity is about 900 tons.

In the boiler house there are at present eight Babcock & Wilcox boilers arranged in pairs. Each boiler has an evaporative capacity of 12,000 pounds of water from and at 212° F. The boilers are fitted with Babcock & Wilcox chain-grate stokers and superheaters. The chimney is of steel, 120 feet high and nine feet six inches in diameter inside the firebrick lining. The boiler pressure is 160 pounds.

So far the engine room contains only two 800-kilowatt alternators and one 1,500-kilowatt alternator, the latter being still under erection. There is space for two more sets of the larger size without prolonging the engine room, and there is sufficient land unoccupied to lengthen the engine room to three or four times its present size at least. The alternators generate two-phase current directly at 7,500 volts. All three are of the Ferranti make, the two smaller ones being driven by Ferranti cross-compound engines, and the larger one by a Yates & Thom cross-compound engine. A drawing of the 800-kilowatt alternator is given in Fig. 3. The Ferranti engines run at 166 revolutions per minute, and the Yates & Thom engine at 90 revolutions. Each of the Ferranti 800-kilowatt engines is to develop 1,300 indicated horsepower.

The dynamos differ but slightly in general design from the Ferranti moving-magnet, single-phase design. Their armatures are tunnel-wound, the windings being cotton-covered and placed in micanite tubes. The magnets have cast-steel pole-pieces and the magnet coils are wound with insulated copper strip on edge.

On the two smaller sets, the exciters and the circulating and air pumps of the surface condensers are rope-driven from a pulley on the main shaft. The exciters are 100-volt, 60-ampere Parker machines. Ropes from the same pulley on the alternator shaft pass underneath the engine-room floor, over a jockey pulley, which drives the centrifugal circulating pump, to the pulley of the Edwards air pump. The larger set does not drive its air and cir-

culating pumps, these being separately driven by B. T. H. and Fuller-Wenström two-phase motors.

There is a Higginbottom and Mannock crane spanning the engine room. It is worked by three two-phase motors, and is rated at 25 tons. Running the whole length beneath the engine room is a tunnel for cable, with openings to the machines and switchboard.

Probably the most interesting part of the plant at the power house is the switchboard. The switch gear, which has been supplied by Messrs. Ferranti, includes oil-break switches of entirely new design, and a modification of the Ferranti oil-break fuse, both of which are employed for the first time at the "Midland" works. The switches are on the divided-break system, with oil container. The fuses are a modification of the Ferranti oil type, there being four breaks in parallel, the fuse-wire in each case being bridged over the top of each pair of the upright porcelain tubes.

The two phases are quite independent on each dynamo, and a pair of lead-covered concentric cables leads up from each machine to the switchboard, rising vertically from below. The feeder cables are two-phase cables, however, with two cores and a common-return concentric with the lead covering. The switchboard is single-pole, the cables rising in the usual manner through the fuses, switches and ammeters. The two high-tension switches forming each pair are mechanically connected by a link, and are worked by the same lever; and the same type of switch, fuse and ammeter is used for connecting the feeder to the bus-bar as for connecting the generator to the bus-bar. The bus-bars rest on insulators on the top slate, and are completely covered in.

There are two switchboards in addition to the main board, one the meter board and the other the works switchboard for distributing the current used for light and power on the works. The former is divided into two parts by a projecting horizontal shelf of black marble, the fuses protecting the meters being placed below the shelf. Above the shelf are three pairs of Thomson meters to measure the energy delivered from each phase of each machine. They are each connected to the secondaries of two transformers, one in series with and the other in shunt with the mains from the machines. The low-tension power board is by Messrs. Kelvin and White, and distributes two-phase current at low pressure. It is more or less a reproduction on a slightly smaller scale of the low-pressure, two-phase board at the sub-stations.

The area to be covered by the Midland scheme and the position of the existing mains and sub-stations are indicated in the map. Cables are used whose two inner conductors are each 0.14 square inch in section, and the common return, which is composed of flat strip, has a sectional area of 0.2 square inch. The cable is insulated with paper, and is not armored, but outside the lead covering there is a serving of jute impregnated with preservative compound. It is laid at a depth of about three feet in earthenware troughs filled "solid" with pitch and covered with bricks. The troughs are of U-section, with spigot and socket joints, and the cable rests on separate bridge pieces.

Subsidences due to the mining operations in the district are things to be guarded against, says the London Electrician, from which this article is abstracted, and in places where trouble from this cause might have been expected, a different mode of main laying has been adopted. Lengths of cast-iron piping are used whose ends are merely butted together, and these are held in place by two-foot shelves passed over the ends of the pipe and packed with yarn. In addition to this increase in flexibility, "loop pits" are provided every 200 yards, in which about six feet of slack cable is left, this being passed over rollers, so that it is taken up automatically without undue strain in case of a subsidence occurring.

The high-pressure and low-pressure cable is lead-covered concentric, and is laid in the same way as the extra-high-pressure cable. Double service boxes of the usual pattern with compound glands are employed.

Distribution takes place in three ways: Directly from the sub-stations at 200 volts two-phase; from street transformers fed at 2,700 volts from the sub-stations, and delivering at 200 volts two-phase to the consumers' networks, and (from the Bilston sub-station only) at 500 volts continuous current for railways, through rotary converters.

The sub-station floor is occupied by the stationary transformers and the rotary converters, and the various switchboards are placed on two low galleries only just above the floor level, and running about half the length of the room by the transformers. Two extra high-pressure cables (both of 0.105 square-inch section inner conductors) come in to the sub-station, and two (0.105 square-inch and 0.07 square inch) go out again, the extra high-pressure cables being arranged more or less in a ring to feed the sub-stations. All four cables are led to an extra-high-pressure switchboard, divided into two parts, and connecting the extra-high-pressure mains to the 7,000:2,000 and 7,000:200-transformers for the high-pressure and low-pressure distribution, respectively. The transformers which transform down for the rotary converters are not connected to this board directly, there being merely switches to connect the extra-high-tension mains to the top of the rotary-converter board, to which these transformers are connected. Rubber cables on insulators connect these switches with the rotary-converter board.

There are seven switchboards for various purposes in the sub-station. The 7,000:2,000-volt transformers will be pairs of separate transformers, one transformer on each phase. From the secondaries of these, mains are led to the high-pressure board, whence feeders will run to Ferranti tank transformers, which will be used in the Willenhall district, the first portion of the company's area to be supplied at this pressure. The low-pressure, two-phase board receives current from two pairs of 50-kilowatt and one pair of 25-kilowatt transformers. One set of switches and fuses connects the transformers to the bus-bars, and the other set is between the feeders and the bus-bars, and in each case the switches of the two-phase are coupled together. Although the mains are two independent concentric cables for the two phases and the transformers are also separate, both the outers are connected to a common bus-bar, and there are no fuses on these outers except on the consumers' premises.

At the top of the converter board are four "time-element" cut-outs, which are also used as switches, for connecting the two pairs of step-down transformers which feed the rotary converters to the 7,000-volt bus-bars of the adjacent extra-high-tension switchboard. Two pairs of 100-kilowatt Westinghouse transformers are connected to these cut-outs, the connections being single-pole, as are all the extra-high-pressure switching arrangements. The secondaries of these transformers are brought back to the board to the two pairs of switches in the bottom row but one, which connect them to the slip rings of the rotary transformers. At the bottom of the board are two throw-over switches to switch on induction motors placed on the shafts of the rotaries for starting them. When the switch is thrown over to one side, the induction motor is started through a resistance. The switch is then thrown right over to the other side, and the synchronizer switch is closed, and, finally, when synchronism is reached, the transformer secondary switches are closed, and the starting switch placed in its middle or no-contact position. Above the secondary switches are hand-wheels for adjusting the field excitation of the rotaries, and above these again are three ammeters for each rotary. Two of these in each case are connected to the secondaries of small transformers, whose primaries are in series with the slip rings; they therefore show the current flowing from each phase to the rotaries. The third ammeter is in the field circuit. These connections are seen in the upper part of Fig. 4, the lower part of which corresponds to the board at which current is metered to the tramway circuits.

On the meter board there is a voltmeter and two ammeters to indicate the continuous current passing from each converter and its voltage. A time-element cut-out is placed on each of the positives from the converters, and an instantaneous cut-out on the negatives. The four switches in connection with each converter (as arranged in Fig. 4) enable it to be utilized as a shunt machine, or as a compound-wound machine, with an equalizing switch for paralleling. As agreed with the Wolverhampton and District Tramways Company, the current delivered to it is passed through three meters in series.

The rotary converters are rated at 250 kilowatts each, and they run at 600 revolutions, the frequency being 50 cycles a second. They are of the Westinghouse standard type, with a damping coil on each pole-piece, and are compound-wound. Their continuous-current output is 400 amperes at from 500 to 550 volts. The regulation of the continuous-current voltage takes place by a variation of the excitation.

The Wolverhampton and District Tramways is one of the offspring of the British Electric Traction Company. Its route, which is indicated in Fig. 1, is in all 10 miles in length, and is part single and part double track. The current is all taken from the Bilston sub-station, and is supplied to the line through the usual feeder pillars placed at about one-half-mile intervals. The line construction is chiefly with span-wire suspension from side poles, but there is a certain amount of single-bracket pole construction as well.

All the supply, except to the tramway company, is by two-phase alternating current at 200 volts pressure. For lighting, the consumer can choose between a flat rate of 4½d. per unit, or 6d. per unit for the first 100 hours of maximum demand per quarter plus 3d. for additional units. For power, the flat rate is 1½d. per unit with discounts to large consumers, and the "Wright" system tariff is 3d. per unit up to 78 hours of maximum demand per quarter, and after that 0.825d. per unit.

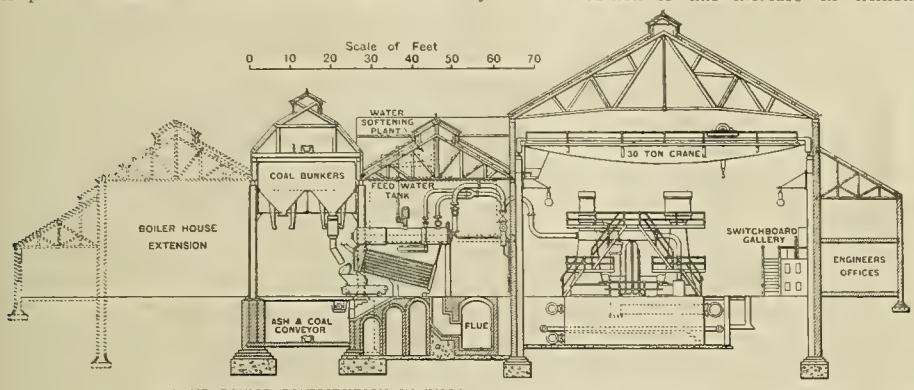


FIG. 2. MIDLAND POWER DISTRIBUTION IN ENGLAND.—CROSS-SECTION OF GENERATING STATION.

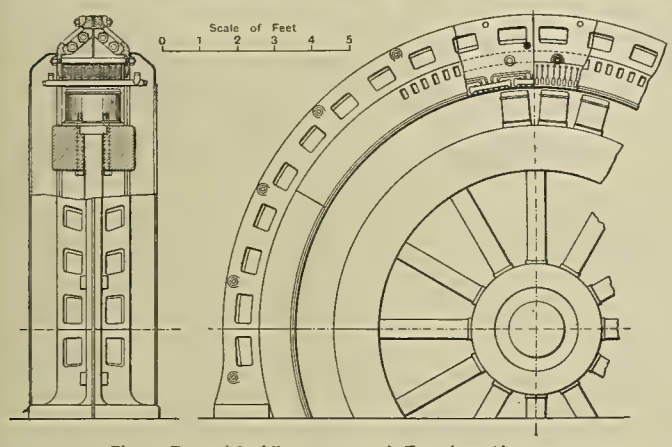


Fig. 3. Ferranti 800-kilowatt. 7,500-volt Two-phase Alternator.

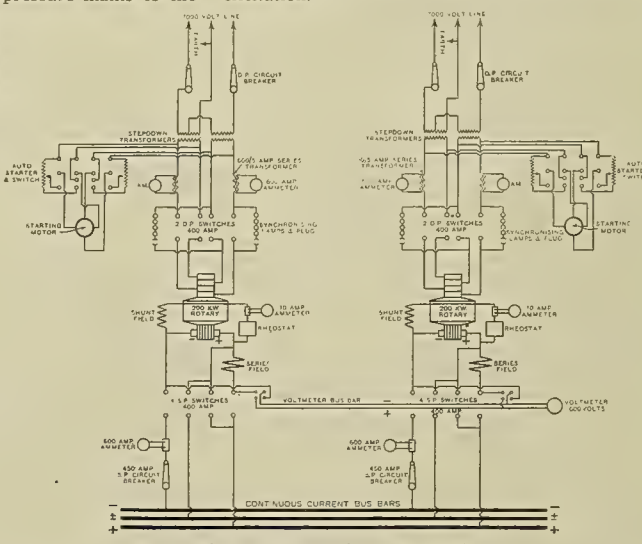


Fig. 4. Diagram of Connections to Rotary Converter.

MIDLAND POWER DISTRIBUTION IN ENGLAND.

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

Independent Telephone Association of Wisconsin, Madison, Wis., June.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 22d to 26th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

GREAT deliberation is exercised in devising and executing means to improve the facilities for transportation in London, but then the problem is, to be sure, one of great importance, having many complications. As our London correspondent relates this week, King Edward has very recently appointed a commission to inquire into the whole subject. One question outlined for the consideration of this royal commission is the desirability of establishing some tribunal to which all schemes of railway or tramway construction of a local character must be referred. Such a central tramway board would relieve Parliament, with its tedious processes, of the duty of passing on each application, and it would seem, at this distance, that its institution would be a desirable reform. However, it would seem to be unwise to let needed improvements wait while discussing the question of procedure.

ACCORDING to the Washington correspondents, Senator Fairbanks of Indiana has conceived a novel scheme for combining postal transmission and telephonic distribution of messages. He proposes, it is said, to introduce a special mail delivery in the rural districts by telephone. His idea is that a special stamp should be provided, which would authorize a postmaster to open any letter bearing it, and telephone its contents to the person to whom it is addressed. The advantages of the special-delivery service in the cities by means of messengers would thus, he thinks, be extended to the country by the telephone. This scheme would work to the advantage of rural telephone companies, perhaps; but its practicability is very doubtful. There would be an extra charge, of course; and for a few cents more the sender could use the long-distance telephone or telegraph outright, with much greater dispatch. In addition, it may be observed that letters of the special-delivery class are often of such a nature that the writers would prefer not to have them relayed through a garrulous country postmaster. The field for the proposed service seems to be, in fact, rather limited.

AND now the question arises, Who invented the mercury-vapor lamp? One would naturally say, at once, that the honor of bringing forward this interesting device, with possibilities which seem to extend far beyond the domain of lighting, belongs to Mr. Peter Cooper Hewitt of New York. But there's another Richmond in the field. And this gentleman is Mr. H. J. Dowsing, an electrical engineer of London, who says that he invented the mercury-vapor lamp in 1896. The English patent specification of that date, to which reference is made, mentions Mr. H. S. Keating of London, a lawyer, as joint inventor with Mr. Dowsing, but so far Mr. Keating seems to have remained in the background, and it is Mr. Dowsing alone, apparently, who is contesting the honor with Mr. Hewitt. In putting forth his claim (as he does in a letter to a London contemporary) Mr. Dowsing indulges in some rather bitter reflections. "Perhaps it would be interesting to your readers to know," he writes, "that mercury-vapor lamps have been made in this country, as you will see from my patent No. 4,261 of 1896. The firms engaged in the lamp industry at that date seemed to be very busy, and quite satisfied with carbon. Now, however, that the mercury lamp has been shown to be practicable by the Americans, it might be possible to get such a patent taken up even by an English firm. I have learned, like many others, that the most likely source from which assistance could be obtained, or an invention even inquired into, is an American one." Mr. Dowsing admits that his patent has lapsed for lack of payment of the annual fees. "Mercury lamps, therefore, can be made free of royalty by British firms, who will probably think they have gained something by not being too rash in taking up a new invention." Here the bitter touch is again evident. The provisional specification for the English patent of Dowsing and Keating is dated February 25, 1896, and the complete specification October 23, 1896. In the latter this is the claim: "An electric lamp consisting of a glass tube of very small bore connecting two bulbs containing mercury which are connected by leading-in wires sealed through the glass to a source of high-tension electricity, the atmosphere within the tubes and bulbs being rarefied." Whether this is to be considered an anticipation of the Cooper Hewitt devices may be a question for lawyers and courts to decide; but it is very curious to observe with what regularity the announcement of any important invention is followed by the voice of some modest gentleman declaring "That's old; I did it myself years ago." But usually it is discovered that the protester or protesters—there may be a dozen—did not do the essential "it" after all.

ONE trouble about municipal ownership is that so many of its advocates do not know what they are talking about. Alderman Finn, sponsor for one of the public-ownership bills presented to the Legislature at Springfield, is, for instance, thus reported: "Not only would the people of Chicago get cheaper light under municipal ownership, but heat could be furnished to every home at such a price as would make another coal famine an impossibility." This is, of course, simply nonsense. Think of advocating the transmission of electrical energy for heat, as a matter of economy, to every home in a city which is 24 miles long and from 6½ to 10 miles wide! Pursuing the subject, Mr. Finn is further quoted: "Were the electric-light bill passed the city should at once proceed to put it into operation, and as a first step should secure from the Sanitary District the right to the invaluable waterpower at Lockport. With this cheap power not only could we light all our streets with electricity at a comparatively small cost, but we could furnish electric light to the people much cheaper than rates which now rule for gas." This, too, is absurd. With all the available energy of the Drainage Canal transmitted to Chicago there would probably be little surplus for domestic consumption if the streets were properly lighted. And certainly what there was could not be supplied to householders at rates cheaper than the equivalent cost of gas at $1 a thousand. It would be better for the whole public-ownership proposition if its supporters would moderate an excess of zeal in the direction of practicability and sanity.

CONSIDERING the subject of railroad-train operation by telegraph, which, in view of constantly recurring accidents resulting in loss of life and destruction of property, is of great importance, Mr. Raymond B. Dickey of Washington, D. C., makes some sensible observations in a letter to the Chicago Tribune. He thinks that the trouble is not with the "system," especially the "block system," used by almost all the leading railroads, but rather with the human element—the incompetent or overworked men and boys—necessary to its operation. He makes these recommendations:

First—The position of operator on the railroad should be elevated to its proper dignity, whereby it would offer some inducement for competent men. (a) In relieving them of some of the drudgery which takes their time and attention from the important duties of handling trains. (b) By paying salaries somewhere in proportion to the admitted responsibilities. (c) By reducing the hours of service, so that a day's service shall consist of eight hours, instead of 12 and in some cases 15, and allowing no operator who has to handle a train to work more than 16 hours under any circumstances.

Second—The Legislature of every state should enact a law creating a board of examiners or a commission, composed of three or five members, whose duties will be to examine all applicants for the position of operator within that state, recognizing, however, the certificate of a similar board of another state. (a) By placing a minimum age limit, say 18, upon all applicants. (b) The examination to consist of a medium educational qualification, familiarity with the rules of the various railroads, and a strict standard of telegraphic proficiency.

These suggestions are of much interest, and they deserve consideration on the part of legislators and railroad companies. If carried out, they would add to the expense of railroading, to be sure; but certainly no money consideration should be allowed to weigh in the balance against human life. Of course the dispatchers and telegraph operators are not to blame for all railroad disasters; other railroad employes sometimes make dreadful mistakes, and some accidents are due to causes which no human agency can guard against. But it is obviously the duty of the companies to take every possible precaution to ensure the safety of railroad travel, and as Mr. Dickey's proposals seem reasonable and calculated to do good we should like to see them discussed by the responsible heads of the operating departments of railroad companies.

Third-rail Train Operation.

Especially timely in view of the recent tie-up of some of the lines of the Manhattan Elevated in New York, due to trouble with the third rail, the address of Mr. H. M. Brinckerhoff, general manager of the Metropolitan West Side Elevated Railway Company of Chicago, before the Chicago Electrical Association on February 20th, was listened to with attention by an interested audience of fair size. Professor P. B. Woodworth, the president of the association, occupied the chair, and H. G. Dimick performed the duties of secretary in place of Mr. Hale, who was detained at home by a slight illness.

Mr. Brinckerhoff's subject was "The Third-rail System for Electrical Railways," and he illustrated his talk by numerous stereopticon pictures. His address was based on one delivered about a year ago before the students of Lewis Institute, but considerable new matter was added. The speaker began by saying that the great to-do over the opening of the first electrically operated elevated-railway train in New York was rather amusing to a Chicago man, inasmuch as such trains had been in regular service in this city for a number of years. New York had, in fact, drawn heavily on the experience of Chicago in electrically equipping its elevated roads, as was shown by the fact that the superintendent, electrical engineer, master mechanic and other officers of the Manhattan lines were former Chicago elevated-railroad men. As to the beginning of the third-rail conception, it would surprise many to learn that the germ of the system was covered in some French patents issued in the '70's. But the first commercial application of the idea was seen on the Intramural road at the World's Fair of 1893, although the Liverpool Overhead line (using the third rail) was almost simultaneous in its development. Now the third rail is used on all the Chicago elevated roads, the Brooklyn and Boston elevated, as well as a number of surface lines, and has recently been introduced on the Manhattan Elevated of New York.

Mr. Brinckerhoff touched on the general advantages of using electrically transmitted power in elevated-railway operation. The cost for coal, for one thing, was about one-third of that required for steam locomotives on a car-mile basis. The third rail was preferred to the overhead trolley, principally because it permitted the taking off of heavier currents, sometimes as much as 1,200 amperes being required to start the heavy trains. On interurban surface roads using the third rail the right-of-way should be fenced in. The Albany and Hudson and the Aurora, Elgin and Chicago are examples of interurban roads using the third rail for high-speed stretches and the overhead trolley in the towns through which they pass. The New York, New Haven and Hartford railroad shows another field for the third-rail system—the running of light passenger trains between heavy steam trains or on spurs or branches feeding steam-railroad systems. As to possible danger to human life from the third rail, there has been, as a matter of fact, practically no trouble on this score. The Baltimore and Ohio tunnel furnishes another example of the applicability of the third rail. It has been shown that it is perfectly feasible to handle the heaviest freight and passenger trains by electric-motor cars taking current from a contact rail. The New York Central is one of the latest of the steam railroads to decide to use electricity on a portion of its lines. It will undoubtedly use the third rail. In fact, in electric-railway operation, where high speed and heavy construction are demanded, the third rail furnishes the cheapest and best method of getting the current to the motors.

After showing several pictures of various third-rail systems, the speaker said that it was now the practice to use a cast-iron contact shoe weighing from 6½ to seven pounds, pressing with its own weight merely on a steel contact rail of special composition. Such a shoe has a life of 150,000 miles. It is better to place the third rail at the side rather than between the track rails, because it is there easier of access and there is more space for clearance. One of the pictures displayed was that reproduced in the Western Electrician of December 27th last (page 459) showing contact shoe and steel brushes used on the Metropolitan Elevated of Chicago. Mr. Brinckerhoff explained his method of fighting sleet and ice on the third rail, as detailed in the article in the Western Electrician of which the illustration referred to was a part. About once in two years, he said, they encountered an "ice storm" when it was necessary to keep the contact rail clear by a man standing on the car and using a scraper; at all other times the steel brushes were sufficient. The recent trouble on the Manhattan road in New York was due to the requirement of the Board of Health of that city by which two guard boards, higher than the rail, were placed on each side of the third rail. This made a trough which filled with snow, on which a crust formed, and this was the cause of the difficulty, as it was hard to keep the trough clear. These boards are not used in Chicago; they are not necessary, as accidents are very infrequent.

Touching on the question of heating the cars, the lecturer said that in zero weather 40 per cent. of all the current from the power house was used to heat the cars during the rush hours, electric heaters being, of course, employed. One difficulty is that these heaters have no heat-storage capacity, like steam pipes. In very cold weather every engine in the power house must be running. This is hazardous, but the expense of installing reserve equipment above the peak of combined heating and motor load at times of maximum demand is prohibitive.

Contrasting locomotive and multiple-unit systems of electric traction, the results in economy seem to be about the same. Comparison of curves of current consumption shows greater fluctuations with multiple-unit system, but, on the other hand, by using that system the motorman can cut off the current sooner and coast to the next station.

Some interesting statistics of the traffic on the Union Loop in Chicago, used jointly by the four elevated electric railways of this city, were given by the speaker. At the corner of Fifth Avenue and Van Buren Street 1,523 trains pass on the loop every 24 hours. This is an average of one train every 53 seconds day and night. But during the rush hours this average is greatly cut down, being a train every 33 seconds between the hours of 5 to 7 p. m., and one every 16½ seconds during the busiest quarter-hour in the morning rush. Between the hours of 5 and 7 p. m. 54,000 people are loaded and taken off of the Union Loop.

Mr. Brinckerhoff concluded by exhibiting the following table to show the composition of common steel rail for railroads and of various special steel rails designed for the third rail of electric roads.

Elements.	Common Rail.	Special Contact Rails.		
		Manhattan Railway.	Albany and Hudson.	Metropolitan, Chicago.
Carbon.....	0.470	0.073	0.090	0.090
Manganese	0.760	0.341	0.440	0 500
Phosphorus.....	0.104	0.069	0.088	0.100
Sulphur.....	0.030	0.073	0.080	0.053

By thus altering the constituency of the steel the conductivity has been improved, so that, whereas the ratio of the common rail to copper is 10.17 to one, that of the special rails is about 7.25 to one.

A brief discussion followed Mr. Brinckerhoff's address. Messrs. Dimick, Mayer, Junkersfeld, Almert, Carlton, Woodworth and others participated. The fact was brought out that on the Aurora, Elgin and Chicago road trains had been operated when there was 12 inches of dry snow on top of the third rail. As to aluminum feeders, it was stated that one of the objections to them was their great expansion and contraction, by reason of variations in temperature. A unanimous vote of thanks was extended to the lecturer of the evening for his instructive and interesting address.

The Future of the Electric Railway.[1]

It is almost absurd to begin to consider the limits of the use of electrical transmission on railways at this date. The future of electric railways, electric tramways and automobiles is rather a matter of vague conjecture and picturesque prophecy. Tubes are multiplying rapidly, and railways are putting down electric transmission on suburban lines in Europe and the States. On short lines with many stops we have to contend with inefficiency at starting. On long lines there is difficulty of transmission or cost of transformation and difficulties of collection. We are very much handicapped, or limited, by the want of a suitable variable-speed gear for large powers. For short lines the ordinary tramway system is used, and many schemes have been proposed. Three-phase motors, either in cascade with high primary pressures or arranged simply are being tried, and have many advantages. Various arrangements of motors have also been discussed or tried. Series distribution has been proposed, but never tried. Though it superficially resembles series tramways, it differs essentially in the switches being a long way apart, and not worked by the train, and having constant-current variable-speed generators. One difference makes it practical as far as the switches go, the other efficient. But a variable-speed gear would solve the difficulty very much better than any of these schemes. We could then have simple alternating circuits with all the consequent ease of transmission and transformation, and the trains could go at suitable speeds with high efficiencies throughout. The Leonard is an electrical variable-speed gear, but it is expensive and not very efficient. A few mechanical gears have been proposed to work with synchronous alternating motors. The most obvious arrangement is a system of pumps. Air pumps with a reservoir have been proposed. A system of oil pumps of variable stroke is also in use to some extent for automobiles. But machinery of that sort practically means that an electromotive must have not only a motor of say 1,000 kilowatts, but what amounts to two sets of motion work. This must mean serious expense. We may, therefore, say that we are limited by the want of either a variable-speed simple alternate-current motor, or a simple variable-speed gear capable of transmitting very large torque and packing into an engine. A recently developed scheme is the use of low-frequency, alternating currents with laminated series-wound motors. This solves the difficulty, but at the expense of large idle current, induced pressure in short-circuited armature coils, large, expensive and inefficient transformers, and the ordinary disadvantage of the series motor on constant pressure. This plan is well worth serious study.

The collection of large currents at great speeds has long loomed as a limit. The published accounts of experiments at Zossen would lead us to suppose there is no trouble on this score. Still it is a difficulty many engineers fear.

In electric tramways there is no limit in sight. The power can be sent over any distance desired, and there seems to be no limit to the people who want to travel on electrical trams. The question of electrolysis is rather that of a limit to the duration of pipe companies' property. It is a very difficult question. Though the threatened effects of electrolysis have no doubt been exaggerated, it is at best a question of degree, and the ingenuity of engineers is continually reducing the chance of damage. It has recently been urged that frequent reversals of polarity of the system reduces the electrolysis very considerably.

1. From the presidential address of James Swinburne before the British Institution of Electrical Engineers, delivered in London in December last.

Mexican Gulf Cables.

A regular meeting of the New York Electrical Society was held on February 18th. Dr. A. E. Kennelly of Harvard University, and an honorary member of the society, lectured on "The Laying of the Mexican Government Mexican Gulf Cables." This was the first cable of American manufacture laid for a foreign government. Dr. Kennelly said that if all the cables now lying at the bottom of the sea were joined end to end they would measure 200,000 miles, or nearly as far as from the earth to the moon. The life history of the cable was shown by a series of lantern slides, from a view of the spool machines in the factory of the Safety Insulated Wire and Cable Company at Bayonne, N. J., to the final joining aboard ship in the Gulf of Mexico. The cable was 500 miles long, one inch thick, excepting near the shore, where it was twice that size, and weighed 1,300 tons. It was carried in four deep tanks in a Norwegian cable ship of 1,400 tons' burden to Vera Cruz; and a partition cable house, which had been brought from the United States, was put together, and a two-mile length of the cable was towed ashore and dragged up to the house. The end at sea was joined to the cable on this ship, which then went to Frontera, where another house was erected, and the operation was repeated. At Campeche serious difficulties were met. The water was very shallow for seven miles out to sea, and although the town had 19,000 inhabitants, it did not possess a steam launch or even a barge. A one-masted schooner was procured by the cable people, the mast was removed, and the coil of seven miles was stowed away in the boat. Another schooner, with two masts, served as a tug. When this tug went too fast the sails were taken in, and when it was becalmed there was nothing to do but wait. Eventually the end of the first long American cable was made fast at the cable house, which stands almost on the spot where the Spaniards first landed in Mexico, 400 years ago.

In spite of the inclemency of the weather, there was a large audience, among which were many ladies. Representatives of all the prominent cable firms in New York were present, and the fine collection of cables recently presented to the society by the family of the late Cyrus W. Field was inspected with much interest.

Iowa Electrical Association.

An interesting programme has been arranged for the annual meeting of the Iowa Electrical Association, which will be held in Davenport, Iowa, on April 8th and 9th, at the Masonic Temple, and the convention promises to be a notable one. W. L. Bowers of Davenport has prepared the programme, which calls for assembling at 10 a. m. on Wednesday, April 8th, with routine business the rest of the morning. At the afternoon session there will be a report of the committee on electric street-lighting data, by W. S. Porter, Eldora; report of committee on proposed legislation relating to the development of plans for the inspection of wiring, by J. S. Bellamy, chairman, Knoxville, and report of committee to establish uniform method for arriving at the cost of furnishing electric current, and to collect forms in use by different companies, by Isaac B. Smith, chairman, Cedar Rapids. These papers will then be read: "Maintenance and Operation of Central Stations by Steam Power," by H. T. Fiske, Muscatine, and "Maintenance and Operation of Central Stations by Waterpower," by George S. Carson, Iowa City. At 4 p. m. an electric trip will be made to the government arsenal, inspecting the dam and water plant, and to Rock Island and Moline, visiting the Moline Power Company's plant at the latter place. That evening there will be a lecture, either by W. D. Ryan on "Modern Illumination" or by Mr. Hine of Chicago, "On Arc Lighting in General."

On Thursday, April 9th, there will be a report of committee on feed-water heaters by J. A. Innis, Eagle Grove; report of committee on data for city pumping by central station, by D. F. McGee, Red Oak, and report of committee on lamp testing, by George S. Carson, Iowa City. A paper, "Commercial Rates, Including Fan and Power Rates," will be read by R. H. MacMullan, Des Moines, and a paper or talk will be given by Mr. Ryan or Mr. Hine. At the afternoon session there will be papers on "Analysis of the Cost of Street Lighting" by Austin Burt, Cedar Rapids, and "The Necessity of the Grounding of Secondary Circuits," by W. J. Greene, Cedar Rapids.

Electric Power in the United States.

PART II.

The following table presents the essential features of a number of the characteristic waterpower developments which transmit electric power over long distances:

COMPANIES ENGAGED IN LONG-DISTANCE POWER TRANSMISSION.

NAME AND LOCATION OF COMPANIES	Capacity, Horse-Power.	Length of Line. Miles.	Line Voltage.	Distribution.
Montgomery Water Power Company, Tallassee, Ala	3,500	30	30,000	phase 3
Bay Counties and Standard Power companies, Marysville and Electra, Cal	6,300 10 000	140 220	60,000	3
Blue Lakes Water Company, Bigbar Bridge, Cal	1,800	40.20	10,000 25,000	2
Central California Electric Company, Newcastle, Cal	1,700	35,28	15,800	2
Jamestown Light and Power Company, Jamestown, Cal	1,500	15	16,000	3
Power Development Company, Bakersfield, Cal	1,200	16	10.000	3
Redlands Electric Light and Power Company, Redlands, Cal	1,310	21	10,000	3
Sacramento Electric, Gas and Railway Company, Folsom City, Cal	4,000	22.5	11,000	3
San Gabriel Electric Company, Azusa, Cal	1,200	23	15,000	2
San Joaquin Electric Company, Fresno, Cal	1,400	55.35	11,000 19,000	3
Southern California Power Company, Redlands, Cal	4,000	80	33,000	3
Tuolumne County Water Company, Sonora, Cal	1,500	10	15,000	3
Truckee River Power Company, Truckee River, Cal	2,000	33	22,000	3
Yuba Power Company, Marysville, Cal	1,200	19	16,000	2
Colorado Electric Power Company, Colorado Springs, Colo.	1,875	25	20,000	3
Ouray Electric Light and Power Company, Ouray, Colo	1,200	7	12,000	2
Pikes Peak River Company, Victor, Colo	2,000	10	12,000	3
San Miguel Consolidated Gold Mining Company, Telluride, Colo	1,600	25	11 600	2
Hartford Electric Light Company, Hartford, Conn	4,000	11	10,000	2
Lewiston, Brunswick, and Bath Railway Company, Lewiston, Me	1 000	20,10	10,500	3
Sanford Power Company, Sanford, Me	2,000	9	10,500	2
Kalamazoo Valley Electric Company, Kalamazoo, Mich	2,000	46	40,000	3
St. Anthony Falls Water Company, Minneapolis, Minn	7,500	10	12,000	3
St. Croix Power Company, St. Paul, Minn	4,000	28	30,000	3
Helena Water and Electric Power Company, Helena, Mont	4,000	11,8	11,000	2
Missouri River Power Company, Canyon Ferry, Mont	4,800	70	50,000	2
Montana Power Company, Butte, Mont	4,000	21	15,000 26,000	3
Manchester Traction, Light, and Power Company, Goffstown, N. H	1,600	6	10,000	3
Albany and Hudson Railway and Power Company, Kinderhook, N. Y	3,000	18	12,000	3
Empire State Power Company, Amsterdam, N. Y	2,400	17	12,000	3
Hudson River Power Transmission Company, Mechanicsville, N. Y	5,000	18,14	12,000	3
Niagara Falls Power Company, Niagara Falls, N. Y	50,200	27	11,000 22,000	2
Utica Electric Light and Power Company, Utica, N. Y	4,000	12	22,000	3
Fries Manufacturing and Power Company, Salem, N. C	1,000	15	12,000	3
Lehigh Power Company, Easton, Pa	1,500	3½	12,000	3
Anderson Water, Light and Power Company, Anderson, S. C	3,000	10	11,200	2
Big Cottonwood Power Company, Big Cottonwood Canyon, Utah	2,675	14	10,000	3
Pioneer Electric Power Company, Ogden, Utah	5,000	40	15,000 26,000	3
Salt Lake City Water and Electric Power Company, Big Cottonwood Canyon, Utah	2,000	12	16,000	2
Telluride Power Transmission Company, Provo City, Utah	2,000	55	40,000	3
Utah Power Company, Salt Lake City, Utah	2,000	13	15,650	2
Snoqualmie Falls Power Company, Snoqualmie Falls, Wash.	8,000	45,31	25,000	2
Tacoma Railway and Power Company, Tacoma, Wash	1,340	45	13,000	2

ELECTRIC POWER IN COTTON MANUFACTURES.

In cotton-goods manufacture electric power is being rapidly adopted, not only in New England, but in the South; perhaps the most conspicuous examples can be found in the latter region, where waterpower has been largely utilized.

One of the earlier and larger plants at which waterpower was utilized for the generation of electric power is the Ponemah Mills, at Taftville, Conn., where the energy from the waterpower at Baltic, 4½ miles away, has been used for years to run the weaving mill, of 1,700 looms, and to operate 1,200 incandescent lights. The generating plant consists of two alternating-current generators of 350 horsepower each, and these drive two 350-horsepower motors at Taftville. A street-railway system is operated in connection with the mill, and an electric locomotive is employed to haul freight cars a distance of one mile.

The typical southern mills, utilizing waterpower are those at Columbia, and at Pelzer, S. C., the former requiring about 1,400 horsepower and the latter, 3,000 horsepower. At Pelzer the saving in the first cost of the shafting and belting, as compared with an identical mill driven by a mechanical system amounted to nearly $10,000. The success of the Columbia Mills led the owners to develop a large waterpower system of their own, from which are driven the Granby Mills, 1½ miles distant, using 1,800 horsepower in motors, and the Palmetto Mills, using 200 horsepower in motors. An even more striking instance of transmission of energy is that of the Anderson Cotton Mills at Anderson, S. C., driven from the electric-light plant at Portman Shoals, 10 miles away. Between the waterwheels at the remote generating plant and the spinning frame in the mill there is not a single belt or auxiliary shaft. The increase in the quality of production obtained by the omission of belting is reported to have been very marked over the old-fashioned mechanically driven frames.

It happens, however, that the most typical southern cotton mill operated by electric power is one in which the generators are not driven by waterwheels but by steam power. Mr. W. B. Smith-Whaley of the Columbia Mills, already referred to, had found that the cost of repairs in an electric mill was about one-half that in a mechanically driven mill under the same ownership, although the latter was the smaller; and had also noted an increase of product, amounting to at least four per cent., due to the more uniform speed of the producing machinery. With this knowledge, when the Olympia Mill was located at Columbia, two sets of plans were drawn, one contemplating the distribution of power by small wires to motors, and the other by the old-fashioned system of belts and shafting throughout. Bids were obtained for both, with the result that the electrical system was found to be decidedly the cheaper.

There being no need of heavy transverse walls for the main shafts at the belt way, the use of electricity reduced the cost of the mill building 10 per cent. Sixty-one per cent. of the line-shafting cost was also saved, and 66 per cent. of the cost of the belts and ropes. It is stated that the saving due to these three items was more than sufficient to pay for the cost of the electrical equipment.

The maximum power required by the mill is about 3,600 horsepower, furnished from the central mill plant through the generators, the same plant also supplying current to light the town and operate the street railway. Mr. Smith-Whaley states that the total cost of the Olympia Mill, on a basis of 10,000 spindles, is about $18.50 per spindle as against $15 per spindle for one of the best mechanically operated mills in New England. The $18.50, however, includes the laying out, sewering, water piping, etc., of 150 acres of land, the construction of 325 cottages, and the providing of 2,400 horsepower above all necessities, which can be disposed of to outside parties. The aggregate of these three items makes a difference of $4.96 per spindle, leaving $13.54 per spindle as the proper cost in comparison with the New England mill. It should also be mentioned that the Olympia Mill is equipped with 2,400 40-inch Draper looms, each costing $85 more than the looms in the other mill. The electric current is distributed by 22 induction motors of 150 horsepower each, as well as by several smaller motors for miscellaneous purposes.

GOVERNMENT PRINTING OFFICE.

Electric motors doing miscellaneous work in manufacturing establishments are scattered so widely throughout the field of industry that it is impossible to consider them all in detail. It will suffice, perhaps, to note the figures given by Mr. W. H. Tapley, electrician of the Government Printing Office, at Washington, D. C., where the advantages have been so marked that the new office, the largest of its kind in the world, is being equipped throughout with electric power. At the time Mr. Tapley made his report—the period of the census year—the office had, connected with the power circuits, 575 electrical horsepower of motors for presses, etc., and 125 horsepower of motors for elevators. The most marked feature of economy mentioned by Mr. Tapley is in the increase of 15 per cent. in the output of the press room. If there is any printing office where trustworthy power conditions must be had, it is that of the government, the plant being run 24 hours daily during the sessions of Congress. Mr. Tapley states that there has never been a hitch in the motive power. "In fact, such a freedom from interruption of power has not been known in the history of the office as during the past three years, or since we have adopted electric power."

ECONOMIES OF ELECTRIC POWER.

The economies introduced into the manufacturing processes of the United States by electric power may be summed up generally or may be treated under separate heads; perhaps the best method of consideration is to cite the arguments usually advanced and then to mention a few typical cases in support of them.

Professor F. B. Crocker of Columbia University, in a recent classical discussion of the subject before the Franklin Institute, Philadelphia, Pa., enumerated the principal advantages obtained by employment of electric power in mills and factories as follows:

1. A real economy in amount of power used.
2. A reduction in cost of the construction of buildings, which can be lighter, owing to the fact that there is no need to install heavy lines of shafting and pulleys.
3. A reduction in expense of service, such as oiling, depreciation, etc.
4. More efficient arrangement of machines and tools, which need no longer be placed in straight lines parallel with the shafting, but can be located exactly as desired.
5. Access to the machinery is easier from the suppression of belts and pulleys.
6. Greater cleanliness, as there is less dust and no scattering of oil or steam, etc.
7. Hygienic conditions are improved, owing to the diminution of dust and dirt; better light, owing to the absence of shafting, pulleys, etc.; the lessening of noise, etc.
8. Greater ease of placing different shops in separate buildings and in locating them according to the strict requirements of the work and without regard to the necessities of the motive power.
9. Greater facility in the increase of establishments.
10. Localization of accidents due to motive power, with consequent less injury to individuals and the stoppage of work only at the point where an individual motor is incapacitated.
11. Greater control of the speed of the tools.
12. A marked increase in the product of any given establishment.

In signalizing these advantages, Professor Crocker divided the application of motors to manufacturing into three classes. The first method consists in connecting the motor directly with the machine. The second consists in the interposition of gearing to reduce or increase speed. The third depends upon the utilization of auxiliary shafting and belting. The cases cited herewith of the application of electric motors come within the range of the points enumerated.

At the thirty-third annual convention of the American Railway Master Mechanics' Association in 1900 an elaborate and interesting report was made by a special committee on power transmission by shafting versus electricity for railroad shops. One of the most significant cases cited was that of the Baldwin Locomotive Works, where not quite 1,000 horsepower in electric current was utilized at the time for power purposes. Electricity was first introduced in the erecting shop for driving two 100-ton cranes, and an immediate saving of 80 men was effected. In the wheel shop the "common-labor" force was reduced from 40 men to six; the time consumed in reloading a lathe was cut down from 30 minutes to five; and the saving in power in that shop was estimated at fully 50 per cent. In the frame shop the laboring force was reduced 60 per cent. The fuel economy, involving a possible reduction of $120 per week, was but one item. The saving on labor was stated at $1,800 per week. The increase in output was large.

[*The end.*]

Westinghouse Internal-combustion Gas Engine.

The Westinghouse Machine Company of Pittsburg, Pa., has for some time been engaged in developing a double-acting internal-combustion gas engine and says that it is now prepared to build this type of engine in sizes ranging as high as 3,000 horsepower. The general design of the engine resembles to a noticeable extent that of a modern high-speed tandem-compound steam engine in the arrangement of cylinders, frames, bed-plates, bearings, flywheel and generator. This resemblance is further carried out in the matter of crank effort. Each revolution is accompanied by two impulses, one occurring at each successive in-stroke and out-stroke. The engine operates therefore upon the four-stroke cycle, involving distinct periods of admission, compression, explosion, expansion and exhaust, a cycle yielding the highest practical as well as theoretical efficiency and economy of fuel. The employment of the four-stroke cycle involves a feature of great importance, that of positive scavenging.

The cylinders are double-walled and are united by heavy tie rods at the top and by a cast-iron distance piece at the bottom. They are closed by water-jacketed heads. Both admission and exhaust valves, which are of the standard poppet type, operate vertically and with opposite throw. The valve gear is of the standard cam and roller pattern, and is driven by a helical gear, engaging a similar split gear belted around the main shaft.

The igniters are of the "make-and-break" electrical contact type. The engine is started by compressed air pumped into a steel reservoir during a previous run before shutting down. A sensitive flyball governor of the standard design is used. It operates a vertical piston valve, supplying a fuel mixture of constant quality, but in quantities proportionate to the load.

The single-crank engine is at present manufactured in sizes ranging from 250 to 750 horsepower and the double-crank from 750 to 1,500 horsepower. In the latter the cranks are placed at 90 degrees angularity, giving four impulses per revolution, and a crank effort corresponding to that of a cross-compound, double-acting steam engine.

Several installations of this type of engine are in progress. The first to be put into operation will be at the works of the Consolidated Industries Company, Batavia, N. Y., employing 250-horsepower, single-crank, double-acting engines, direct-connected to Westinghouse alternating-current generators, operating in parallel upon a general light and power-distribution system. A special coke and gas process known as the Lowe will be employed, yielding three products, metallurgical coke, coal and water gas, the former to be retailed and the latter used for power purposes.

The Common Council of Cheboygan, Mich., has adopted a plan for investing $275,000 in a city waterworks and electric-light plant.

New Alkaline Storage Battery.

An exhibit at the recent Chicago Automobile Show held in the Coliseum that attracted considerable attention was the display of the Chicago Storage Battery Company. This company had a space in the Annex, and the exhibit shown there is illustrated in Fig. 1. In the foreground is seen a set of 28 cells of the company's new storage battery, which is made on a new principle, and was exhibited publicly for the first time at this show. Each cell weighs slightly less than six pounds and is said to have a capacity of 100 ampere-hours on a closed circuit of 1.4 volts per cell. The remainder of the exhibit included a light runabout mounted on a speedometer and a switchboard, the whole being arranged to demonstrate the possibilities of the new battery. The runabout, on a test made during the exhibition, required 30 amperes to drive it a speed of 20 miles an hour, and the cells, with the minimum weight stated above, six pounds per cell, are able to deliver this amount of current for three hours continuously.

FIG. 1. NEW ALKALINE STORAGE BATTERY.—EXHIBIT AT CHICAGO AUTOMOBILE SHOW.

This cell, which is the invention of William Gardiner, is noteworthy from the fact that it contains neither lead nor acid. The electrolyte is a composition alkaline solution, and is contained in a copper cell which forms the negative element. The positive element is a tri-metallic composition. Like all alkaline solutions, the electromotive force is lower than in a lead battery. From a number of tests the working pressure was found to be about 1.25 volts.

During the last year the inventor of these storage batteries has secured the financial aid of J. W. Duntley, president of the Chicago Pneumatic Tool Company, Chicago, who has advanced the necessary funds to carry the invention from its inception to its present commercial condition. Continued and exhaustive tests have been made, both in practice and in the laboratory, and the results have been such that the owners of the patents are at present manufacturing the product for commercial purposes.

The invention has a number of features of particular interest to automobile makers and users. Each cell is hermetically sealed, and therefore it becomes unnecessary to standardize the specific gravity of the solution. The spilling of the acid or electrolyte is entirely prevented. The efficiency of the battery compares favorably with lead cells and is proportional to the rapidity of charge or discharge. For example, with a cell having a capacity of 100 ampere-hours (25 amperes for four hours), there is said to be no disturbance whatever in the electrolyte, no gasing, development of heat, expansion of the elements or damage in any way to the battery if the cell be given a charge as high as 45 amperes for nearly five hours. The same conditions are permissible under similar or greater rate of discharge. With the operator of an electric vehicle, this becomes particularly attractive, since he may give practically full charge to his batteries in an hour or two and discharge them at such rate as conditions may require, and all this without any danger to any part of the batteries. The cost of the cell is stated to be slightly above that of the lead cell, but the guarantees given as to life and duty of the batteries and other conditions are such that the battery in the end is said to be cheaper. The results of a watt-hour and voltage test for charge and discharge is shown in Fig. 2, while Fig. 3 gives curves of the battery discharging at 45 amperes.

In regard to the performance of the batteries, the company says: "The battery will receive a maximum charge in one or two hours, and is capable of being discharged at practically the same rate if occasion demands. While this is important and practicable to the automobile service, yet there is a condition in storage-battery work wherein this is particularly valuable. For central-station and street-railway work, the batteries may be charged without injury to their full capacity in not to exceed two hours, and, when called upon, as in central-station work and street-railway service, to take care of the peak of the load, they will readily and without any possible damage, meet this requirement."

The Chicago Storage Battery Company is incorporated under New Jersey laws with a capital stock of $1,000,000, and is equipping a large plant for the exclusive manufacture of storage batteries for all purposes and of all sizes. The present offices of the company are at 1406 Fisher Building, Chicago, and the factory is at Aurora, Ill. William Gardiner, the inventor of the battery, is the president of the company, and George H. Stout, formerly with the Helios-Upton Company, is manager.

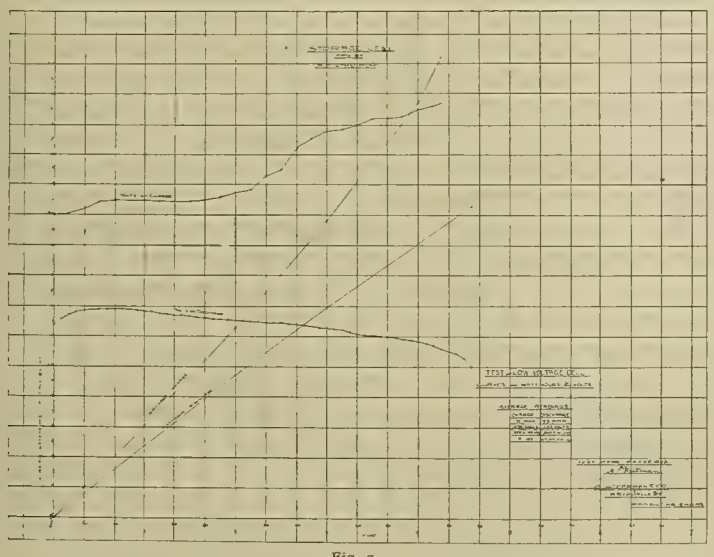


Fig. 2.

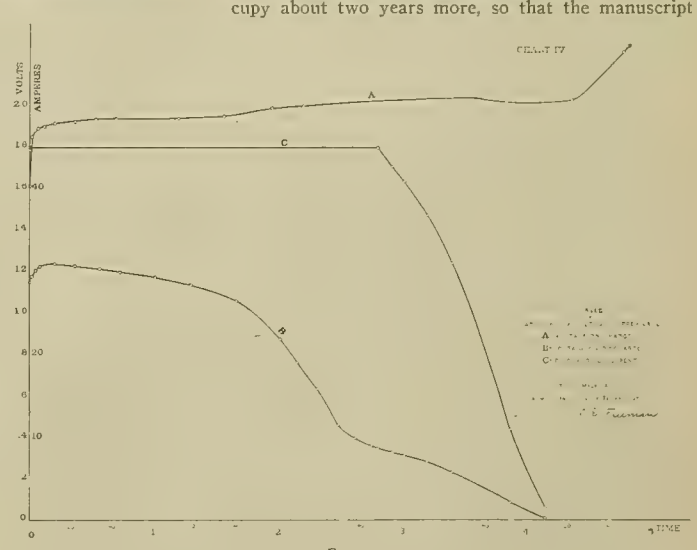


Fig. 3.

NEW ALKALINE STORAGE BATTERY.

Municipal-ownership Sentiment in Chicago.

As probably fairly indicating the trend of sentiment in Chicago on the question of public ownership, the following from the Chicago Daily Tribune is useful:

"The idea of the municipal ownership of street railroads has taken hold of the public mind or imagination. From popular votes and other sources of information it is apparent that a considerable proportion, if not a majority, of Chicagoans think the city should own the street railroads as it does the waterworks, and many think it should operate the railroads as it does the waterworks.

"The financial condition of the city at this time is not good. It is in debt beyond the constitutional limit. There are creditors whom it should have paid long ago, but whom it cannot pay. When are the special-assessment rebates which have been due for many years to reach the property owners who are entitled to them? With scanty revenues and with no credit, how is the city to buy or build street railroads? It is proposed that it pay for roads with bonds which are not to be a liability of the city, but are to be a lien on the roads and their revenues. It is assumed that the earnings will extinguish the bonds and the city will have acquired valuable properties without paying a cent for them. If the city defaults on its bonds, the railroads will foreclose. The city will have had an interesting experience which will cost it nothing. The scheme is not one which meets with the approval of all lawyers. It may not meet with the approval of the Supreme Court.

"No matter what may be said about the practical difficulties which stand in the way of the introduction of municipal ownership in the near future, the pressure for legislation on the subject will not abate. If the demand is not granted by this General Assembly, a more urgent demand will be made upon the next General Assembly. It will be better to end the agitation now by adopting enabling legislation. Perhaps such legislation may be of real assistance to the city in its negotiations with the traction companies."

* * * "If the city were to operate a street railroad without civil service the public would be wretchedly served—far worse than it is now—and the operating expenses of the road would eat up the receipts. The road would be serviceable only to the politicians it provided with patronage.

"Chicagoans desire municipal-ownership legislation, and it should be given them, but the legislation should be conservative, cautious, and hedged around with safeguards. No law on the subject should be hurried through. There should be long deliberation and full discussion."

The Technolexicon.

Work on the Technolexicon—the great German-English French technical dictionary to be published under the supervision of the National Society of German Engineers—is steadily progressing. An idea of the comprehensiveness of the work may be obtained from the statement of Dr. Jansen that although words have already been gathered for one and a half years by societies and individuals in Germany, Belgium, France, England and the United States, the collection will probably not be completed before the end of the year 1904, when the compilation of the contributions will begin, which will occupy about two years more, so that the manuscript will be ready by about the end of the year 1906, after which it will go to the press. Contributions of technical terms, or catalogues or assistance of any kind, are solicited from engineers, designers, manufacturers, etc., the world over. They should be addressed to the editor of the Technolexicon, Dr. Hubert Jansen, Berlin, N. W. (7), Dorotheenstrasse 49. Dr. Alfred Mueller, 150 Nassau Street, New York city, can give further information.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Supreme Court of Iowa has handed down a decision which gives the Iowa Telephone Company the right to construct a system in Des Moines without a franchise. The decision holds that all companies organized prior to the code of 1897 have the right to use streets as public highways without authority from the council.

The Chicago and Northwestern Railway is experimenting with a system of railroad telephone apparatus, to enable crews of trains to attach a wire to the telegraph lines by means of a jointed pole, and telephone to stations. The use of the wires for telephoning does not interfere with the telegraphing. The telegraphone, as it is called, seems to work well.

Norway township farmers will build a line of telephone into Vermilion, S. D.

A telephone line will be built from Bertha to Henning, Minn., via Wrightstown.

A telephone line is projected from Reading to Fulda, Minn.

The Valley City (N. D.) Telephone Company contemplates extending a line to Litchville, N. D., and establishing a local exchange there.

The Southwestern Minnesota Telephone Company contemplates a local exchange for Westbrook, Minn.

J. J. McKinnon and R. H. Armstrong propose a local exchange for Canistota, S. D.

The Steele County Telephone Company will extend its lines from Blooming Prairie, Minn., to Geneva, Ellendale, Hayfield, Waltham and other points.

The Woonsocket (S. D.) Telephone Company has sold its switchboard to Dale Wallace of Wessington Springs, S. D., and will put in a new board of 200 connections.

An Independent telephone exchange is talked of for Owatonna, Minn., unless the Northwestern Telephone Exchange Company makes all the improvements promised to its exchange without delay.

The Farmers' Mutual Telephone Company of Baltic, S. D., will consolidate with the line at New Hope under the title of the Baltic and New Hope Telephone Company.

The Morrison County Telephone Company will build a line from Little Falls, Minn., to Pierz and Buckman.

The Greenwood Prairie Telephone Company of Plainview, Minn., has extended 127 miles of metallic circuit and 45 miles of ground line in the last year.

The decision of the Supreme Court of Iowa giving the Iowa Telephone Company full rights to the streets of Des Moines, despite the expiration of its franchise, is taken by the Mutual Telephone Company of that city as abrogating its five per cent. gross earnings' tax.

A farmers' co-operative telephone system is projected from Great Falls, Mont., through that county. Barb-wire fences are to be utilized in the construction of the system.

The Nebraska Telephone Company expects to expend a total of $600,000 in Nebraska this year.

The Stratford (Iowa) Telephone Company has been formed and will start work on the line about April 1st.

The Bidwell Telephone Company of Bidwell, Iowa, has been formed, and will build a line to Blakesburg. R.

Ohio Telephone Notes.

At the annual meeting of the Stark County Telephone Company, held at Canton a few days ago, the directors authorized the expenditure of $48,000 in the improvement of the plant and the extension of the lines. A. S. Hillhouse is the general manager.

The officers of the Cuyahoga Telephone Company report that the new preferred stock to be issued under the refinancing plan has had a good demand from the present stockholders at 60, and that indications are that the plan will work all right. W. B. L. Turner, the new manager, who comes to the company from Atlanta, Ga., has assumed his duties, succeeding Maxime Reber, who will from this time devote his attention to the affairs of the properties of the Federal and the United States companies. President Dickson said that Mr. Turner would devote all his time to the Cuyahoga Telephone Company's plant and would make one of the best in the United States of it.

The Marion County Telephone Company of Marion will increase its capital stock from $100,000 to $250,000. Of this $50,000 will be common and the remainder preferred. The money secured from the sale of this stock will be used in extending the lines of the company and improving the plant in various ways.

The Citizens' Telephone Company of Tuppers Plains has been incorporated with a capital stock of $10,000. C. W. Oakes, L. L. Lowman, F. C. Taylor and others are interested.

The annual meeting of the Cincinnati and Suburban Telephone and Telegraph Company was held a few days ago, when the same directors and officers as served last year were re-elected. The company spent last year for improvements $542,800.91. The officers denied that the capital stock of the company would be increased.

The Bradford Telephone Company, recently incorporated with a paid-up capital stock of $20,000, will purchase the plant at Bradford and extend the rural lines over the territory thereabout.

Philip Fitzsimmons has applied for a franchise for an underground telephone system in Cincinnati, where he agrees to lay the wires in conduits under the alleys in a territory bounded by Third, Liberty, Sycamore and Central Avenue. He says he will install an automatic exchange, and already has 6,000 subscribers promised.

The well-known law firm of Squires, Sanders & Dempsey of Cleveland has rendered an opinion to President F. S. Dickson of the Cuyahoga Telephone Company to the effect that the city of Cleveland has no authority to fix the rentals which the company may charge, nor has it power to compel the company to furnish free telephones for the city offices.

The Celina Telephone Company, Celina, is arranging to increase its capital stock sufficiently to make extensive improvements in the plant and extend its lines out through the country along every public road. J. D. Johnson is president of the company. O. M. C.

Indiana Telephone Items.

John C. McCabe, connected with the Wells-Fargo Express Company, has bought the Independent telephone exchange at Greentown and will make extensions and improvements.

The Central Telephone Exchange of Loogootee was completely destroyed by fire in the 19th inst.

An attempt was made at an early hour on the 15th inst. to blow up the office and wreck the toll cable lines of the Commercial Telephone Company of Warsaw. A large charge of dynamite was exploded just outside the exchange office and the wires and poles nearby were greatly damaged. Windows in all the surrounding buildings were smashed. The telephone system is owned by Strauss Brothers of Ligonier. No motive can be conceived for the dastard work, nor is there any clew to the identity of the dynamiters.

A committee of telephone men headed by Hugh Dougherty of Bluffton appeared before the legislative telephone committee last week to discuss the bill to require telephone companies to connect their switchboards in towns where two or more companies are operating and furnish service over each other's lines. The speakers showed how such a provision would work the greatest hardship on them while it would do but little good for the people of the state.

Telephone companies were incorporated last week as follows: Bainbridge Telephone Company, Putnam County, capital stock $800, directors H. O. Balman, N. W. Adar, A. L. Priest, John Jacobs, and others; Knightstown Six Mile Telephone Company of Knightstown, capital $200, directors R. S. N. Oldham, M. M. Thomas, Frank Boren, and others; Castleton Telephone Company of Castleton, Ind., capital stock $1,000, R. S. Irwin president and William Herrin secretary. F.

Michigan.

City Electrician Worden of Jackson, Mich., in conformity with the orders of the Common Council, has disconnected all the city office telephones which had been furnished free of charge by the Bell company, excepting those in the city engine houses, which will be left until a few of the outlying factories, which have no other fire protection, can install the telephones of the Citizens' company. This is the outcome of the warfare which has been waged against the Bell company ever since the Citizens' company, which is operating under a franchise, began doing business, and had its outgrowth in the refusal of the Bell company to accept any franchise. The Bell Company as a result has been in difficulties. It furnishes service in some instances at a lower rate than does the Citizens' company, and is spending $60,000 in the rebuilding of its plant, keeping on improving its service. The Citizens' company, it is said, now has a larger number of subscribers.

The Co-operative Telephone Company of Detroit has let the contract for the erection of poles for a toll line from Pontiac to Detroit. When the line is completed connections will be made with the Independent plants of the lower part of the state through the Union Telephone Company of Alma. W.

Southern Telephone Developments.

The Southwestern Telephone and Telegraph Company is constructing the following new lines in Arkansas; Bridge Junction (near Memphis, Tenn.) to Hoxie, 85 miles; Walnut Ridge to Newport, 30 miles, and Jonesboro to Paragould, 20 miles. The company's purpose is to extend the system over the entire state. Exchanges have recently been completed at Atkins, Plumerville, Cabin Creek, Coal Hill, Mulberry and a number of other places. The company now has over 5,000 miles of long-distance lines in the state of Arkansas.

The war between the Bell Telephone Company and the Moultrie Telephone Company at Moultrie, Ga., has been settled by an agreement by which the Bell telephones are to be put in by the local company at the option of the patrons.

There is still a hitch in granting the franchise for a new telephone system at Chattanooga, Tenn., to Mrs. Annie McElroy Brett. A number of Chicago capitalists are interested in the proposed system. L.

Telephone Extensions in Mexico.

John Woessner of Saltillo, Mexico, who was recently granted a concession by the Mexican government for the construction and operation of long-distance telephone lines throughout that country, will soon have the line between Monterey and Saltillo and between the latter city and Torreon completed. Mr. Woessner will extend the long-distance lines to the Texas border, where connection will be made with the long-distance lines of Texas. He will soon commence the construction of local exchanges in Monterey and a number of other cities of Mexico. It is reported that Ohio capitalists, who are largely interested in the Independent telephone exchanges and toll lines in Texas, are interested with Mr. Woessner in the Mexican projects. Under the terms of the concession which Mr. Woessner has obtained from the Mexican government the property is exempt from taxation for a period of 20 years.

Progress of the Midway Company in Oregon.

The Midway Telephone and Telegraph Company is an enterprising Independent company located at Hillsboro, Ore. The company was incorporated less than a year ago, and since that time it has built 200 miles of line from Ashland, Ore., east in Klamath County, mostly through timber. It has an exchange at Klamath Falls (800 population) of 64 subscribers and 40 long-distance subscribers. This year the company expects to build about 200 miles additional into Lakeview, Lake County, and thence south into California. Lines will also be built north of Klamath Falls into the Crater Lake country. The company connects at Ashland with the Pacific States Telephone and Telegraph Company, thus giving communication with Portland, Ore., and San Francisco. The officers of the Midway company are: President, H. V. Gates; vice-president and treasurer, E. R. Reames; superintendent, O. B. Gates.

Bell Telephone Output.

The American Telephone and Telegraph Company's instrument statement for the month ended January 20th shows a great increase in use of the telephone, the net addition to number of instruments in licensees' hands under rental being 86,551. The figures for January also exceed all previous high records, both for the gross and net output. The largest previous gross output for any one month was 96,300 in June, 1901, and the largest previous net output was 72,281 in October, 1901. Comparisons follow:

	1903.	1902.	1901.	1900.
Gross output	129,837	87,412	66,048	58,853
Returned	43,286	34,796	25,766	18,966
Net output	86,551	52,616	40,282	39,887
Outstanding	3,236,871	2,578,626	1,993,098	1,620,392

Home Company of Louisville Wins a Point.

In the case of the Cumberland Telephone and Telegraph Company against the Home Telephone Company of Louisville, the Court of Appeals of Kentucky has decided that the Cumberland company does not have the exclusive right to the use of the streets in Louisville for its poles and wires, and that the Home company, although chartered in Delaware, has the right to do business in Kentucky, and that the state or city government, and not the Cumberland company, has the right to question in the courts its right to operate in Kentucky. The court was unanimous in the opinion, which is an important victory for the Home company.

Receiver for Michigan Telephone Company.

The Union Trust Company of Detroit has been appointed receiver for the Michigan Telephone Company (Bell). The financial troubles of this company have recently attracted attention. Only a few days ago the company renewed its obligation to the Old Colony Trust Company by the filing of a new mortgage for $4,715,000. The mortgage acknowledges default in two interest payments, one due July 1, 1902, and the other on January 1, 1903. The total interest was $235,750.

The free telephones have been taken out of the police stations in Chicago. City Electrician Ellicott says that abuse of privileges by the police department has caused the withdrawal of the instruments. The policemen not only dropped in slugs themselves, but they distributed slugs among their friends, it is said. Hereafter, telephone subscribers must call up Police Headquarters, and there be connected, to talk to any police station.

Improved Telephone Receiver.

One of the most neatly designed and durably constructed of telephone receivers is that recently evolved by the International Telephone Manufacturing Company, Chicago. Fig. 1 shows the receiver complete, ready for use. There are no parts exposed excepting the polished hard-rubber shell, which is shaped artistically and pleasing in appearance. The receiver cord terminates inside the shell. Fig. 2 shows the parts of the receiver.

This receiver has a horseshoe magnet constructed in one piece. It is fitted at its pole ends into the

FIG. 1. IMPROVED TELEPHONE RECEIVER.

adjusting block and firmly clamped to the bobbins and block by a heavy binding bolt and nut. The diaphragm is firmly clamped to a metal head by a threaded metal ring, to give it the greatest possible freedom to vibrate, and so it does not depend on the rubber cap for its permanency. Its double pole-pieces are made of a special grade of soft Norway iron. The cores are swedged, under heavy pressure, in a special die, to make them uniform in width and provide positive stops for the spool heads. The ends are milled perfectly square in a special jig, making them all of one length. The spool heads are mounted and set to the core by machine to give the bobbins all the same spacing. The spools are interchangeable. The cores fit together into the adjusting block, making it impossible for the receiver accidentally getting out of adjustment.

This receiver is adjustable, so that the diaphragm and pole-pieces of every instrument may be placed in their proper relation with each other, to secure the best possible results for the service desired. The spools may be conveniently and readily replaced

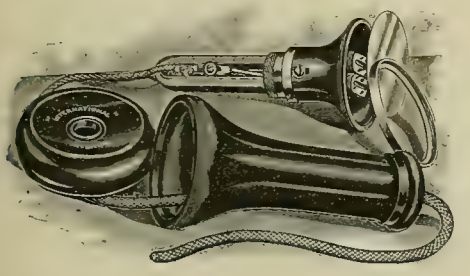


FIG. 2. IMPROVED TELEPHONE RECEIVER.

and the receiver accurately and permanently adjusted without returning the entire instrument to the factory.

The magnet, together with the spools, is securely fastened into a strong cast-brass threaded adjusting block. The adjusting block is adjustably fastened into a metal cup. The diaphragm is clamped firmly to the edge of this cup by a finely threaded metal rim. The adjustment is locked by two binding screws passing through slots in the cup, firmly clamping it to the adjusting block.

The cap of the receiver is provided with a small ridge around the hole, so that perspiration, due to long use of the instrument in hot weather, will not enter and rust the diaphragm. The shell and cap are constructed of the highest grade of polished hard rubber.

NEW COMPANIES.

The Central Illinois Telephone and Telegraph Company has been incorporated in New Jersey with a capital stock of $500,000 by Louis B. Daily, Kenneth K. McLaren and H. O. Coughlan.

Thomas, Okla., has a brand-new telephone system of 75 subscribers. The owners of the system are Riley Mitchell & Co., late of Clay County, Mo. Five years ago Thomas was a wheat field. To-day it is a booming town.

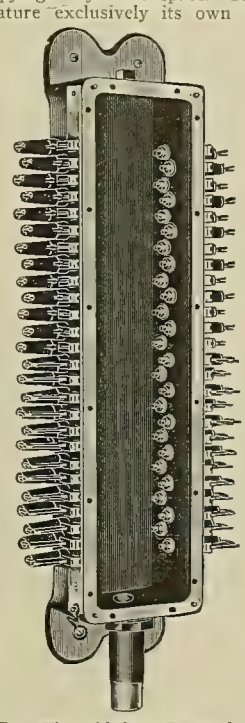
The Georges Telephone Company at St. Georges, Dorchester County, S. C., has been organized with $5,000 to build a system of telephones in the above-named county. R. L. Weeks, M. S. Connor and D. S. Dukes are interested.

The People's Co-operative Telephone Company has been incorporated at New Brunswick, N. J., to conduct a telephone business in Middlesex and Union Counties. The capital stock of the company is $100,000. The incorporators named are John B. Yeager, Frederick C. Kirkendall, George S. Alexander, Harry S. Peets, Andrew G. Raub and Joseph L. Dunn, all of Wilkesbarre, Pa., and Staats V. D. Clark and Theodore E. Townsend of this city.

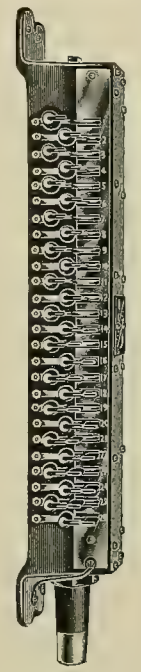
Moon Fuse Terminal with Carbon Arresters.

The Moon terminal head for telephone cables was placed on the market when the demand first came for cable protection by the pioneer Independent telephone exchanges. The efficiency of this terminal has been well tested and the apparatus has gained a wide reputation. Owing to the increased number of trolley and electric-light lines, together with the extensive growth of the telephone industry, there is a demand for apparatus that will not only protect the cable wires from currents of heavy voltage, but which will divert these currents to the ground without injury to the terminal apparatus itself.

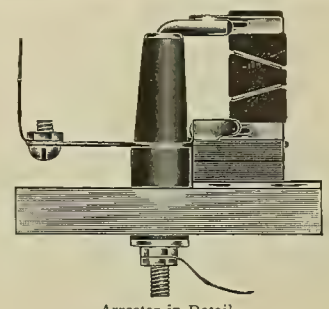
To accomplish this purpose, the Moon Manufacturing Company of Chicago is making a fuse terminal head having carbon arresters, and embodying all the features of the first apparatus which made it a complete protection to the telephone cable. The accompanying illustrations show this new apparatus. The lower carbons rest upon a heavy copper strip, to which a grounded wire is attached. The two carbons are separated by a thin sheet of perforated mica. Lightning, electric-light or trolley currents will cut out the fuse and pass through the two carbons to the ground, without forming an arc of sufficient heat to injure the insulations of the terminal connections. The apparatus has been thoroughly tested and will withstand a current of very heavy voltage. It will be noticed that the fuse, the carbons and the line connection are all supported by a single insulated terminal post, which is locked into the terminal head by nuts and washers. This makes a compact and substantial form of construction, occupying very little space. This apparatus has one feature exclusively its own in that the point the



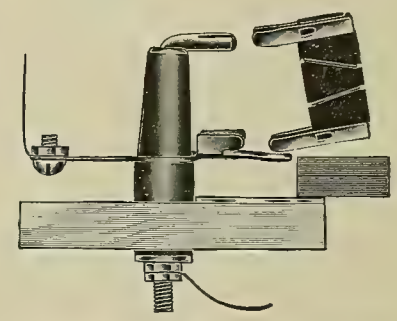
Front View with Cover Removed.



Side View.



Arrester in Detail.



Parts of Arrester, Showing Manner of Adjustment.

MOON FUSE TERMINAL WITH CARBON ARRESTERS.

high-potential current must reach before it can enter the terminal head and damage a cable wire is a point furthest removed from the natural path of such current, being furthest removed from the greater attraction of the large body of metal of the terminal head with its grounded wire.

The Moon fuse terminals, with carbon arresters, together with the Moon metal outer case or storm box, seem to constitute an efficient terminal apparatus.

EXTENSIONS AND IMPROVEMENTS.

It is said that telephone connection between Denver, Colo., and Butte, Idaho, will soon be an accomplished fact. Only a part of the line remains to be built. The two cities are about 610 miles apart in an air line.

The Sunset Telephone and Telegraph Company (Bell) says that it installed 3,506 new telephones in Seattle during the year 1902. The percentage of increase in number of subscribers last year was 53, the jump being from 6,616 at the close of 1901 to 10,122 at the end of 1902.

The Central District Printing and Telegraph Company of Pittsburg (Bell) has added $1,250,000 to its capital stock, which brings it up to $10,000,000. Of this $171,000 has been set apart for buying real estate and buildings in Pittsburg and vicinity and in building an addition to the Seventh Avenue building. It is also the intention to erect buildings at East Liverpool, Ohio, and Newcastle, Pa. The company will spend $176,000 for additional switchboards, $88,000 for extensions of underground conduits and $193,000 for the extension of various other lines. The company has added $5,000,000 to its capital stock within the last three years.

GENERAL TELEPHONE NEWS.

The Nebraska Telephone Company of Omaha has increased its capital stock from $1,800,000 to $2,400,000.

The Cape Cod Telephone Company of Barnstable, Mass., has been incorporated. F. Percy Goss is president and Arthur G. Guyer is treasurer.

The Gila Valley and Globe Telephone Companies of Safford, Ariz., have consolidated and will build a line between San Carlos and Mathewsville at once.

The farmers of Spring Valley, Ore., are preparing to build a rural telephone line. A company has been incorporated by D. H. Elliott, S. Phillips and others.

Sealed bids for a telephone franchise, as applied for by the Home Telephone Company, will be received by the City Council of Pasadena, Cal., up to 10 a. m., March 3d.

A bill has been introduced in the House of Representatives of Texas taxing long-distance telephone companies, or all telephone companies operating toll lines, one per cent. on their gross earnings.

R. H. C. Wood has resigned as manager of the Northwestern Telephone Exchange Company at Grand Forks, N. D., and is succeeded by George Blakely of Fargo. Mr. Wood becomes assistant to the superintendent of long-distance service, with headquarters at Minneapolis.

The Basanta system of electric intercommunication between moving railroad trains was successfully demonstrated on the Chemin de l'Etat line in France recently, according to a Paris dispatch. Constant communication was maintained between passengers of two sections of the railroad by means of telephones.

The two-story brick building occupied by the Glen Telephone Company in Johnstown, N. Y., was completely destroyed by fire recently. The exchange served over 1,000 telephones, and the damage was about $15,000.

In the year 1902 the gross revenue of the New England Telephone and Telegraph Company was $6,024,609; expenses, $4,855,840; net revenue, $1,168,769. After paying six per cent. in dividends, the surplus for the year was $60,042. Outstanding capital stock amounts to $21,616,700. The number of subscribers' stations is 111,774—an increase during the year of 17,952.

The Cumberland Telephone and Telegraph Company reports gross revenues for 1902 of $3,070,162; expenses, $2,068,163; net revenue, $1,001,978. After meeting charges of $219,813 and paying dividends amounting to $623,203, $158,962 was carried to surplus. The company now has 338 exchanges, 49 of which were built and opened during the year, showing a net gain of 15,893 subscribers, making the total on December 31, 1902, of 92,425 subscribers.

Experiments have recently been made in Vienna with a pocket telephone apparatus invented by a Swedish officer, Lieutenant Ljungmann. A number of policemen were sent out from the central police station supplied with the pocket apparatus, and by applying them to the fire-alarm boxes they were able to establish an instantaneous connection with headquarters. The apparatus, which is no larger than a cigarette case, is said to have been adopted by the Vienna police.

Liability for Maintaining an "Attractive Nuisance" with Electric Wires.

The Supreme Court of Kansas says, in the case of the Consolidated Electric Light and Power Company against Healy, that the company was given permission by the city to carry its electric wires on a viaduct constituting a part of one of the streets. This the company did by stringing them on timbers projecting out from the side of the viaduct or bridge. There were a number of wires placed at distances of about a foot to several feet from the ends of the boards constituting the floor of the bridge. The sides of the bridge were guarded by an iron railing or balustrade, several feet high, running, substantially speaking, over the ends of the boards constituting the bridge floor. However, many of the boards projected beyond (that is, outside) the bridge railing. The electric wires alongside the viaduct were defectively insulated. Their insulating covers had rotted away in many places. This fact the company knew. It also knew that small boys were in the habit of climbing over the viaduct railing immediately by the electric wires. Holly Healy, a boy about 10 years old, and of average intelligence and characteristics of boys of that age, climbed over the railing, and came in contact with one of the electrically charged wires, and was killed. The Supreme Court affirms a judgment for damages, in favor of his parents.

As to the boy, who was not at the time on the highway proper, but who was engaged in a dangerous sport immediately outside of it, was the company negligent in maintaining its wires in an uninsulated condition, where he was liable to come in contact with them? To the mind of the court, there could be no doubt as to the answer. It was liable. To an adult it might not have been. To a small boy, in the buoyancy of sport, and lacking the intelligence and discretion of older years, the company was liable, in view of the fact that it knew that children of his class were in the habit of venturing in dangerous proximity to its negligently kept wires. The place where the boy met his death was one of those denominated in the law books "attractive nuisances," the keepers of which, according to those decisions which this court regards as the sounder exposition of the law, are liable to one who, without inculpating fault on his part, is injured thereby. True, the company did not maintain the bridge and the railing and the elevation above ground, constituting an attractive climbing place for boys, and it might be that its wires were not themselves attractive playthings for the boys, but it maintained them in such immediate proximity to that which was attractive as to constitute them an integral part of the whole. When the company answered that it did not furnish the attraction, it was sufficient to reply that it furnished the danger to combine with the attraction. It could have neutralized the harmful ingredient of attractiveness in the compound by guarding against the danger, and to require it to do so was not to impose upon it any greater burden than though it were responsible for both the hurtful constituents.

New York Safety Automatic Governor.

Since the advent of shaft governors for steam engines numerous types have been shown by engine builders. The accompanying illustration represents a self-oiling governor which has been thoroughly tested and which is said to give a perfect ballast.

NEW YORK SAFETY AUTOMATIC GOVERNOR.

The eccentric travels direct on the center line of the shaft and does not swing off of center on a pin, as other shaft governors do. Two guide blocks circle the shaft, the outer part forming a guide for the eccentrics to travel on. A long, tapered adjustable gib is provided and attached to one-half of the boxes, so any lost motion or wear may be taken up. The governor may be oiled at the end and center of shaft while running. The eccentric and all parts may be removed without taking the wheel off of its shaft. A 16 by 16-inch engine equipped with this governor has been in operation for some months at the Saratoga Hotel, Chicago, making at times a continuous run of 20 days and nights. The governor is sold by the New York Safety Steam Power Company of New York city.

Institute Meetings in Boston and Pittsburg.

A chapter of the American Institute of Electrical Engineers was organized at the Massachusetts Institute of Technology in Boston on February 13th. Professor Elihu Thomson presided and some 200 persons were present, including the Technology Electrical Engineering Society and many Harvard University men. Charles F. Scott of Pittsburg, president of the Institute, Vice-president Samuel Sheldon of New York, Secretary Ralph W. Pope of New York and President Pritchett of the Massachusetts Institute of Technology made short addresses. Thomas D. Lockwood read his recently presented paper on "The Evolution of the Telephone Switchboard," which was discussed by Ralph W. Pope, Dr. A. E. Kennelly of Harvard University a past-president of the society, and Louis A. Ferguson, vice-president of the Chicago Edison Company. The executive committee of the Boston chapter is composed of Dr. Louis Duncan, Professor Harry E. Clifford, J. W. Welsh, K. W. Endes and R. W. Eaton.

At the recent meeting of the Pittsburg branch of the Institute at the Electric Club, Pittsburg, the telephone papers presented at the New York meeting of January 23d were read in abstract. R. A. L. Snyder of Pittsburg described and exhibited the arcophone, or talking arc lamp (see Western Electrician of September 27, 1903, p. 208). There was a general discussion of telephone topics, in which S. P. Grace, Charles Bradley, P. M. Lincoln, Mr. Gallagher and L. Hommel participated. A paper by S. H. Browne was received after the meeting adjourned. John S. Peck is secretary of the Pittsburg chapter.

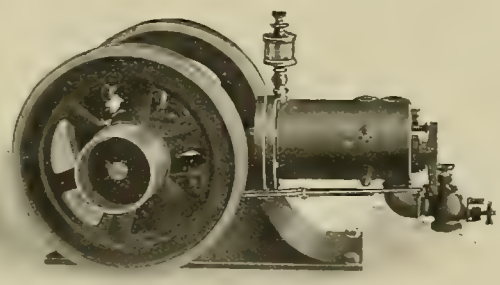
Hewitt Mercury-vapor Interrupter.

Mr. Peter Cooper Hewitt, whose work with the mercury-vapor lamp and mercury-vapor converter has attracted wide attention, has now made public an invention which promises to be of great importance in space telegraphy. The new device is an interrupter and consists of an adaptation of the mercury-vapor vacuum tube. It may be used to set up electrical oscillations instead of the spark-gap interrupter commonly used, and is especially valuable in space telegraphy, as it affords what has long been needed in that work—a low-resistance, efficient, simple and inexpensive interrupter. The device depends for its operation upon the "electric-valve" property, which characterizes the mercury-vapor converter. The interrupter has a very high efficiency and it can be used on almost any potential from 2,000 volts up, depending upon the size, shape and temperature of the tube and other features. It will thus afford an easy and efficient method of sending selective messages by space telegraphy. The loss in potential in the tube itself is but 14 volts, independent of the current. A rate of several million impulses a second may be obtained, which is not possible with the ordinary spark gap.

In this connection it is interesting to note that Dr. Weintraub of the research laboratory of the General Electric Company has invented an ingenious device which is used in starting a mercury-vapor lamp by means of a small auxiliary arc without any increase in voltage over that at which the lamp operates normally.

Lowell Gasoline Engine.

The accompanying illustration shows a new one-half-horsepower gasoline engine of the four-cycle type, which is especially constructed for hard service up to its rated power. This engine, which develops one-half-horsepower at 500 revolutions per minute, and on trial test ran eight 16-candlepower incandescent lamps at 650 revolutions per minute,



LOWELL GASOLINE ENGINE.

is suitable for running machinery in bicycle-repair shops; also for small lathes, blowers, meat choppers, fans, small refrigerating plants, incandescent lighting, pumping water, etc. The engine may be run on either gasoline or illuminating gas satisfactorily. The vibration is very slight, and an efficient muffler reduces the noise of exhaust to a minimum.

The cylinder is made of the best grade of cast iron, thoroughly water-jacketed, and is firmly bolted to the base. The cylinder head contains the valves and is also water-jacketed. The bearings are cast on the base, and are parted on an angle of 45 degrees; the crank shaft is of steel, drop-forged, while the connecting rod is of bronze. Cast iron is used for the piston and rings. Two heavy balance wheels are used, one of which carries the governor, and the other a belt drum. Ignition is made by an electric spark, and is operated by the piston.

The engine has the following dimensions: Cylinder, 2½-inch bore, 3½-inch stroke; crank shaft, one-inch diameter; crank pin, one-inch diameter; piston pin, five-eighths-inch diameter; balance wheels, 12-inch diameter; floor space, 21-inch length, 17-inch width; 12½-inch height; weight, 125 pounds.

To the many mechanics and amateurs who wish to construct a gasoline engine of substantial design this engine will be of interest. The castings and all material required for building the complete engine may be obtained; also blue-print drawings showing the construction. Other information will be cheerfully furnished by the manufacturer, the Lowell Model Company, Drawer 1213, Lowell, Mass. This company also furnishes castings and complete gasoline motors for launches, automobiles and stationary purposes.

Spongy Antimony for Storage Batteries.

Among the recent French patents is one which has been granted to Mathias for improvements in accumulators. The original feature of the process is the substitution of spongy antimony for forming the negative electrodes. This results in reducing the weight of the electrode by 60 per cent. The spongy antimony is obtained in the following way: With the oxychlorides of antimony and water a paste is formed into which is incorporated a solution of rubber in benzine. The holes in the lead grid are filled with this paste, care being taken to compress the substance so as to expel the excess of water. It is then dried in an oven at a temperature of 50 degrees C., when the mass becomes porous. To form the plate thus prepared it is necessary to reduce the antimony compound. For this purpose the plate is immersed in an electrolyte formed of sulphuric acid diluted to 10 per cent. It is placed opposite a carbon plate of the same surface, forming the positive electrode, and the two are connected by a wire. The hydrogen resulting from the decomposition of the water acts upon the oxychloride of antimony to combine with the chlorine, forming hydrochloric acid, and with the oxygen to form water. The antimony is thus reduced, and the formation of the plate is complete when no more hydrogen is given off. The plate, after being washed and dried, is ready to receive its charge in the presence of a positive plate. The spongy antimony can also be prepared in the form of powder by reducing a concentrated solution of antimony chloride by zinc or iron scrap. The powder thus formed is washed and dried and then worked with the rubber solution into a paste, which is pressed into the holes of the grid. The electromotive force of an element using negative plates prepared in this way is stated to be as high as in the usual forms.

A New Supply House in St. Louis.

Considerable interest attaches to the announcement that a new electrical supply house has just been established in St. Louis. The Ewing-Merkle Electric Company, which is the title of the new corporation, has just been organized with the following-named gentlemen as officers: President and treasurer, N. W. Ewing; vice-president, William S. Merkle; vice-president, William C. Brown; secretary, Milton Mill. These gentlemen are already well known in the electrical supply and machinery business of the West and Southwest. The new company starts, it is stated, with a liberal capital, and with excellent backing for any future needs that may arise. The Ewing-Merkle Electric Company's headquarters are 1106 Pine Street, St. Louis. The establishment occupies a six-story building with a frontage of 40 feet and having 110 feet depth. It is near the corner of Eleventh Street. The store is already equipped with stock, but it is the purpose of the company to be second to no supply house in the West in the matter of carrying a full and varied stock, from which "hurry" orders can be filled with the utmost dispatch. About March 1st the company will begin placing its salesmen throughout the West and Southwestern territories.

Hairpins Used as Fuses on an Electric Car.

The following interesting tale comes from Columbus, Ohio: "The ever useful hairpin once more proved itself an indispensable article late last night and saved a carload of trolley passengers a walk of several miles over ice and snow. The last car on the May Street line last night was crowded and the rails were slippery with ice, so the car crawled along with discouraging slowness. While near the out end of the line the fuse blew out. The motorman found his supply of fuses exhausted and the passengers for a time contemplated the prospect of walking a few miles apiece. The motorman entered the car and asked the women passengers for contributions of hairpins. He got a couple dozen of them. The metal was inadequate, but it was found that a hairpin would carry the car four blocks before it melted. After that distance another was inserted. In this way the car finally reached its destination. If there had been no women on the car all would have had to walk."

Proposed New York State Electrical Laboratory.

The New York State Electrical Laboratory Commission presented its report to the Legislature on February 17th. The commission is composed of Edward A. Bond, state engineer, Charles P. Steinmetz of Schenectady, and Harold W. Buck of Niagara Falls. After referring to the act of Legislature that created it, the commission states that it has found $1,462,615,595 invested in electric railroads, electric-light and power stations, telegraph and telephone companies in the state, while $217,974,695 represents the capital of companies engaged in the manufacture of electrical apparatus within the state. The commission has given its attention to the dispute arising in the use of electrical energy, and the following list, while not exhaustive, is sufficiently comprehensive to show both the range and the nature of questions demanding settlement:

(1) From mutual induction, static or magnetic, between independent circuits, especially between circuits carrying large currents or high potentials and circuits used for the transmission of intelligence, such as telephone, telegraph, fire alarm, railway block signals, etc.

(2) Accidents to life resulting from conditions frequently not clearly understood at the time of accident, such as crossing of circuits, failure of insulation, etc.; also from insufficient warning notices on circuits of dangerous potential.

(3) Between producers of electrical energy and public consumers, such as municipalities in street lighting contracts, involving the quantity of light supplied, the trouble arising from lack of officially standarized photometric methods.

(4) Between producers of electrical energy and public and private consumers on the quantity of current or energy supplied, resulting from inaccuracy of meters or methods of measurement.

(5) From electrolysis in railway and other grounded systems.

(6) From risk and damage to property from fire caused by defective insulation of circuits.

(7) Between producers and consumers of electrical energy and fire insurance underwriters on methods of installation.

(8) Between independent interests having adjacent distributing circuits underground from damage caused by heat in short circuits in conduits and subways.

(9) From damage caused by explosions in subways and conduits.

(10) Between manufacturers of electrical apparatus and purchasers on guarantees for electrical performance.

(11) Between producers of electrical energy and municipalities on the subject of transmission voltage of overhead circuits.

(12) Between the producers of electrical energy and the general public in cases of rights-of-way for very high voltage transmission lines where danger to life and property is claimed.

(13) Between the general public and manufacturers of electrochemical products where destructive fumes and gases are claimed to be set free in the process of manufacture.

(14) Many other cases which will undoubtedly arise as the art advances, such as interference in wireless messages.

"It will be noticed," continues the report, "that these questions concern not only the interests of capital invested in various electrical enterprises, but the interests of the consumers of electrical energy, the security of property and the protection of life. They are therefore of commanding importance to the general public and cannot be dismissed as belonging simply to the rivalries of commercial interests. It will be noticed further that these questions are purely technical, so that their settlement demands expert knowledge as well as impartial testimony, and the problem before the state is how to secure both the knowledge and the impartiality required for just judgment. As the commission considered this problem, it became convinced that a state electrical laboratory, adequately equipped and properly conducted, would meet many, if not all, of the demands growing out of such questions in dispute, and that these demands could not be met as satisfactorily by the use of any other means." Following is an abstract of the remainder of the commission's report:

"The first and most obvious use of such a laboratory would be the calibration of all types of electrical meters according to standards already fixed and universally accepted. At present no such official standardizing laboratory exists, apart from the National Bureau of Electrical Standards at Washington, to which it is manifestly inconvenient and practically impossible to refer all disputes involving the accuracy of electrical meters. It is the opinion of this commission that every state must in time have its own standardizing electrical laboratory, and that in no other state is the need of such a laboratory so immediate and so imperative as in the state of New York, where by far the greatest amount of electrical power is generated and sold.

"But apart from the work of calibration, a state laboratory, equipped for experimental work, could supply expert and impartial evidence demanded by nearly all of the questions in dispute to which reference has already been made. At present these disputes when carried into the courts, can be settled only by the testimony of witnesses summoned by one or the other of the contesting parties, and paid for their services by those in whose interests they testify. This represents one of the most important services which the state laboratory would render in the sphere of electrical science. Questions at issue could be subjected to actual experiment with adequate facilities, under the direction of competent men whose only object would be to seek the facts, all of the facts, in the interests of justice.

"Another office which would be fulfilled by a state laboratory is that of constant investigation and experimentation, with a view to increasing knowledge of this subtle and serviceable energy and discovering new applications of electrical power to useful ends.

"It is pertinent to state that the expense of maintaining the laboratory would be borne, in part at least, and perhaps in time altogether, by fixed charges for the work of calibrating meters, and by fees for such other work as might be referred to the laboratory by the courts, or by legislative act, or directly by contesting parties.

"It is not intended to establish a laboratory to determine electrical standards. These are already determined, but if they were not, that function would belong to the national bureau at Washington, or to some international commission. The state laboratory would simply apply accepted standards, passing authoritatively upon all meters submitted to it for calibration. Again, there is no thought of creating anything like a court for the settlement of disputes involving technical questions. All that is proposed in this connection is the establishment of a laboratory where such questions can be submitted to adequate tests with the guarantee of impartiality, whenever desired by the contesting parties, the courts or by the Legislature. Another misconception which appears in some of the replies is that a commission is to be instituted to take general control of the electrical interests of the state, passing upon qualifications of workmen, issuing permits, making rules to govern installation, etc. While this may be found to be desirable and necessary in the future, it does not fall within the scope of the present plan for a state laboratory. All that is proposed by this commission, is the establishment of a laboratory for:

"(1) The calibration of all forms of electrical meters and other electrical apparatus and appliances.

"(2) Experimental tests which may be called for by the courts, by municipalities, or by individuals, for impartial evidence on disputed questions of fact.

"(3) Continual investigation and experiment with a view to the development of electrical science and the further application of electrical power to useful ends.

"In the opinion of this commission, these purposes are of such importance to the people of the state as to justify the immediate establishment of the laboratory upon the lines proposed in this report.

"It is proposed to have the laboratory consist of five separate buildings, as follows: A power house, a storage building, an electrochemical building, a machinery building and an administration and instrument building."

The estimated cost of the laboratory is $275,000, of which $81,949 is for buildings, $182,500 for equipment and $10,551 for superintendence and contingencies. Some of the estimates of equipment are as follows: Five hundred horsepower in boilers, $10,000; engines, generators, auxiliary apparatus and switchboard in power house, $49,700; storage battery, $9,400; electric furnaces, $1,000; analytical apparatus in electrochemical building, $10,200; transformers, $6,700; switchboard in machinery building, $5,900; motor-generator sets of various descriptions, $48,400; various instruments, $10,400; wires and conduits, $9,400.

The commissioners recommend that an appropriation of $275,000 be made to build and equip the laboratory, the work to be supervised by the governor, comptroller and the members of the commission; that the commission select the site; "that this special commission be instructed to prepare and submit to the next Legislature a plan for the control of said laboratory, whereby reasonable assurance will be given of freedom from all influences that would tend to discredit the absolute independence of the laboratory and the scientific value of its work," and that the commission be instructed to nominate a suitable man for the office of director of the laboratory.

In response to the circular letter sent to electrical engineers of prominence and to most of the prominent electrical companies, the commission received replies in support of the project from the following, among others: William B. Rankine, Niagara Falls Power Company; Douglass Burnett, New York Edison Company; George A. Redman, Rochester Gas and Electric Company; F. P. Fish, American Telephone and Telegraph Company; E. W. Rice, Jr., General Electric Company; F. A. C. Perrine, Stanley Electric Manufacturing Company; Tylor Field, Bullock Electric Manufacturing Company; C. O. Mailloux, consulting electrical engineer; W. S. Barstow, consulting engineer; Ralph D. Mershon, consulting engineer; Harris J. Ryan, electrical engineer, Ithaca; R. B. Owens, Montreal; Johnson & Morton, Utica; Townsend Wolcott, New York; William H. Rakes, executive offices Postal Telegraph-cable Company, New York; L. B. Marks, New York; Albert F. Hemingway, Chicago; Calvin W. Rice, Pittsburg, Pa.; L. B. Stillwell, New York; William J. Hammer, New York; F. C. Phillips of the Ewell-Parker Electric Company, Cleveland, Ohio.

It is reported that the London and Northwestern Company of England will send a deputation to the United States to study the latest American railway methods. Frank Ree, freight manager, will head the deputation, which will include an electrician and an official competent to go thoroughly into every point connected with the American system of electric signaling. Scotch railway companies are also anxious to pick up hints from the United States, and a deputation from the Caledonian company may accompany the Northwestern officials.

CORRESPONDENCE.

London Letter.

London, February 14.—Orders for the electrical equipment of some 37 miles of the Northeastern Railway, near Newcastle, have now been given. The British Thomson-Houston Company has secured the contract for the electrical equipment of 50 motor and trailer cars, fitted with the multiple-unit system of control. The railway company will supply the bodies of the coaches, but the British Thomson-Houston Company will carry out the necessary alterations to the track and also supply a few locomotives for freight traffic. The Westinghouse company will supply and erect the high and low-tension switchboards, rotary converters, stationary converters and all the sub-station equipment.

A royal commission has been appointed by the government to consider the question of congested traffic in London. The whole thing indirectly turns upon the electric-railway and tramway facilities, and one of the chief duties of the commission will be to consider the desirability of appointing an authority which will take away from Parliament the onus of deciding the merits of such schemes. Owing to the methods hitherto pursued, very few miles of underground railways have been added during the last three or four years, and that some radical reform is necessary is generally admitted.

The conversion of the Inner Circle to electric traction is proceeding rapidly. On Mr. Yerkes' side trains are now being run experimentally, while the Metropolitan Railway Company is also expediting matters. The Westinghouse company has entered into a contract to supply the whole of the machinery for the Metropolitan company's power house, which will at first consist of about 14,000 horsepower, the whole to be in running order by November this year. Other orders for rolling stock, conductor rails, substation equipment, etc., have been placed, and there is no reason to anticipate any hitch at present.

The arbitration which has been proceeding for a number of months to determine the price to be paid by the Marylebone Borough Council for that portion of the undertaking of the Metropolitan Electric Supply Company which lies within the borough, has now been completed, and the arbitrators' award has been published. Under this award the company will receive $7,250,000—a price which everyone thinks will not tend to reduce the price of current in the district under the local authority for some time to come.

Two motor-car exhibitions have already been held in Great Britain this year, and a few new electric vehicles have made their appearance. One of the most novel is a combination petrol-electric vehicle made by a British firm, in which a petrol engine directly drives a dynamo and also charges a set of cells. Another new British vehicle is a two-seated accumulator car manufactured by one of our accumulator firms, having a capacity for a 50-mile run. More than one new continental electric vehicle was shown, as well as the few American ones that have been here for some time now. There would appear to be now a larger variety of automobiles than hitherto, and the number actually on the streets appears also to be on the increase. Yet another show will be held in April.

The Miller system of electric signaling, which is well known in the United States, has now been introduced over here, and an English company has been registered to exploit the system. A portion of the Great Central Railway in Derbyshire has been equipped, and a special visit was arranged a few days ago, when everything went off quite smoothly and satisfactorily.

The proposal of the London County Council to seek parliamentary powers to empower local bodies to undertake electric wiring is being strenuously opposed by the electrical contractors' associations, who are petitioning against it.

The question of the compulsory adoption of the metric system of weights and measures in Great Britain has once more been receiving great attention, and several papers and discussions have been presented at different scientific societies. The general impression seems to be that mechanical engineers are decidedly against it, but that scientific men and electrical engineers are in favor of it. Thus, we find such men as Sir William Preece, Sir Andrew Noble and Mr. Alexander Siemens all in favor of it, and Colonel Crompton and others against it. At the same time a fair percentage think that as the metric system is legal in Great Britain, things might very well remain as they are. A bill on the subject is to come before Parliament this session. The name of American has been brought a good deal into the debates, but, as one speaker will say the Americans are in favor of the system and another immediately contradict him, we hardly know what the opinions across the Atlantic really are. W.

New York Notes.

New York, February 21.—William Barclay Parsons, chief engineer of the Rapid Transit Commission, has devised plans for the future improvement of the traction systems of New York city which surpass in extent and comprehensiveness anything heretofore considered. They were embodied in a report made to the commission on Thursday. The proposed changes, which the mayor and the commission will push rapidly, include many new sub-

ways with elevated track and connections with the steam railroads. In detail the plans are as follows: One hundred and thirty miles of subway and elevated single track at an expense of between $50,000,000 and $60,000,000, about one-half of which will fall on the city; a new three-track subway line for Lexington Avenue, with a junction with the present subway at Fortieth Street and Park Avenue; the removal of the New York Central's tracks from the surface of west-side streets and the building of a new four-track elevated structure along the North River front for passengers and freight; arrangement with the New York Central for its local trains to run in the rapid-transit subways; a new subway from South Ferry through Church, Wooster, or Green Streets, University Place and Broadway to Forty-second Street, connecting with the main line; two new elevated tracks on the Second Avenue line from the Harlem River to Chatham Square, and thence on the double-decked structure to the City Hall; an extension of the Sixth Avenue elevated line along Christopher Street to Greenwich Street; an extension of the Bronx rapid-transit lines to Wakefield and Mount Vernon; a subway under Thirty-second Street from Broadway to Seventh Avenue to afford distribution of the passengers using the Pennsylvania tunnel. It is stated August Belmont, who now controls both the subway and the elevated systems of the city, has expressed his agreement with Mr. Parson's suggestions. If the city authorities decide to build the great system of subways recommended by Mr. Parsons, and authorization is given for his proposed elevated railroads, the entire work of providing Manhattan and the Bronx with an adequate rapid-transit service can be completed in 3½ years from the time the contracts are signed.

It is reported that D. H. Louderback, formerly connected with the Yerkes' traction interests in Chicago, has organized the New York Street Railroad Company with a capital of $7,000,000 to build a tunnel between Manhattan and Brooklyn under the East River, in which fast electric cars will be operated. The tunnel will run from the City Hall in New York to the City Hall in Brooklyn, and will be a mile and a quarter long. It is proposed to cover the distance in five minutes, and the fare will be three cents. The Brooklyn Rapid Transit, running over the bridge, charges five cents. The company agrees to pay as compensation to the city 2½ per cent. of its receipts. The syndicate behind the company has been quietly organized. Mr. Louderback has been elected president. The franchise under which the company will operate was secured in 1896, but beyond keeping the charter alive nothing has been done in the meantime. The grant is perpetual, and is regarded as highly valuable.

The story is current that the Standard Oil Company or its backers, will soon, if it does not now, hold a monopoly of the gas and electric-lighting plants and the transportation lines of Greater New York.

For the third time during this winter the service on the Manhattan Railway Company's elevated road was crippled on Sunday night by sleet on the third rail. The trouble was not nearly as bad as on the two former occasions, however, and the train schedules were maintained with but slight delay. The new through electric-train service on the Brooklyn elevated lines was inaugurated on that day, and while the conditions were anything but favorable, no serious block was reported. On Tuesday the worst snowstorm of the last two years visited the city and tied up all the surface roads for some time.

Beverly R. Value, third division engineer of the Rapid Transit Commission, has resigned to accept a position with the Toronto Light and Power Company. He has had charge of the underground work north of One-hundred-and-fourth Street, on the Manhattan-Bronx subway. At Thursday's meeting of the commission C. V. R. Powers, now chief assistant to Mr. Value, was chosen as the latter's successor. O.

New England News.

Boston, February 21.—The Massachusetts Legislature is considering a bill incorporating the Concord and Chelmsford Street Railway Company, with a capital of $300,000. The bill contains provisions for the company's taking private land by right of eminent domain and authorizing the carrying of express and freight. The incorporators are Frederick Winsor, John B. Paine, Charles J. Paine, Jr., Warren B. Chamberlin, and Herbert C. Sweetser. The company proposes to build an electric railway from Concord to Carlisle and Chelmsford, connecting with the Boston and Northern at the latter place.

On March 1st the Massachusetts Electric Companies will increase the wages of the employes on the electric railways under its control. With the exception of the Boston Elevated Railway, the increase affects the employes of practically all electric railways in eastern New England, between Nashua, N. H., and Newport, R. I. The new wage scale will give 25 cents an hour to men who have been in the employ of the companies for 10 or more years, and will raise the wages of new men from 17 to 20 cents an hour. The employes are to be divided into six classes, according to the length of service, and the pay is to be advanced one cent an hour per class. This schedule will affect the wages of 2,522 men, costing the company $154,667 the first year and increasing each successive year.

The semi-blizzard of Tuesday completely demoralized electric-railway travel in the cities around Boston. The Chelsea patrons of the Boston and Northern Railroad and others who had to pass through that city had an unpleasant experience which brought out considerable unfavorable criticism of the Chelsea city authorities. The latter have contended that, under the street-railway law, the company is bound to clear away the snow thrown on the streets by its snow plows, but the company has refused to do this work. On Tuesday Mayor Willard again called upon the company to clear the snow from the streets, but General Manager Foster refused to do so. At 7:30 p. m. Superintendent of Streets Alfred Maggi started out a number of levelers and a gang of shovelers, and they quickly leveled the high banks of snow left by the electric-railway snow plows, covering the tracks to the depth of a foot, completely stopping the cars. About nine o'clock the railway company started two snow plows, but the snow was so heavy that they were continually obliged to back in order to obtain headway, and whenever they backed, the city workmen shoveled the snow back on the rails, so the plows could do practically nothing. Finally the railway company sent out shovelers and teams, and some time after midnight the cars were running again. In the meantime, the public, particularly the theater-going portion, was seriously inconvenienced. During the day the Superior Court was petitioned for an injunction against the operating of snow plows on Chelsea streets by the Boston and Northern company. On Wednesday the city authorities stated that they and the company had reached a verbal agreement by which the latter will remove the snow from streets through which its cars run. If the company keeps this agreement, it is probable that the city authorities will drop the injunction proceedings.

Thomas C. Perkins, chief promoter of the proposed electric railway between Hartford and New Haven, Conn., via Middletown, says that the road will cost about $3,000,000.

The Swan Electric Company has been organized at Portland, Maine. It has a capital of $100,000, nothing paid in, and it proposes to deal in electrical apparatus. Walter A. Morgan of Portland, Maine, is president, and Ernest O. Hiller of Boston, Mass., is treasurer. The other promoters are Frederick A. Swan of Saugus, Mass., Frederick L. Fisher of Somerville, Mass., and Llewellyn Carleton of Portland, Maine. B.

Southern Developments.

Charlotte, N. C., February 21.—It is reported that Philadelphia capitalists will probably invest $1,000,000 in developing the falls of Caney Fork, near Rock Island, in White County, Tenn., near the point where the Great Falls Power Company will soon begin a similar undertaking. It is said that 8,250 horsepower is available. The company will probably offer the power developed in the neighborhood.

The Chattahoochee Terminal Company of Atlanta, Ga., proposing to build an electric line to Marietta, has been chartered by Thomas A. Gramling and others. The road will be 20 miles long. The capital stock is $250,000 to begin with.

A second company composed of New York and local capitalists will soon apply for a charter for the Atlanta (Ga.) and Marietta Electric Railway. The capital will be $600,000. D. B. Gray of New York, P. D. McCarley of Fulton County and others are interested.

The Lynchburg (Va.) Water Power Company has let the contract to George O. Tenney of Spartanburg, S. C., for building a dam across the James River. The power will be used for operating the electric lines and lighting the city. The work will cost over $100,000.

J. T. Black is soliciting stock for a company proposing to erect a $11,500 electric-light and power plant near Calhoun, Ga.

The International Steam Engineering Company of Atlanta has made a bid to erect a plant for municipal lighting at a saving of $83,000 annually in the cost of lights. The bid has been filed.

Electric lights are being agitated for Brevard, N. C. S. B. Alexander, Jr., of Charlotte, N. C., has furnished an estimate of available waterpower. L.

From the Buckeye State.

Cleveland, Ohio, February 21.—The commissioners of Clarke County, in which Springfield is situated, have granted the Campion Construction Company of that city a franchise to build an electric road from there to Piqua through Lawrenceville, Troy and Dalton. The interests of the Springfield, Piqua and Sidney Traction Company, which was granted a franchise over about the same route some months ago, have been acquired by the company. The franchise is for 25 years and the company is to pay annually to the county $50 for each mile of road built for the purpose of keeping the highways in good condition. Ex-Governor Asa S. Bushnell is at the head of the syndicate which will build this road.

The work of building the line of the Toledo, commence as soon as the weather will permit The contract will be awarded to J. G. White & Co. of New York, at about $730,000 for building the 32 miles of road.

The Leesburg Manufacturing, Light, Power and Water Company, Leesburg, has been incorporated with a capital stock of $25,000. M. Reakey, J. Worthington and others are interested.

The Western Electric Company has been awarded the contract to furnish 1,500 arc lamps for the Columbus municipal lighting plant, with other apparatus, at a total price of $33,200.

The Ohio Central Traction Company, a Mandelbaum-Pomeroy property, has been reorganized, and besides the properties which have been operated under that name in the past, it will include the Mansfield, Crestline and Galion lines which have just been completed. It will have a capital stock of $1,175,000.

The Lake Shore Electric Railway Company has filed an amendment to its charter, increasing its capital stock from $6,000,000 to $7,500,000, in accord with the plans adopted a short time ago for refinancing the company. The general offices of the company will be moved back to Cleveland from Toledo as soon as the receivership is terminated by the courts. O. M. C.

Michigan.

Detroit, February 21.—A representative of the Detroit United Railway has been in Flint for several days, effecting a settlement of the differences of that company and the city, which have existed for the last two years. The company refused to double-track and pave, as required by the franchise. It now wants an extension of the tracks to the factory district, and must have the council's permission, which explains the settlement.

More street-car troubles have developed in Battle Creek, where the Michigan Traction Company, to build an interurban line from that city to Lansing, completed a survey on a dozen streets. Many of these streets are also opened to the Jackson and Battle Creek Traction Company, and if both companies use their franchises, it means more double-tracking, and probably a repetition of the difficulty now on between the Michigan Traction Company and the Battle Creek and Jackson Traction Company, which has reached the injunction stage.

The Grand Rapids, Grand Haven and Muskegon Electric Railway Company has elected the following-named officers: President, J. D. Hawks; vice-president, W. K. Morley of New York; secretary and treasurer, Wallace Franklin of Detroit. It was decided to build a summer theater at Fruitport, and it is probable that the road will be double-tracked between Grand Rapids and Muskegon.

Ground was broken at Albion last week for the shops of the Jackson and Battle Creek Traction Company, and the construction of the buildings will be pushed.

Plymouth (Mich.) voters will decide, at their election in March, whether their village shall be bonded in the sum of $12,500 for a municipal electric-lighting plant. The people want better lights, but it is a question as to the hiring of the light or the erection of a municipal system of lighting. C. G. W.

Information from Indiana.

Indianapolis, February 23.—Three new electric interurban railway companies were incorporated during the week. The Knox, Chicago and Northern Traction Company (capital stock, $150,000) will construct a line from Logansport to Laporte via Rochester, Bass Lake, Knox and other towns. J. C. Fletcher, banker, of Knox is president. The Kokomo, Converse and Marion Traction Company (capital, $10,000) will construct a line 29 miles in length, connecting the cities named. The officials are O. V. Darby, G. E. Bruner, T. C. McReynolds and others. The Huntington, Columbia City and Northern Traction Company (capital, $50,000) will construct a line connecting the two cities and intermediate towns. The officers are: President, John A. Kintz; vice-president, F. J. Heller, and secretary, W. A. Jones.

Reports come from Laporte that Senator Mark Hanna is behind a gigantic plan to connect New York and Chicago by electric lines, and that franchises and right-of-ways have been secured between South Bend and Chicago. J. B. Hanna of Cleveland is said to be representing the Senator in the enterprise.

The stockholders of the Indianapolis, Shelbyville and Southeastern Traction Company held a meeting last week and voted to extend the line on through to Greensburg and Batesville, work to be begun at once. This is regarded as the first step toward building to Cincinnati before Charles L. Henry gets his Indianapolis, Rushville and Cincinnati line completed.

Charles L. Henry, president of the Indianapolis and Cincinnati Traction Company, in company with his chief engineer, John W. Moore, and H. B. Bridon of Chicago, who represents a firm of mechanical engineers who will oversee the construction of the new line, were in Rushville last week to locate the power house. The building will be a large one, and will, with its equipments, cost nearly $200,000. Mr. Henry says the work of grading and bridge building for a double-track system will begin just as soon as good weather appears.

The City Council of Hobart has granted a franchise to the Hobart and Western Electric Railway Company. A double track with a third rail for motive power is the plan being crystallized by the company. The line is to run from Valparaiso to Chicago via Hobart. Samuel A. Wright of Chicago is president.

The Syracuse Light, Power and Manufacturing

Company has been incorporated with a capital of $60,000. The company will dam the Elkhart River for waterpower to generate electric power for manufacturing purposes. Henry Boozer is president and J. P. Dolan secretary.

A reputable company has proposed to buy the Richmond municipal electric-light plant and furnish light at $20 to $25 a lamp-year cheaper that it has been supplied.

The Citizens' Electric Light Company of Marion was formed and incorporated last week with a capital of $50,000. The company will construct a modern plant and will compete with the Marion Light and Heat Company.

The Cannelton Council has purchased the local light plant and will make extensive improvements.

Bills are pending in the Legislature providing for a special levy (in towns) of 30 cents on the $100 for electric lights; and permitting waterworks and electric-light companies in cities of more than 10,000, not operating under special charter, to improve their plants and to pledge their receipts to pay the costs. F.

Northwestern Notations.

Minneapolis, February 21.—Diehl & Becker have been granted a franchise at Scotland, S. D., for lighting and will consider both gas and electricity.

The General Electric Company of Minneapolis is taking steps to remove its wires to underground conduits as rapidly as possible. All service to patrons is to be given from the curb. In many streets the wires are already so laid, and the remainder will be changed as quickly as possible.

The plans of the Interurban Railway Company of Des Moines cover the construction of 250 miles of interurban line within three years. Connections are to be made with other lines, giving Des Moines access to 500 miles of electric road.

The Marshalltown (Iowa) Electric Street and Interurban Railway Company has been incorporated and proposes to build lines from Marshalltown to Eldora and Grundy Center.

The St. Paul City Railway Company contemplates expending $250,000 on improvements to its system in St. Paul the coming year, largely on track improvement and paving between the rails. If the company builds the new car shops on University Avenue and Snelling, the amount will be increased to $750,000.

Surveys are in progress for an electric railway from Winona, Minn., to Rushford. It is understood that the intention is to continue the line on to the Twin Cities. It may also be carried southward toward La Crosse, Wis.

The Watertown and Lake Kampeska Railway and Transportation Company has been granted a franchise at Watertown, S. D., for a trolley line through the city to Lake Kampeska, 3½ miles distant. Local capital is behind the plan.

The Cedar Falls and Janesville Power Company has applied to the council of Cedar Falls, Iowa, for a franchise to enter the city with wires for the transmission of electricity for light and power.

Cooperstown, N. D., wants an electric-light plant and will consider applications for a franchise.

The Boston and Great Falls Electric Company, operating the electric-light plant at Great Falls, Mont., has been sold to Mrs. Marcus Daly and John D. Ryan of Butte, Mont. They have also purchased the street-railway lines at Great Falls.

An electric-haulage system will be installed up to the twelfth level of the big Chapin mine at Iron Mountain, Mich.

St. Peter, Minn., has granted a franchise to Hord & Keator for a street-railway system through that town. Kasota, Minn., has also granted the same parties a similar franchise.

R. H. Patterson, T. Cramer von Storch, George H. Rice and M. E. McDonald have been granted a franchise at Grand Forks, N. D., for an electric street-railway line. They will now apply to East Grand Forks, Minn., across the river, for a similar franchise. R.

On the Pacific Slope.

San Francisco, February 18.—Application has been made to the City Council of Seattle, Wash., by P. J. Donahue, representing Montana capitalists, for a franchise for a street railway into the city limits. It is proposed to construct an electric street-railway line, to cost approximately $250,000.

The Pacific Electric Railway Company of Los Angeles will claim the right to lay a third rail for a standard-gauge railway on Main Street from First to Sixth Street, regardless of any action by the Board of Public Works or of the City Council. It is claimed by Epes Randolph, general manager, that the company already owns the right to maintain a standard-gauge railway on Main Street, by virtue of the old franchise of the Los Angeles company, a half interest in which was purchased by the Pacific company.

Z. A. Johnson, proprietor of the Nez Perce (Idaho) Roller Mills has located a water right on Lolo Creek, a short distance from Greer, and will establish an electric power plant there. The length of the transmission wire will be 11 miles. Mr. Johnson has secured the franchise to light the city of Nez Perce.

Sealed proposals in triplicate will be received at the office of the constructing quartermaster, Vancouver Barracks, Wash., up to 11 a. m. March 6th for the construction of an electric-light plant at Fort Stevens, Oregon. Information will be furnished on application to F. H. Hathaway, constructing quartermaster.

Sidney Sprout, electrical engineer, has just completed extensive surveys and measurements on the Tuolumne River above Jacksonville, Cal., and finds that sufficient water is available to supply power for the mines in the east belt and mother-lode districts. A company of capitalists is now ready to take over this proposition and erect the plant at the earliest date possible.

The council of Big Timber, Mont., has passed an ordinance empowering the clerk and mayor to enter into a contract with the Big Timber Electric Company to maintain and operate a lighting system.

The Grays Harbor Power and Light Company has been organized at Aberdeen, Wash., by J. L. Wilson, Judge Gordon and L. C. Finch, to furnish light and establish an electric-car system for Grays Harbor cities. Spokane will be the headquarters of the company. Power will be obtained from Little North River Falls.

The Western Electric Drill and Machinery Company has been incorporated at Butte, Mont., by L. P. Sanders, R. H. Ballard and others.

The Citizens' Water, Light and Power Company of Long Beach, Cal., has been incorporated by John Carroll, C. Coughran and others of Long Beach, Cal.

J. J. Seymour, receiver of the San Joaquin Electric Company of Fresno, Cal., has been in Los Angeles for the purpose of receiving his discharge as receiver and officially turning over the property of the company to the recent purchasers. The name of the local concern will be changed to the San Joaquin Power Company, and the plant, it is said, will be duplicated. Mr. Seymour will be the local manager of the company

General Manager John A. Muir of the Los Angeles Railway, Los Angeles, Cal., says that H. E. Huntington has just given his consent for the purchase of four storage batteries to cost from $200,000 to $250,000. Such is one of the plans of the Los Angeles Railway Company to better its service. Bids will be advertised for. The storage batteries are to be installed in 90 days. A.

PERSONAL.

E. L. Broome has been appointed assistant steam engineer of the New York Central and Hudson River Railroad Company, with office in New York.

Dennis J. Burns, father of P. C. Burns, the widely known president of the American Electric Telephone Company of Chicago, died in Fond du Lac, Wis., recently in his 77th year.

Lieutenant (Marquis) Luigi Solari of the Italian Navy, well known by his collaboration with Marconi in space-telegraph work, was married to Baroness Ida Di Rubini at Turin, Italy, on February 23d.

At a recent meeting in London, England, of the shareholders of the London United Tramways Company, the chairman, Mr. White, announced his approaching resignation, and said he would be succeeded by Charles T. Yerkes.

C. H. Wilmerding of Chicago has been appointed consulting engineer for the Chicago, Rock Island and Pacific Railroad Company, in connection with the construction of its new shops at East Moline, Ill. These shops, it is stated, will be among the largest and most complete of railroad shops.

George C. Pratt and L. H. Blanchard have resigned their positions in the auditing and purchasing departments, respectively, of the Western Electric Company, Chicago, to become managers of the Chicago office of Hapgoods, a high-grade engineering employment agency, with headquarters in New York city.

First-lieutenant Edward P. O'Hern, ordnance department, United States Army, has been ordered to proceed to the works of the Westinghouse Electric and Manufacturing Company, Pittsburg, on business pertaining to the inspection of electrical machinery in process of manufacture for the ordnance department.

Alonzo F. Walter has resigned his position as general superintendent of the Michigan Traction Company of Kalamazoo, Mich., on account of impaired health. He will be succeeded by F. E. Tobe of Battle Creek, who filled his position for several months during last summer. Mr. Tobe came to Michigan from the offices of the Railways Company General of Philadelphia, which operates the local roads in Kalamazoo and Battle Creek and the connecting interurban.

James W. Plaisted, one of the best-known telegraph-construction men in New England, died at Portland, Maine on February 14th. Until a few years ago he was for many years superintendent of construction and repair for the Western Union Telegraph Company, having charge of its Maine district. He had been employed by that company and its predecessors for 50 years or more. He was the eldest son of Samuel P. Plaisted and assisted his father in building the American Telegraph Company's lines into Portland, Maine, the first telegraph wires strung into that city. James W. Plaisted superintended the connecting of the Atlantic cable with the shore at Cape Canso.

New members of the New York Electrical Society are Axel O. Bendichsen, William C. Wall, Jr., Clarence R. Dean, Henry M. Bascom, Albert E. Blackman, Joseph Guttman, William Hogan, Richard J. Riedl, William Mackay, Norman K. Althause, William W. Cully, Alfred R. Tahl, Alfred Bourgeois, Frank Gardner, Alfred J. Thompson, Emile C. Boerner, Jr., T. P. Teale, Jr., M. S. Clawson, G. W. Hallock, Alonzo C. Bell, Alfred W. Ekhoff, W. C. Minier, Bernard B. Neal, Charles V. Walter, A. Th. Moberg and Harry J. Smith.

John A. Duggan, one of the best-known electric-railway men in Massachusetts, died on February 16th, at his home in Quincy. He was 49 years old and had served in many municipal offices in Quincy. He was instrumental in organizing the Quincy and Boston Street Railway Company, which built the first electric railway in Quincy. He was superintendent for the company for many years. He was also a director and a director of the Braintree Street Railway Company. During the last few summers he has been general manager for the Cottage City Railway Company. He was a member of the firm of Burnham & Duggan, Boston dealers in electric-railway supplies. He left a wife and three children.

ELECTRIC LIGHTING.

Waxahachie, Texas, contemplates the establishment of an electric-light plant to cost $7,000.

The City Council of Cannelton, Ind., has purchased the electric-lighting plant of that city for $5,850.

An electric-lighting plant is to be built at Kinnberg, Iowa, to supply that place, also the towns of Dayton and Stratford.

The Town Board of Newport, Ind., has granted a franchise for 10 years to the Newport Electric Light Company.

The consolidation of the Laclede Gas Light Company and the Missouri-Edison Electric Company of St. Louis, Mo., is reported.

At a special election held in Springville, Utah, it was voted to bond the city for $20,000 for the purpose of building an electric-lighting plant.

The People's Power and Light Company of Watertown, N. Y., capitalized at $50,000, has been incorporated by J. M. Carpenter, C. W. Simons and G. H. Smith of Watertown.

The Boyson Light and Power Company of Brownwood, Texas, has been incorporated with a capital stock of $50,000 by S. R. Coggins, R. S. R. Boyson, Henry Beard and others.

E. W. Cummings and Mr. Ransom are making arrangements for the rebuilding of the electric-light and power plant of the Olympia Light and Power Company. All plans are complete. The new plant will cost about $100,000.

The electrical central stations of Bristol, England, present a novel feature in proprietorship, inasmuch as they are owned in partnership by a company and by the municipality. There are 28.5 miles of trolley lines operated by the tramway company, while the lighting is entirely in the hands of the city.

The Edison Electric Company of Los Angeles will erect a new fireproof office building and sub-station covering its entire property on East Fourth Street. The company will occupy a temporary business office on the ground floor at No. 123 West Second Street, and general offices on the top floor of the Tajo Building, northwest corner of First Street and Broadway.

The Cape Town (South Africa) Times of recent date states that the Municipal Council of Umtata is prepared to receive plans and specifications and estimates for a water supply and the electric lighting of the township. Tenders marked "Water and Electric-lighting Schemes" should be sent to the municipal office not later than March 31st. Further particulars may be obtained from the town clerk, E. J. Ramsay.

At the Women's College of Baltimore nearly white light is obtained for microscope illumination by using 40-volt lamps on a 50-volt current. About 25 per cent. of the lamps are renewed annually. Forty-five-volt lamps last longer and give a much less yellow light than the proper 50-volt lamp. The bulb is of ground glass, and this is mounted in a reading globe with mirror back and ground-glass front. This gives a very even field of light.

ELECTRIC RAILWAYS.

It is stated that Cincinnati capital will build an interurban electric railway from Decatur to Springfield, Ill., a distance of 40 miles. B. W. Campbell of Decatur is interested.

The threatened strike of the cable splicers and some of the other employes of the Chicago City Railway Company has been averted and the matter submitted to arbitration.

The Lake Shore Traction Company has been granted authority by the New York Railroad Commission to construct an electric railroad 14 miles

long from Westfield to Silver Creek, Chautauqua County. The line may later be extended to Buffalo.

At the recent annual meeting of the Milwaukee Electric Railroad and Light Company of Milwaukee, Wis., John I. Beggs, Silas W. Burt and Edwin M. Bulkley were unanimously re-elected as directors.

The Indianapolis and Eastern Interurban Railway Company has adopted a rule requiring that each conductor shall learn the duties of a motorman, so that in case anything should befall the motorman, the conductor will be able to finish the run.

C. Lunchford and P. R. Clark, promoters of the proposed electric railway which is to traverse the Big Bend country in the state of Washington, have secured a franchise for operating an electric line in Lincoln County, Wash. Surveyors are now in the field and grading will commence as soon as the route is finally located.

According to a recent agreement between the union and the managements of the Northwestern and Lake Street Elevated Railroad Companies of Chicago, the wages of motormen are fixed at 28 and 25 cents an hour, guards 18½ cents an hour and towermen 30 cents. All other employes receive a stipulated wage, and every employe of the two lines receives an increase in wages amounting to almost 10 per cent.

The Chicago Record-Herald makes the startling announcement that John W. Gates and leading capitalists of St. Paul and the East will build an electric railway from Duluth to the Gulf of Mexico. The road, it is said, will be used chiefly for freight but will eventually carry passengers. The estimated cost is given as $70,000,000, and the name of the company is to be the Texas, Iowa and Minnesota Electric Railway Company.

An electric interurban railway, 40 miles in length, is to be built from Rochester through Canandaigua to Geneva, N. Y. The road will be known as the Rochester and Eastern Rapid Railway. The Comstock-Haigh-Walker Company is building and equipping the line, and expects to have it in operation by next July. The electrical apparatus, furnished by the Westinghouse Electric and Manufacturing Company of Pittsburg, includes two 650-kilowatt, three-phase, 3,000-alternation, 390-volt, engine-type alternators, direct-connected to cross-compound engines; seven 300-kilowatt, three-phase rotary converters; four 500-kilowatt and nine 200-kilowatt, oil-cooled transformers, arranged for transformation from 390 to 16,500 volts; also exciters, switchboards, etc., for the main generating station and three sub-stations.

AUTOMOBILES.

John H. Grout, United States consul at Valletta, reports that there is some inquiry for American automobiles in Malta. He asks for catalogues.

The first week in April will be known as "Automobile Week" in Indianapolis, as the automobile show will be given at that time. A feature of the show will be a parade with 200 machines in line.

POWER TRANSMISSION.

A franchise has been granted A. B. Frame, on behalf of the Oregon Electric Power Company, by the City Council of Sumpter, Ore., for an electric transmission line in and about that city.

The bill for an act to authorize the Chicago Sanitary District to develop the canal waterpower and levy taxes therefor has been approved by the annexation committee of the board, and will soon be presented in the state Legislature.

The Niagara Falls Power Company has about completed a new conduit extending from the south side of power house No. 1 around the west side and to the subway designed by Professor George Forbes. In this conduit 24 ducts have been laid, and through 20 of them cables of 1,000,000 circular mils will be run. These cables will take care of the local distribution from power house No. 1. The conduit is about 800 feet long. The company has placed generator No. 15 in commercial service. This machine is the fifth of a total of six of the external revolving-field type to be installed in power house No. 2. In general appearance these generators apsemble those in power house No. 1, with the exception that the iron bridge over the machine has been omitted.

SOCIETIES AND SCHOOLS.

At a meeting of the Western Society of Engineers in the Monadnock Block, Chicago, on March 4th, William B. Jackson of Madison, Wis., will read a paper on "Hydraulic Development as Related to Electrical Installations."

The alumni of Washington University at St. Louis, living in Chicago, held their annual banquet on February 20th. The dinner was in celebration of the fiftieth anniversary of the founding of the university. Dr. C. M. Woodward, president of the St. Louis Board of Education and for the past 25 years dean of the school of engineering of Washington University, was the speaker of the evening.

The annual banquet of the Northwestern Alumni Association of the Massachusetts Institute of Technology was held at Kinsley's, Chicago, on February 21st. T. W. Robinson, vice-president of the Illinois Steel Company and president of the association, presided. Addresses were made by Dr. Henry S. Pritchett, president of the Institute; Dr. George E. Hale, director of the Yerkes Observatory, and others.

The next regular meeting of the Chicago Electrical Association will partake partly of a social nature and will be held at the Albion Cafe in the Pullman Building on March 6th. Dinner will be served (50 cents table d'hote) at 6 p. m., and will be followed at eight o'clock by an address on "Middle-West Engineering—An Optimist's View," by S. G. McMeen of the engineering department of the Western Electric Company.

ELECTRICAL SECURITIES.

Application has been made to the New York Stock Exchange to list $1,973,000 additional common capital stock of the General Electric Company.

Boston advices state that the directors of the Western Electric Company have voted to issue a stock dividend of $2,000,000, or 20 per cent., increasing the outstanding stock to $12,000,000.

SPACE TELEGRAPHY.

A French company has petitioned the postal authorities of France for permission to establish a space-telegraph station at St. Pierre, near Newfoundland, with the object of establishing a service between there and Cape la Hague, near Cherbourg, France. The Branly-Popp system will undoubtedly be used.

Under orders from the Bureau of Equipment of the United States Army, a space-telegraph station will be established at Cape Henry and another at Norfolk, for the purpose of instructing enlisted men in the service in the use of the wireless apparatus. It is the intention of Rear-admiral Bradford, chief of the bureau, to establish wireless stations at all naval training stations.

Punch represents two waterfowl perched on a rocky ledge overlooking the ocean. One, sleek, fat and healthy, is addressing, with great astonishment, his companion, who is drooping, forlorn and in a badly battered-up condition. He asks: "Goodness, Bertie, whatever's the matter with you? Been plucked for your exam?" "No," answers the other. "Just flew into one of those new fangled Marconigrams, that's what!"

TELEGRAPH.

The Western Union Telegraph Company has taken an appeal to the United States Court of Appeals in the case recently decided by Judge Joseph Buffington at Pittsburg in favor of the Pennsylvania Railroad Company.

At a meeting of the shareholders of the Eastern Telegraph Company in London last month, Sir John Wolfe Barry, the chairman, declared that people who were best qualified to speak on the subject still held the opinion that the wireless system of transmission could never be a serious rival of the cables for long-distance communication.

A man lost in the bush of South Australia, after wandering about for days, came upon the telegraph line between Adelaide and Port Darwin. He hadn't strength to go farther, but he managed to climb a pole and cut the wire. Then he made himself as comfortable as possible and waited. The telegraph repairers were sent along the line, and they came to the wanderer in time to save his life.

PUBLICATIONS.

The D'Olier Engineering Company of Philadelphia has published a bulletin devoted to direct-current De Laval steam-turbine dynamos.

The Jandus Electric Company of Cleveland, Ohio, pending the issue of its 1903 catalogue, is distributing to electric-fan dealers and buyers a circular calling their attention to the Jandus alternating and direct-current electric fans.

Charles F. Scott's recent address on "The Engineer of the Twentieth Century" delivered at the twenty-fifth anniversary of the Engineers' Club of Philadelphia last December, has been printed in neat pamphlet form for general distribution.

Three recent publications of the General Electric Company relate to the design and construction of transformers, their respective titles being "Sheet Steel for Transformers," "Transformer Economy" and "Some Facts Regarding Type-H Transformers."

The H. W. Johns-Manville Company of 100 William Street, New York, is distributing a pamphlet which treats of "Salamanderite," a new fireproof and waterproof paneling that the company is putting forth as a perfect substitute for inflammable interior decorative work.

The Electric Appliance Company, Chicago, has just issued for immediate distribution a handsome conduit catalogue. It is well arranged and very complete. Besides illustrating the complete line of Toler system of conduit boxes, it furnishes a number of working diagrams, and is full of valuable information along that line.

A catalogue, descriptive of whitewash, painting and spraying machines is distributed to the trade by the Star Brass Works, Chicago. The catalogue is well arranged, the machines being illustrated with good cuts, and the various points are brought out clearly. These spraying machines are especially adapted for power-station use.

"Conduit Comments" is the title of a well-printed and attractive pamphlet that is distributed by the Standard Vitrified Conduit Company of New York. The company's vitrified-clay, salt-glazed underground conduits and third-rail insulators are illustrated and described, and results of several severe tests on the insulators are given.

The Gregory Electric Company of Chicago has been sending to its friends a wall card containing in colors a beautiful woman's head entitled "Jeanette." A handy wire table on the bottom of the card gives data of bare copper and weatherproof wire, including their safe carrying capacities, and will serve as a convenient reference to the electrician.

The Little Giant Stoker Company, manufacturer of the Little Giant stoker, has just issued a new catalogue describing its product. Among the many claims which the manufacturer makes for his stoker are simplicity, practicability, adaptability, durability, efficiency, smokelessness and inexpensiveness. This stoker is said to possess a number of features not to be found in any other stoker, and is reported to be giving entire satisfaction by those who have installed it.

Foree Bain, the well-known patent attorney and electrical expert of Chicago has issued a new edition of his book, "Useful Information for Practical People." This handy little work has been received with marked favor by electricians, engineers, mechanics, inventors, manufacturers and other practical business men. It contains concise tables, explicit formulæ, recognized rules, apt suggestions and standard data of value. Mr. Bain, whose office is in the Monadnock Building, has set aside a number of copies for gratuitous distribution.

Baker & Co., the well-known platinum refiners of Newark, N. J., among their trade literature, issue pamphlets descriptive of the Shimer combustion apparatus for the determination of carbon in iron, steel, etc., and Tucker's combustion apparatus for determining the volatile ingredients and total ash of any organic matter. Another publication treats of jump-spark terminal wires and platinum ignition tubes for automobilists, while an interesting pamphlet gives a brief account of the origin and meaning of the alchemistic symbols, with illustrations of some of the symbols. Platinum is described in another pamphlet.

The new fan-motor catalogue of the Fort Wayne Electric Works illustrates and describes the various styles of fan motors which they are introducing this year. These fan motors are manufactured for both direct and alternating current. They are also made in two distinct types—the revolving and the desk type. The revolving type is very unique, and is different from anything that has heretofore been placed on the market. The desk type operates an eight-inch fan, which gives just sufficient and not too much of a breeze. Attention is called to the very small amount of energy required to operate these motors. The publication is artistic and shows off the fans to the best advantage.

G. W. de Tunzelmann of London, England, editor of "Science Abstracts," announces that in future the work will be published in two sections. Section A, Physics, will embrace light, including photography, heat, sound, electricity and magnetism, chemical physics and electrochemistry, general physics, meteorology and terrestrial physics and physical astronomy. Section B will embrace steam plant, gas and oil engines, automobiles, oil-engine-driven ships and launches, balloons and airships, general electrical engineering, including industrial electrochemistry, electric generators, motors and transformers, electrical distribution, traction and lighting, telegraphy and telephony. The American Physical Society is now joined with the Institution of Electrical Engineers and the Physical Society of London in the direction of the publication and has elected Professor E. H. Hall of Harvard University as its representative on the publishing committee. The American Institute of Electrical Engineers is also cooperating with the committee and taking special means to bring the publication to the notice of all its members, who will in future be able to obtain it at a reduced subscription rate through the secretary of the American Institute.

MISCELLANEOUS.

"If the citizens of St. Louis," says the St. Louis Globe-Democrat, "want their gas or electric meters inspected at their own cost, they can employ persons in whom they have confidence and agree on terms for the service. The bill introduced in the Legislature by Selph of St. Louis to create here, by the mayor's appointment, an army of partisan inspectors at an expense to each consumer of at least

$4 a year, is one of the most outrageous political jobs ever conceived in the state."

The New York Central Railroad has recently placed an order with Westinghouse, Church, Kerr & Co. for four Westinghouse-Corliss engines of the horizontal cross-compound type. These engines will form the main power equipment of a new power station in process of erection on the company's property at Weehawken, N. J., which will supply power to the grain elevators and shops there located. Two of the engines are 1,200-horsepower normal capacity, and the remaining two of 700 horsepower, each pair being direct-connected, respectively, to 750 and 400-kilowatt, polyphase generators of the revolving-field type. They will operate with 140 pounds of steam, superheated to 500° F. and with high vacuum. The equipment also includes a small exciter engine of the Westinghouse vertical-compound type.

TRADE NEWS.

The Electrical Equipment and Inspecting Company of New York city was recently incorporated with a capital stock of $25,000. B. B. Dolars, L. G. Goldsmith and P. S. Russell were named as directors.

The Memphis Furniture Manufacturing Company, Memphis, Tenn., contemplates the installation of electric power in its several factories in the near future. The company has a large plant in Little Rock, Ark.

The newly incorporated Eddy Electric Corporation of Windsor, Conn., has chosen the following-named officers: President, Edwin W. Rice, Schenectady, N. Y.; vice-president, Walter C. Fish, Lynn, Mass.; treasurer, James L. Dalzell, Lynn, Mass.; secretary and assistant treasurer, Myron F. Westover, Schenectady, N. Y. The capital is $150,000, and it has all been paid in in cash.

The third annual meeting of the Milwaukee Electric Company was held recently at Milwaukee and the old officers re-elected as follows: President, J. A. Whaling; vice-president, Walter Cary; treasurer, Otto R. Hansen; secretary and assistant treasurer, Thomas G. Whaling. The officers, except T. G. Whaling, with Edwin Reynolds and W. D. Gray, form the directory, which was also re-elected.

BUSINESS.

The Electric Appliance Company, Chicago, general sales agent for the Gutmann alternating-current wattmeter, is enthusiastic over letters and reports of tests which it has just received from Europe. According to these accounts, two Gutmann meters sent for comparative tests with all other makes of wattmeters, both domestic and foreign, easily carried off the honors.

The Holcomb-Lobb Company, Chicago, one of the largest producers of cedar poles, has already for delivery a large stock of poles which are said to be "as straight as a string." W. H. Holcomb, president of the company, is one of the pioneers in the cedar-pole business. The company has for years supplied poles for many of the largest consumers in the country. In anticipation of a brisk demand during the coming season, the company has cut a large stock of poles of all lengths. W. H. Herbst, secretary and treasurer of the company, is also well known in the pole business and has an acquaintance among consumers all over the country.

George H. Stout, 1406 Fisher Building, Chicago, western agent for the Keystone Electric Company of Erie, Pa., states that the demand for Keystone apparatus is becoming larger every day. While Mr. Stout has represented the Keystone company for only a short time, he has been most successful in interesting users of electrical machinery in the product he handles. The Keystone company manufactures machines up to 1,000-kilowatt capacity, and its apparatus is used in some of the largest and most interesting installations in the country. Mr. Stout is one of the best-known electrical men in the West, and his large acquaintance, together with his well-known ability as a salesman, will doubtless result in making the Keystone company's machinery well known throughout the West.

Eugene Munsell & Co., 218 Water Street, New York, 117 Lake Street, Chicago, and 332 Wellington Street, Ottawa, who have long been engaged in mining and importing mica, have recently added to their business the manufacture of mica specialties, such as lamp chimneys, canopies, candle-shade protectors, etc. In its 1903 catalogue and price list, just issued, is given a line of reflectors for incandescent electric lamps, which is said to be absolutely new. Being made of the best clear mica, the reflectors cast no shadow, and it is asserted that they intensify the light fourfold. Some of the forms are made to produce a flowerlike effect, and when used with colored lamps for decorative purposes, the results are said to be marvelous. Application has been made for a patent on these reflectors, and all of Munsell & Co.'s mica specialties will be distinguished by the copyrighted word "Micalite." The catalogue can be obtained by application to any of the above addresses.

Among the recent contracts closed by the Gould Storage Battery Company of New York are the following: Philadelphia and Lehigh Valley Traction Company, 196 cells and switchboard, discharge capacity 200 amperes; Warren (Pa.) Electric Street Railway Company, 240 cells, switchboard and Gould C. E. M. F. regulating booster, discharge capacity 160 amperes; Dayton and Muncie (Ind.) Traction Company, four plants, each battery consisting of 305 cells in lead-lined tanks, plate capacity 320 amperes, tank capacity, 400 amperes, switchboard and 44-kilowatt regulating booster; Odell (Ill.) Illuminating Company, 124 cells, capacity 240 ampere-hours at 240 volts for three-wire lighting system; Manhattan Heat, Light and Power Company, battery located at St. Paul, Minn., consisting of 56 cells in lead-lined tanks, capacity 2,080 ampere-hours, also switchboard and automatic booster for block lighting and regulation.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 17, 1903.

720,550. Electric-circuit and Polarity Indicator. Vincent G. Apple, Dayton, Ohio. Application filed June 17, 1901.

The device has contact points carried by two movable members and electrically connected with circuit terminals, and a decomposable, electrolytic element carried by one of the members and forming part of the connection between its contact point and circuit terminal.

720,563. Storage-battery System. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed October 17, 1901.

A polarization cell is connected between the two sides of the end-cell switch and has a counter electromotive force substantially equal to the electromotive force of the end-cell sections included between successive positions of the switch.

720,568. Space Telegraphy. Lee De Forest, Chicago, Ill., assignor to the Wireless Telegraph Company of America. Application filed March 6, 1901.

In the apparatus are receiving apparatus comprising aerial receiving conductors, receiving devices and means for changing the phases of the energy waves produced in one or the other of the conductors, whereby the receiving devices may be so located that a maximum of positive potential and a maximum of negative potential occur simultaneously at the respective terminals of the receiving devices. (See cut.)

720,577. Electric Battery. Edwin R. Gill, New York, N. Y., assignor to the Invention Developing Company. Application filed June 26, 1900.

In the test set described are a retaining-block containing cavities opening at one surface of the block, battery cells in the cavities projecting slightly beyond their orifices, and means operating by spring tension for holding the cells in place.

720,592. Electric Battery. Milton M. Kohn, Chicago, Ill. Application filed July 31, 1895.

The battery has a metallic retaining vessel, positive and negative elements, an excitant, means for sealing the retaining vessel to prevent the escape of gas, and a valve for the discharge of the gases generated by the action of the battery.

720,595. Ringing Generator. John C. F. Malthaner, Minneapolis, Minn., assignor of one-half to J. O. Therien, Minneapolis, Minn. Application filed September 13, 1902.

The generator combines with the contact springs and the source of electric current, an oscillating bobbin provided with primary and secondary windings.

720,596. Electromagnetic Reciprocating Tool. Cloyd Marshall, Lafayette, Ind., assignor to James S. Andrews, St. Louis, Mo., and William M. Simpson, Chicago, Ill. Application filed June 8, 1901. Renewed July 18, 1902.

Combined with a plunger and a pair of solenoids for reciprocating the same, are an external rotary commutating device comprising a series of disks of different diameters and means for operating the same to energize the solenoids alternately and momentarily short-circuit each solenoid at the time its circuit is broken.

720,599. X-ray Tracer. Friederich Moritz, Munich, Germany, assignor to Voltohm Electricitats-Gesellschaft, A. G., Munich, Germany. Application filed October 13, 1900.

A device for ascertaining the exact shape, size and location of an object is described. It consists of the combination of a stationary drawing-surface, a surface parallel therewith, a bow or frame supported on the latter surface, an X-ray generator carried by the bow, and a position-indicating device also carried by the frame adjacent to the drafting-surface.

720,604 to 720,610. Electric-lighting System and Train-lighting System. James F. McElroy, Albany, N. Y. Applications filed January 24, 1901, to October 23, 1902.

For these seven patents see page 167.

720,612. Trolley Wheel. Thomas McWilliams, Kings Park, N. Y., assignor of one-half to John J. Cusick, King's Park, N. Y. Application filed April 12, 1902.

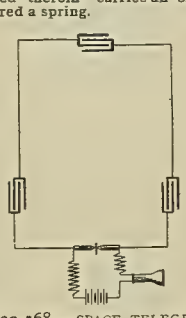
The wheel has a pair of recessed disks with inwardly projecting annular flanges arranged to form an oil reservoir.

720,621. Apparatus for Electromagnetically Recording Speech. William A. Rosenbaum, New Rochelle, N. Y. Application filed June 22, 1901.

See page 168.

720,633. Trolley. Joseph Spena, Lilly, Pa. Application filed August 4, 1902.

A trolley-pole having a bifurcated end and a trolley-wheel mounted therein carries an enlarged portion in which is secured a spring.



NO. 720,568.—SPACE TELEGRAPHY.

720,636. Automatic Hammer. Ernest H. Swift, Hartford, Conn. Application filed April 28, 1902.

The hammer has a solenoid for imparting movement to it in one direction, a switch mechanism comprising a rotary contact device, and a normally stationary brush co-operating therewith and shiftable for variably timing the initial point of energizing the solenoid relatively to the hammer-stroke.

720,650. Electric Arc Lamp. Alfred Witte, New York, N. Y. Application filed February 26, 1902.

In an enclosed-arc lamp are a gas-check comprising a sinuous conduit for the air and gases, the conduit comprising a series of ducts leading upward and a series of ducts leading downward through which the air and gases are adapted to circulate.

720,654. Electric Battery. Vincent G. Apple, Dayton, Ohio. Application filed June 3, 1901.

A vertical series of lateral bars joined to the sides of the containing-case constitute a supporting structure for active material. A series of removable plates or grids are placed in alternating position with the bar structure.

720,661. Regulating Device for Electrical Machines Driven by Steam Motors. Charles E. L. Brown, Baden, Switzerland. Application filed August 30, 1902.

Means for automatically causing the excitation of the field-magnets to vary as the load consist of a spring-controlled piston moving in a cylinder under the influence of the steam from a point of the motor where the pressure varies as the load and a rheostat in the circuit of the field-magnet windings of the generator, actuated by the piston.

720,668. Printing Telegraph. Luigi Cerebotani, Munich, Germany. Application filed July 3, 1899.

A printing telegraph for transmitting messages over short distances comprises a keyboard transmitter and a receiver, a printing wheel, means for feeding a paper ribbon to same and other parts.

720,674. System of Electrical Distribution. John L. Creveling, New York, N. Y. Application filed February 12, 1902.

In the system are a generator and a regulator-motor therefor, the motor being provided with windings and means whereby the magnetomotive forces of the windings oppose each other and tend to reverse the direction of magnetic flux. When the windings are out of magnetic balance the output of the generator is automatically varied.

720,675. System of Distribution. John L. Creveling, New York, N. Y. Application filed February 12, 1902.

The inventor describes the combination with a generator and a lamp or consumption circuit of a motor device controlling the output of the generator comprehending a member having a magnetic flux which is a function of the current generated and a member whose flux co-operates with the above to produce motion, and means under control of the motor device regulating the lamp or consumption circuit.

720,683. Engine Stop. William H. Dunn, Wallingford, Conn. Application filed February 3, 1902.

An electric alarm is part of the mechanism.

720,684. Electric Railway. George L. Fowler, New York, N. Y., assignor to the Central Electric Construction Company. Application filed July 18, 1900.

Combined with a continuous conductor having oppositely arranged contact-surface, is a shield having a substantially continuous and unbroken upper surface, the shield being constructed entirely of sheet metal and extending over the conductor and insulated therefrom.

720,711. Electrical Influence Machine. Selim Lemström, Helsingfors, Russia. Application filed October 6, 1902.

The machine has a pair of drums, one arranged within the other, means for rotating the same in opposite directions, and a pair of separate spindles supporting the drums at their opposite ends.

720,719. Apparatus for Producing Aerated Beverages. Peter E. Malmstrom, New York, N. Y., assignor to John Mulholland, New York, N. Y. Application filed September 1, 1899. Renewed February 24, 1902.

One claim reads: In a carbonating apparatus, a gas-holder, a liquid-supply pump and electrical mean for driving the pump, a carbonater connected to the gas-holder and pump, a switch provided with magnetic actuating devices, and means automatically controlled by the pressure in the gas-holder for energizing either of the magnetic devices, thereby controlling the operation of the pump.

720,729. Electrical Interrupter. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company. Application filed March 17, 1902.

In the apparatus are an interrupter disk, a motor for driving the same and a lever pivoted to one side of the axis

of rotation of the disk and eccentrically operating over the face of the disk to make contact with portions of the disk.

720,741. Electrolytic Diaphragm and Process of Making Same. Hugh Redman, Philadelphia, Pa. Application filed March 18, 1902.

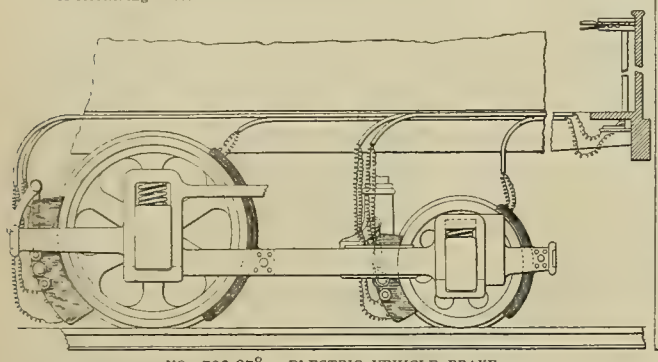
The process of making porous, electrolytic diaphragms consists of mixing an inert gum with a soluble substance, molding and hardening the mixture and subsequently dissolving out the soluble substance.

720,772. Electric Arc Lamp. Henry Baggett, London, England. Application filed December 15, 1902.

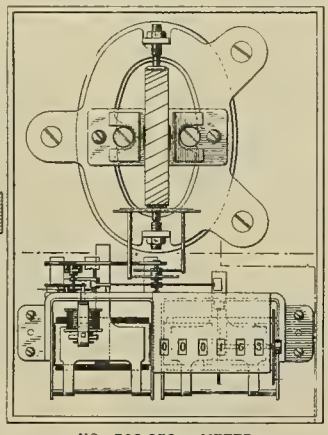
The lamp has a suitably guided upper-carbon holder and carbon-feeding mechanism connected with and actuating the holder, a movable weight located at one side of the path of movement of the holder and a rigid connection between the two, and suitable connections between the weight and the carbon-feeding mechanism.

720,783. Antiseptic Attachment for Telephone Mouthpieces. Charles W. Clough, Watsonville, Cal. Application filed April 17, 1902.

The attachment consists of a thin flat adhesive antiseptic or sterilizing wafer.



NO. 720,978.—ELECTRIC VEHICLE BRAKE.



NO. 720,979.—METER.

720,793. Apparatus for Reinforcing and Standardizing Filaments of Glow Lamps. Ferdinand Fanta, London, England. Application filed July 11, 1901.

In combination are an electric glow-lamp with a filament therein, a communicating tube thereto, a holder adapted to make electrical connections to the filament, and having a distinct ingress to and separate egress from the globe for gaseous supply, mechanical means for forcing air, hydrocarbon gas, or a mixture of both into the electric-glow-lamp globe, means for carbureting the supply of air to the globe, pressure-regulating devices on the supply pipes to control the pressure of the gas in the globe and distinct electrical circuits to the filament of the electric glow-lamp to be regenerated and to a standard electric glow-lamp.

720,808. Incandescent-lamp Socket. Harvey Hubbell, Bridgeport, Conn. Application filed May 26, 1902.

An improved socket is described.

720,823. Locomotive Headlight. James S. Lester, Atlanta, Ga., assignor of one-half to Samuel W. Small and Alexander P. Herrington, Atlanta, Ga. Application filed January 31, 1902. Renewed January 17, 1903.

An incandescent lamp is used in the headlight.

720,858. Snap Switch. William C. Tregoning, Bridgeport, Conn. Application filed July 5, 1902.

The inventor describes an improved push-button snap switch.

720,875. Telegraph System. William E. Athearn, Brooklyn, N. Y. Application filed March 19, 1902.

A direct-current system embracing a differential relay has connections from each of two paths to the key and to the line with a condenser in one of the paths. An alternating system embraces a transformer and a source of currents, the secondary of the transformer forming a part of the main line. Means are provided for sending Morse signals through the primary of the transformer.

720,879. Overhead Trolley. John J. Bouchard, Bradford, Pa., assignor to himself, Earle C. Emery, Burt H. Collins and William F. Ensor, Bradford, Pa. Application filed November 15, 1902.

A single tension spring is attached to opposite sides of the trolley fork and connected with the pole.

720,880. Telephone-receiver Holder. Arthur J. Briggs, Allegheny, Pa. Application filed December 10, 1901.

The holder has a vertical arm formed in section with a swivel connection between two of the sections and means for securing it. A horizontal arm pivotally secured to the upper of the sections carries a clamp adapted to secure the receiver, and a hinge connection is provided between two of the sections with means for securing the hinge connection in any desired position.

720,884. Regulation of Electric Circuits. Charles F. Burgess and Budd Frankenfield, Madison, Wis. Application filed June 12, 1901.

The method consists in including within the circuit the resultant inductance due to alternating and direct magnetizations.

720,885. Self-indicating Operator's Key. George L. Burlingame, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed April 3, 1902.

Combined with a key-lever are a number of sets of switch-contacts adapted to be operated thereby, and means actuated wholly by the key-lever to indicate the last set operated by the lever and returned to normal position.

720,888. X-ray Apparatus. Eugene W. Caldwell, New York, N. Y. Application filed November 10, 1902.

See page 168.

720,898. Means for Dissipating Electricity in Sheets of Paper. Thomas C. Dexter, Pearl River, N. Y., and Thomas E. Breen, Colwyn, Pa. Application filed March 17, 1902.

Combined with a machine adapted to operate upon sheets of paper are an air-blast device having an outlet for the blasts of air, a gas-burner pipe located in the air-blast device, a gas-supply pipe communicating with the burner-pipe, an air-supply pipe, also communicating with the burner-pipe, and an air pump or blower communicating with the air-supply pipe.

720,901. Telegraphic System. John Doyle, Norwood, N. J. Application filed June 19, 1902.

The arrangement of the mechanism is such that the strain of the downstroke is received upon a strengthened anvil and the strain of the upstroke is borne by the anvil head of a cable screw and thence transmitted to an insulating sleeve.

720,903. Brake Mechanism for Electric Elevators. Thomas W. Eaton, Chicago, Ill., assignor to the Eaton & Prince Company, Chicago, Ill. Application filed March 26, 1901.

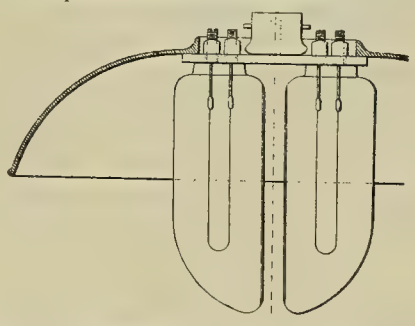
A main controlling and reversing switch is arranged with mechanical connections between the reversing switch and support, whereby when the reversing switch is moved into position to arrest the motor, the support for a weighted arm is released and the brake applied.

720,917. Electric Brake. John C. Henry, Denver, Colo.; Susie A. Henry, executrix of John C. Henry, deceased, assignor to the Stanley Electric Manufacturing Company. Application filed April 1, 1901.

One claim reads: The combination of a power circuit, a motor, a reversing switch and a brake magnet, the reversing switch having contacts to connect the motor with the power circuit to drive the motor in either direction and also having contacts and connections to connect the motor in local circuit with the brake magnet to give a braking effect.

720,935. Lighting Apparatus. Anton T. Kliegl, New York, N. Y. Application filed September 22, 1902.

A system of border or foot lights with a base composed of a trough of bent sheet metal adapted to support a series of lamp sockets inside the same is described.



NO. 720,962.—INCANDESCENT LAMP.

720,951. Electric Brake. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed April 18, 1901. Renewed December 22, 1902.

In the mechanism are combined a running-controller having a handle adapted to be moved in one direction from its neutral position for running and in the opposite direction for braking, and means for moving the controller in the same direction as the handle on the running side and in the opposite direction from the handle on the braking side.

720,953. Electric-lamp Socket. Mortimer Norden, New York, N. Y., assignor to the Norden-Bittner Electric Company, New York, N. Y. Application filed May 12, 1902.

The socket comprises a cup portion and a base, means for securing the base to a wall or other foundation, means for determining the position the parts are to occupy with reference to one another, and devices removably connected to the base and receiving and forming electric contact with the conducting wires.

720,962. Incandescent Electric Lamp. Casimir Pauthonier, Paris, France. Application filed July 7, 1900.

An incandescent cluster electric lamp consists of a disk-shaped mount of insulating material, a socket upon the mount adapted to be connected with an electrical source, contact-pieces secured on the mount connected in circuit with the socket, and lamps having their terminals electrically connected with the contact-pieces, the lamps being grouped on the mount around the center thereof and having translucent adjacent portions. (See cut.)

720,978. Electric Vehicle Brake. Charles J. Specht and Charles R. Krueger, New York, N. Y. Application filed June 7, 1902.

Combined with the wheel and with a magnetic shoe therefor, are a means for reducing the residual magnetism in the wheel after the release of the brakes, the means comprising a shell lying adjacent to the periphery of the wheel, wires carried thereon, and means for connecting the wires with a source of an alternating current. (See cut.)

720,979. Meter. William Stanley, Great Barrington, Mass., assignor to the Stanley Instrument Company, Great Barrington, Mass. Application filed April 5, 1902.

In the meter are combined a dynamometer, a time-beater, an integrating-train actuated thereby, the time-beater having an exciting-coil, and means for periodically making and breaking a shunt-circuit around the coil. (See cut.)

720,980. Meter. William Stanley, Great Barrington, Mass., assignor to the Stanley Instrument Company, Great Barrington, Mass. Application filed June 25, 1902.

There are combined series coils and shunt coils, a time-beater, means actuated thereby to energize and de-energize the shunt coil, means to integrate the indications of the shunt coil periodically, and means for short-circuiting the coil while such integration is taking place.

720,981. Apparatus for Measuring the Energy of Electric Currents. William Stanley, Great Barrington, Mass., assignor to the Stanley Instrument Company, Great Barrington, Mass. Application filed July 16, 1902.

Means are provided for integrating the torque due to the currents in the shunt and series coils at the end of the periods embracing a number of makes and breaks.

721,000. Street-railway Switch. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed July 25, 1902.

Electrically controlled means are provided for uncoupling the tongue and rail, whereby movement of the rail alone is accomplished.

721,025. Dynamo-driving Mechanism. John L. Creveling, New York, N. Y. Application filed November 29, 1902.

Combined with a generator driven from a reversible source of power is a driving-gear embodying in its structure clutch mechanism and co-operating pulleys, supported independent of and on opposite sides of the armature, adapted to communicate motion from one direction only to the generator irrespective of the reversals of the direction of movement of the source of power.

721,032. Electromedical Belt. Frank Farmer, Richmond, Ind. Application filed November 29, 1902.

In an electric battery is a cell having binding-posts extending therefrom, a cap upon the cell and extending over the posts, the posts being adapted to prevent lateral displacement of the cap, and means for securing the cap to the cell.

721,041. Printing Apparatus. Reinhold Herman, Crafton, Pa. Application filed November 3, 1902.

The apparatus has duplex printing cylinders and an electric lamp adapted to be lowered into them.

721,042. Socket Extension Tap. Henry F. Holland, Boston, Mass. Application filed February 11, 1901.

External circuit wires are combined with an incandescent-lamp socket.

721,065. Gas-engine Igniter. Louis P. Mooers, Cleveland, Ohio, assignor to the Peerless Motor Car Company, Cleveland, Ohio. Application filed October 24, 1901.

An electric igniter is described.

721,068. Apparatus for Decomposing Water by Electrolysis. William F. M. McCarty, Rockyridge, Md., assignor of one-third to Arthur Coppell, New York, N. Y. Application filed April 22, 1902.

The apparatus comprises two upright tanks connected about centrally of their height by a horizontal conduit and having outlets at their upper ends, an electrode suitably supported in each of the tanks, the electrodes having their upper ends located between the upper and lower edge of the conduit, a closable inlet located in one of the tanks above the normal water level therein, a water-supply pipe communicating with one of the tanks, and a water jacket surrounding the tanks.

721,084. Audible Electrical Telegraphy. Robert Oxlade, Redfern, near Sydney, New South Wales, Australia, assignor of two-fifths to William Joseph White Richardson, Petersham, near Sydney, New South Wales, Australia. Application filed April 9, 1902.

The system combines with the line, a receiving device, a transformer, a source of current connected to the primary coil of the transformer, a key included between the source of current and the transformer, whereby current impulses of alternately different strength may be sent to the transformer and thereby send similar induced currents to line, and means to short-circuit the transformer and thereby connect the receiving device directly to line.

721,124. Central-energy Telephone System. Francis W. Dunbar, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 22, 1901.

Combined with a telephone line extending in two limbs to the central station are a relay adapted to be bridged between the limbs and having its winding connected with a third conductor, and a source of electricity at the central station adapted to be connected between the third conductor and one of the limbs of the line to energize the relay.

721,128. Multiple-series System of Electrical Distribution. Frederick H. Loveridge, Coldwater, Mich., and Charles D. Haskins, Chicago, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed November 9, 1896.

In the system are combined a main source of current, main and compensating conductors between which the translating devices are connected, an armature and a field-winding connected in series between the main conductors, a second armature and a field-winding connected in series in a branch separate from the last-named circuit, between the conductors of one of the branches of the system, the dynamo-electric machines provided with the armatures having their rotating elements mechanically united.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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Two-phase Motors in a Car-building Plant.

At the works of the Western Steel Car and Foundry Company at Hegewisch, one of the most southern of the many manufacturing districts located within the corporate limits of Chicago, an interesting installation of two-phase induction motors has recently been made. This company manufactures freight cars for all classes of service, its capacity being 50 cars a day, and in its wood mill, machine shop and blacksmith shop it has found it specially advantageous to install induction motors for the operation of the many heavy machines. Several steam engines and long heavy line shafts, with their uneconomical operation, have thus been supplanted, and in their place, stationed at convenient points in the shops, are about 20 motors. The use of the induction type of motors, with its sparkless operation and enclosing case, was of advantage in the wood mill on account of the wood shavings and sawdust and in the blacksmith and machine shops because of the dirt and dust from the handling of the iron and steel material.

A new power house was built for the electric generating plant. It is a brick building situated about in the center of the grounds, and is divided transversely into an engine and a boiler room. The boiler equipment consists of four Aultman & Taylor 300-horsepower water-tube boilers, provided with a Buffalo mechanical-draft steam-driven, double 106-inch fan. The water in the vicinity of the works is not good for boiler-feed purposes, as it contains mineral and organic impurities, so an elaborate purifying plant has been installed. This consists of two filters, a purifying tank and a solution tank of the J. B. Mallers type. When the plant is completed it is the intention to use the shavings and sawdust from the wood mill almost exclusively for fuel. For conveying the shavings to the boiler room three galvanized pipes have been built overhead from the roof of the mill to the boiler-room roof, whence the shavings are carried by pendulum shoots to the boiler furnaces. These pipes are about 400 feet long, two of them being 32 inches in diameter and one 26 inches. They are operated by means of fans driven by two 75, one 50 and one 20-horsepower induction motor. The exhaust steam from the boiler auxiliaries and engines is used for heating the buildings, it being circulated by means of the Webster vacuum system.

In the engine room are located two 250-kilowatt two-phase, alternating-current generators, belt-driven by simple non-condensing engines. One of these engines is a 26 by 42-inch Brown-Corliss and the other is a 24 by 48-inch Fishkill-Corliss. The flywheel of each engine is 18 feet in diameter. The alternators, which are shown in Fig. 1, generate a current of 450 volts at 7,200 alternations, the capacity being 284 amperes per terminal. Their speed is 450 revolutions a minute. Each machine is excited by a 3.75-kilowatt, 125-volt, direct-current generator, belt-driven from the alternator shaft at 1,600 revolutions a minute. These generators, as also the switchboard and motors (type C), are of the Westinghouse manufacture.

The switchboard, shown at the left in Fig. 1, contains two generator panels, an exciter panel and a feeder panel. Each generator panel is equipped with a main oil switch operated by a handle on the front of the board, a field rheostat, a field switch, ground-detector and synchronizing lamps and two 450-ampere ammeters. On the exciter panel are mounted switches for the two exciters and a tie switch to throw them together, two rheostats, two ammeters and a voltmeter. At the left of the board is swung a voltmeter for the alternators. From the feeder panel are run two four-wire two-phase feeder circuits, and the panel is provided with double automatic 800-ampere circuit-breakers protected by marble slabs and a polyphase wattmeter.

The motors at present installed are located principally in the wood mill and the machine and blacksmith shops. Those in the wood mill are suspended on about the same level as the countershafts to which they are belted. There are two 100-horsepower motors driving planers and matchers, and one of these with its starting box is shown in Fig. 2. The other motors in the mill consist of three of 75-horsepower, one of 50 horsepower and two of 30 horsepower, their driving connection to the various wood-working machinery operated being by means of belts. This wood mill handles from 150,000 to 200,000 feet of lumber a day, it being practically all used in the manufacture of freight cars.

In the machine shop, operating lathes, planers, drill presses, and other machine tools are three motors of 75, 20 and 30 horsepower, respectively. The blacksmith shop is immediately adjoining, and in it are placed a 75, a 50, a 30 and a 20-horsepower motor. The 75-horsepower motor is shown in Fig. 3. It is stationed on the floor, as are nearly all of the motors in these two shops, and operates punches, bulldozers, fans for forges, etc., while the other motors drive a similar line of machines, including also hammers, and bending rolls. The motor shown in Fig. 3 operates at 400 volts and takes 88 amperes per terminal. Its full-load speed is 690 revolutions a minute.

A somewhat unusual use of an induction motor is made on a transfer table which operates between some of the larger of the buildings and across the company's factory tract. This table is shown in Fig. 4 (next page), which clearly illustrates the mast-arm with its four trolley contacts, which take current from the four-wire two-phase feeder running the length of the transfer bed. A 25-horsepower induction motor is used, and it is connected through gearing to the driving shaft of the table, so that a speed of 300 feet a minute without load is obtained, the speed loaded being 100 feet a minute. The table has a span of 75 feet and was installed by G. P. Nichols & Bro. of Chicago.

General illumination throughout the grounds and also in the larger factory buildings is supplied by enclosed-arc lamps, operated four in multiple on the single-phase circuits, while incandescent lamps similarly operated are used for special lighting at the machines. It is the company's intention to enlarge its plant considerably and install more motors, and as a step toward the ultimate completion of its plans a 200-kilowatt alternator is about to be installed. The mechanical and electrical engineering work at the plant is in the hands of C. H. Wilmerding, consulting engineer, Chicago.

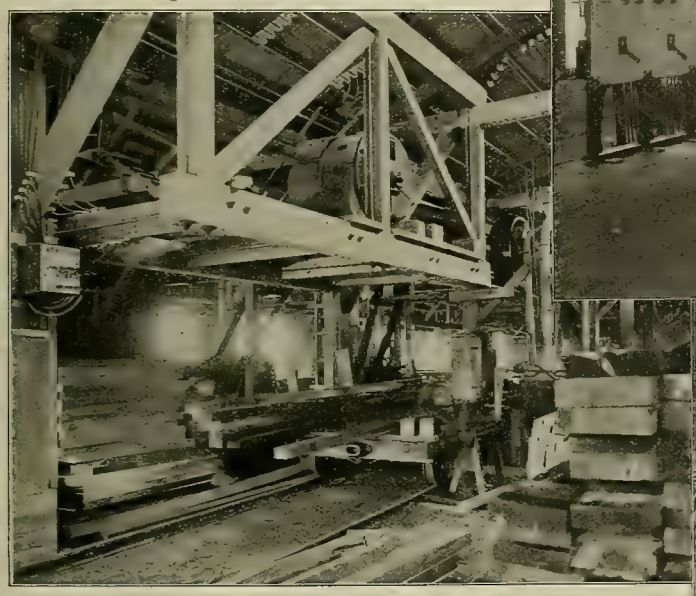


Fig. 2. 100-horsepower Motor in Wood Mill.

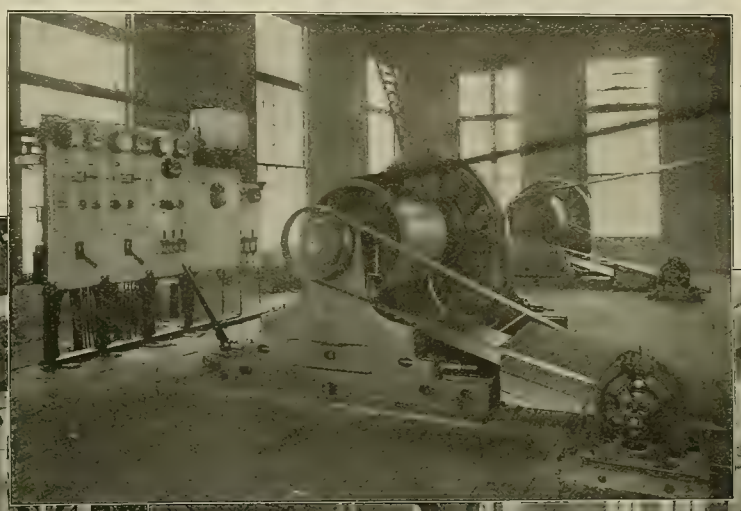


Fig. 1. Generating Plant.
Fig. 3. 75-horsepower Motor in Blacksmith Shop.

TWO-PHASE MOTORS IN A CAR-BUILDING PLANT.

A 25,000-volt Dynamo.

A dynamo-electric machine which gives one ampere at 25,000 volts has been constructed for the purpose of testing the insulation of the transmission line between St. Maurice and Lausanne, Switzerland. The armature, which is stationary, has an internal diameter of 580 millimeters, and a length of 300 millimeters. It consists of 48 Gramme coils, each with 500 turns of silk-insulated wire, 0.5 millimeter in diameter, the total resistance being 700 ohms. The commutator consists of 96 air-insulated segments, and is connected by rotating brushes to stationary slip rings. The rotating magnet has two poles, and is constructed of laminated iron. It takes eight amperes at 80 volts, and revolves at 600 revolutions per minute. An air blast is brought into play on the brushes to prevent sparking. This, however, is unnecessary for outputs up to 0.3 ampere.

Telegraph Construction in African Wilds.

The construction of the telegraph system in the Belgian Congo territory in Africa, which has been carried out since 1894, presents some interesting features, owing to the peculiar conditions of the country. The personnel is nearly all native, and is divided into companies of 40 men, each directed by one or two Europeans. From Boma to Leopoldville the line is formed of two phosphor-bronze wires of two millimeters diameter. To protect the wire from the cupidity of the natives it is covered with a blackish paint. The wire is mounted on steel posts placed 300 feet apart; they are 22 feet high and formed of T-iron, weighing about 11 tons each. At the upper end are three holes, two for the insulators and the third for the brace wires. The insulators, of the Belgian state type, are also of a dark color, to attract less attention. The length of the span has been increased over that of the former lines by using a harder wire, reducing its conductivity to 80 per cent., while the breaking strain is increased to 158 kilograms per square millimeter. Where the line passes through the forest or bush a path 30 feet wide has been cut in order to protect it from forest fires.

At Underhill, where the line crosses the river, a single span is used, mounted upon two towers of angle iron in trellis construction, 50 feet high. As the span is 2,500 feet long, the line wire is supported from four steel wires having a breaking strain of 314 kilograms. The Kassai River is crossed in two spans, with a central tower supported on a small island in the middle of the river. The three towers are respectively 45, 120 and 125 feet high, and the spans are 1,400 and 2,200 feet long.

The line is equipped with three main offices, nine telephone stations and six telephone cabins for the use of the steamer captains. For the inspection of the line there are 50 stations, the line being divided into five sections. Each section has a corps of five inspectors with a European chief. The outfit of the Congo telegraph stations includes a table with removable legs, a Morse receiver, Leclanché cells, an indicating galvanometer, key and sounder, etc. The main telephone posts are provided with microphones of the granular type, with two Leclanché cells, a magneto, bell and annunciator. In the telephone cabins, which are elevated above the ground on posts, so as to be out of the reach of white ants, there is a complete telephone set with dry cells and a special form of switch with points marked 1, 2 and 3. After taking down the receiver from the hook the switch is placed on 1 or 2 to connect with the preceding or the following post. After the communication, the receiver is hung up and the handle falls automatically to 3, which makes direct connection between the two neighboring posts. Many difficulties have been met with in the construction of the line, among these being the cupidity and prejudice of the natives, who consider it as a fetich, and when the wire passes over their houses make haste to move out. A great cause of trouble has been the elephants, which rub against the posts and overturn them. The elephants often uproot the posts with their trunks and twist them into corkscrew shape. In this way many miles of line have been destroyed.

The largest electric power plant in Oregon is being completed at Baker Falls, to be known as the Eagle Falls power plant. It is of 10,000-horsepower capacity. There will be 107 miles of transmission wire used in the main lines.

Electrical Indicating Weather Vane.

Robert Wilson of Newark, N. J., has invented a novel apparatus for the purpose of indicating upon an indicator located at any desired distance from a weather vane the exact direction of the wind at any time by means of electric circuits controlled from the rotary movement of the vane. Fig. 1 is a sectional representation of a building provided with a rotating weather vane upon the outside of the building, an indicator within the building, and the electric circuits between the indicator and a commutator upon the shaft or spindle of the weather vane. Fig. 2 is a diagrammatic representation of the indicator, commutator, and the system of electric circuits between the indicator and commutator.

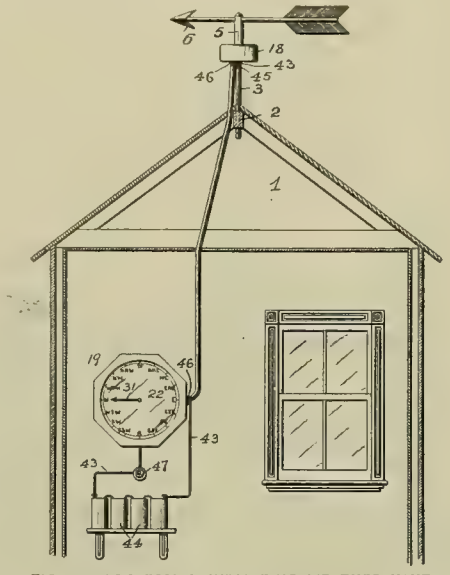


FIG. 1. ELECTRICAL INDICATING WEATHER VANE.

Suitably secured upon the fixed stem or rod (3) and held in a fixed position on the stem by means of a pin is a commutator disk (8) made of a non-conductor of electricity, such as fiber, porcelain, rubber, or the like. Suitably secured by means of screws (9) in suitably arranged peripheral slots or openings in the main disk (8) are commutator sections (10) of copper, the number of sections (10) corresponding to the number of divisions upon the dial of the electrical indicator. Each commutator section (10) is provided with a contact post or screw, to each of which is attached a circuit wire leading to electromagnets of the electric indicator. A pair of contact brushes (16) and (17) are in sliding contact with the peripheral edge of the fixed commutator disk (8) and the contact edges of the commutator sections (10).

The electric indicator consists, essentially, of a suitably-shaped and suitably-constructed box or casing (19), adapted to be secured against the wall or other part of a building. The box is provided with a glass or other transparent cover and beneath this cover and arranged upon a suitable support in the box is a dial plate (22), on which are arranged the usual symbols of the compass. Within the lower chamber (23) and suitably secured upon the base (25) of the box are a series of electromagnets (27), corresponding in number to the number of symbols upon the face of the dial plate (22) and to the number of commutator sections (10). The electromagnets are arranged on the radii of a circle having its center in the central axis of the armature shaft (29) of a suitable electric motor (28). The armature shaft extends in an upward direction through the dial plate, and is provided with an index-hand or pointer (31), and within the chamber (23) in alignment with the index-hand and secured to the armature shaft, is a literally extending arm or bar (32). It will thus be evident that any rotary movement of the armature shaft (29) of the electric motor (27) will produce a corresponding rotary motion of the arm or bar (32) and the index-hand or pointer (31), the same moving in unison with each other.

When the arm of the vane is rotated by the wind in the manner of the ordinary weather vane either one of the brushes (16) or (17) establishes an electrical contact with one of the series of commutator sections (10), thereby magnetizing the magnetic cores of the respective electromagnet (27) which happens to be in the energized circuit connected with the commutator section (10) with which contact is made by one of the brushes (16) or (17). Immediately the proper armature bar (36) is attracted by the magnetic cores of the energized electromagnet, whereby the bar (36) is brought from its normally raised position to its horizontal and lowered position. At the same time the electric motor (28) is operated by the current of electricity passing through it, thereby rotating the arm or bar (32) against the offset (37) of the lowered armature bar (36), and stopping all further rotation of the motor. This movement has also brought the index hand or pointer (31) directly above the proper symbol on the dial plate (22), corresponding to the position of the arm of the weather vane (6) to indicate to the observer within the building the correct direction of the wind. As soon as the direction of the arm of the vane (6) is changed by the wind, contact is broken between the brush and the commutator section (10) and another electrical contact is established between either of the brushes (16) or (17) with another commutator section. At the same time the previously made magnetic contact between the armature bar (36) and the previously energized electromagnet is broken, thereby allowing the armature bar to assume its normally raised position and the motor to assume its rotations, whereby the arm or bar (32) is moved against the offset of another lowered armature bar (36), which has been actuated by another energized electromagnet.

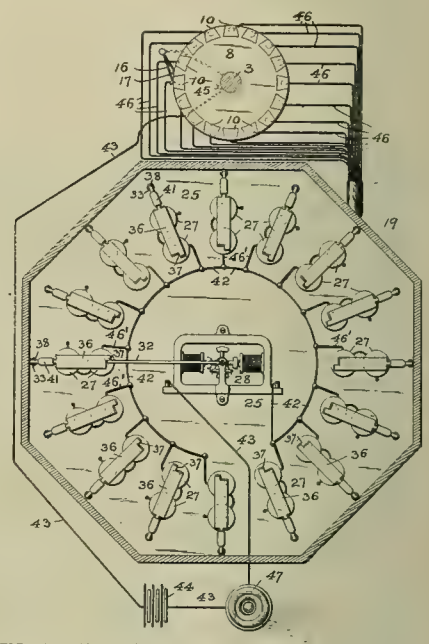


FIG. 2. ELECTRICAL INDICATOR FOR WEATHER VANE.

FIG. 4. TWO-PHASE MOTORS IN A CAR-BUILDING PLANT.—TRANSFER TABLE (PAGE 183).

Great Power Plant in Mexico.

Satisfactory progress is being made in the construction of the great electric power-generating plant on the Duero River, near the city of Guanajuato, Mexico. The Guanajuato Electric Company, which is erecting this plant, is composed of New York city capitalists, and it is estimated that the plans call for an expenditure of not less than $7,000,000. The generating plant will have a capacity of 7,000 horsepower and the transmission lines will extend to every part of the Guanajuato mining district, as well as throughout the city itself. The necessary equipment for the great enterprise is being purchased in the United States.

RAILROAD TRAIN LIGHTING.

At the New York meeting of the American Institute of Electrical Engineers on February 27th the subject for discussion was railroad train lighting. President Charles F. Scott of Pittsburg occupied the chair, and about 175 members and visitors were present. Secretary R. W. Pope announced that at the meeting of the board of directors in the afternoon 101 associates were elected. At the same meeting the date of the annual convention at Niagara Falls was changed to from June 29th to July 3d, one week later than that of the previous announcement, owing to the fact that other very large conventions are to be held at Niagara Falls during the week first selected, and suitable hotel accommodations could not be obtained during that week for the meeting of the Institute.

In his introductory address President Scott said that the electric light was in many respects ideal for train illumination, but that the problem of supplying the current to the lamps was a difficult one. He briefly considered the different systems. Each has its drawbacks. But "the very difficulties are an appeal for new methods, for simple and efficient methods of transforming energy from its abundant and convenient sources into the desired form of electrical current. The motion energy of the train is almost infinite compared with the meager amount of energy required for a few glow lamps, but apparatus for transforming, regulating and storing that energy is complicated and costly. The chemical energy contained in a few pounds of coal would be ample for the evening lighting of a whole train, could it be efficiently transformed into electrical energy. An ice machine by which the heat in a pail of water could be abstracted in the form of electrical energy would illuminate a car during a long journey as a lump of ice was being frozen."

The papers of the evening were then presented. Abstracts are given.

Axle Lighting.

BY ELMER A. SFERRY.

Electrical car lighting in America will attain its majority within the present year. In August, 1882, the Pennsylvania Railroad Company electrically equipped car No. 397 with Faure accumulators imported from France for the purpose. Not only is this the earliest application of electricity to car lighting in this country, but in fact one of the earliest in the world. Again, it was this same enterprising road that promoted the first installation of the solid electrically illuminated trains or series of trains, the Pennsylvania Limited, between New York and Chicago. These equipments were installed in the middle 80's and are still in continuous service; all are direct-connected sets in the baggage compartment, supplying the lamps, together with batteries under each car. Meanwhile, English railways were active in the same line, their first installations being axle-driven.

A perfect system requires that every car shall be entirely independent of every other, and shall maintain its lights perfectly after the train is broken up. Many efforts have been made to perfect devices to accomplish this purpose, and they operate more or less successfully. Some systems employ belt drives as a means of mechanically coupling the generator to the axle. Some of our present fast trains that are thus equipped have come through repeatedly with every belt on the train gone. Again, in some of these equipments, the generator is mounted on the car body with no means of co-ordinating its lines with the constantly changing alignment of the axle within the swiveling truck. Some are mounted upon the trucks themselves, but so hung that the truck springs over the axle box are required to be reinforced upon this end of the truck, owing to the overloaded condition thus imposed. In one of these equipments, hand regulation is in a large measure depended upon, causing the reliability of the system to turn on the faithfulness and intelligence of the trainmen.

It is certain that the system of the future must be one that is thoroughly automatic throughout, especially in view of the modern trend and perfection of electrical and mechanical appliances. Another important feature, and one which must always be reckoned with primarily in the car-lighting system is perfect and constant control.

Announcement is hereby made of the design of a new system of axle lighting, with the regulating devices. We have had six or eight years of experience in continuous and heavy service and every feature of its operation has become familiar and its reliability has been established. The sensitive moving parts may be statically balanced, freeing them entirely from any response to the vibrations, jerk and jar of the car, and rendering them entirely independent thereof. This device may be relied upon thoroughly to regulate not only the potential as delivered to the lighting circuit under varying conditions of load and battery pressure, but also to handle the generator under all possible conditions of speed variations, reversal and change of load. Furthermore, it has been found that a number of valuable features, having an important bearing on this particular subject, and which have never before been introduced as factors, may be employed with perfect success with this system of control and regulation. Not the least of these is a constant-speed generator, the use of which cuts down the torque delivery from the axle, and thus the power absorbed from the axle, in exact accord with the demand for electricity at the time from the generator. When the battery is nearly charged, this current should be largely reduced, and its electromotive force slightly and gradually increased. Any device which will take from a moving train only the power that is at that instant required to be developed and as the demand falls off will release all overplus of power to the train, is certainly desirable, if not positively necessary to the success of the coming train-lighting equipment. Especially is this true in view of the fact that by this device a large amount of power now wasted is not only saved but left available for traction purposes to the locomotive, which is already taxed to its utmost to meet the modern demand for high speeds of heavy equipment.

Moreover, by this system the weight of battery and generators may be reduced, and the whole system rendered simple in the extreme. Nothing is found necessary to the installation inside the car except the ordinary switch panel for controlling the lamps of the car. In some instances, such as private and wildcat cars, it might be advisable to install a voltmeter and ammeter or a combined single instrument which has been designed. Again, in this particular style of equipment, there has been included apparatus designed primarily to reinforce the battery when such a car is required to stand idle on a siding for a considerable length of time. This equipment allows the batteries to be charged from the ordinary 110-volt alternating-current as well as direct-current service. Such service is to be had in almost any station whenever the necessity arises, thus furnishing an element of the system not met in equipment heretofore offered on the market. In this instance the constant-speed machine does not require to take on its load at lower than its normal speed. Therefore, it is of minimum weight and size.

The generator is suspended interior to the truck, and no belts or other than toothed wheels are employed in driving. All parts are housed in dust-proof cases and automatically oiled, and designed to operate for long periods without attention. The generator itself is sealed and can work in snow, wet or dry, with equal reliability. The heating factor is low and radiation ample to keep the temperature well within prescribed limits. The air-wash still further reduces the liability to overheat.

The whole question of car lighting turns on practicability—can the system be made reliable in independent units, and at the same time can it compete in point of cost per unit of light? It is true that it does not need to equal the other systems in point of cost per light unit, owing to the superiority of distribution and its many apparent advantages. It is, therefore, with considerable gratification that the writer is prepared to state that upon this all-important question of cost this system, as a matter of fact, can compete successfully.

Taking the items of deterioration and up-keep, as developed by the plants which have been longest in operation and including interest and all essential factors, it can be stated that a candlepower-hour can be produced for about 68 per cent. of the cost of compressed gas, and that such gas, as now used, costs in the neighborhood of 46 per cent. more than an equal illumination in candlepower by the new axle-driven equipment. When calculated in visual units, which includes the distribution factor, compressed gas is in excess of 50 per cent. more expensive than electric illumination, a result upon which it is believed the electrical fraternity should be congratulated, and which should open up a large field for the use of electric apparatus.

An Electric Car-lighting System.

BY W. L. BLISS.

The generator and driving mechanism of this system are modeled somewhat on the lines of the modern street-railway motor, such modifications and additions being introduced as to adapt the apparatus to the special work in hand. A single-reduction, gear-driven generator has been adopted, but, unlike the ordinary street-car motor, the entire weight of the machine is carried on the truck frame (Fig. 1), it not being possible to journal on the axle, for the latter is not, nor will present railway practice permit it to be, suitably prepared.

The car axle extends through a hollow shaft, a clearance of nearly two inches all around the axle and between it and the hollow shaft being provided. This clearance permits the axle to take all manner of motions and positions (within certain limits), with reference to the hollow shaft. Only one component of the axle's motion is transmitted to the hollow shaft, this component being that of rotation. All other motions, the horizontal, vertical and end shake, being provided for in a positive though flexible connection between the axle and the hollow shaft. This consists of a two-armed dog clamped on by four bolts securely upon the axle, and four specially constructed driving springs, which are attached by means of ball-and-socket fastenings to the two ends of the dog, and to the two arms of the hollow shaft.

All parts of the mechanism which require it are thoroughly encased or otherwise protected. Automatic and profuse lubrication of the shaft bearings is provided. A cut-steel gear on the hollow shaft drives a fiber pinion on the armature shaft. In consequence, these are run dry, without lubrication of any kind, which conduces much to the cleanliness of the apparatus.

The generator is of the ironclad type, having four internal radial salient poles. The poles are placed at an angle of 45° with the horizontal, two poles being in the upper and two in the lower half of the generator, which is divided longitudinally in a horizontal plane.

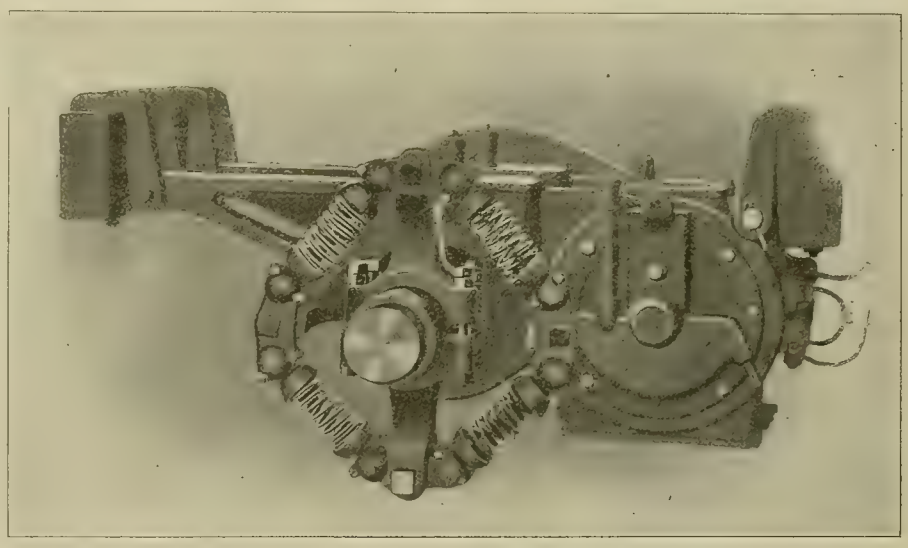


FIG. 1. RAILROAD TRAIN LIGHTING.—BLISS SYSTEM.

The armature is of the four-pole drum type, having a two-circuit singly re-entrant drum-winding of the straight-cut or barrel type. The coils are wound on formers and afterward placed on the armature, thus providing a perfectly balanced winding, both electrically and mechanically. The construction of the armature, shaft and commutator is extremely substantial. All the running parts are heavily proportioned, and are designed to resist the heaviest shocks and stresses. The generator is connected as a plain shunt-wound machine and is self-exciting. Hence, there is but a single winding on the field, each pole being excited by one coil. The armature winding, being of the two-circuit type, requires but a single pair of brushes to take the current from the commutator, but two pairs of brushes are employed.

The polarity of the terminals is preserved by means of a friction device.

The automatic generator switch opens and closes the circuit betwen the generator and the storage battery electrically, and is controlled directly by the generator voltage. Fig. 2 is a diagram of the automatic switch and other circuits.

The method of regulation consists in generating, by independent means, a counter-electromotive force in the field circuit of the generator, which increases in proportion to its speed and voltage, and hence reduces the field current of the generator and prevents excessive output.

The lamps are generally operated in parallel, and in this system are 60 or 65-volt lamps. When the battery, consisting of 32 cells, is freshly charged, its voltage is approximately two volts per cell, giving a total voltage of 64 volts across the lamp mains. As the battery is discharged, this voltage will decrease, but should never be allowed to fall below 60 volts. On the other hand, it must never be allowed to exceed 64 volts.

A separate auxiliary and self-contained machine which we call a "bucker," is bolted to the bottom of the car in any convenient place. This machine

contains a revolving shaft on which are mounted two armature cores. One of these armatures with its commutator and field constitutes a plain shunt motor which takes its power from the generator mains and whose sole function is to rotate the shaft. It is obvious that this motor runs only when the generator is in operation. The other armature has two windings and two commutators, and revolves in a field excited by the current flowing through the battery. This double-wound armature, with its two commutators and field, constitutes the "bucker" proper. The motor simply drives it. The winding connected in the lamp circuit is called the "lamp bucker," and the winding connected in the field circuit of the generator the "field bucker." The field of the "bucker" is referred to as the series field, that of the motor as the motor field. Fig. 3 shows the internal construction of the "bucker."

When no current flows through the battery, none flows through the series field, and hence no electromotive force is generated in the "bucker;" but when

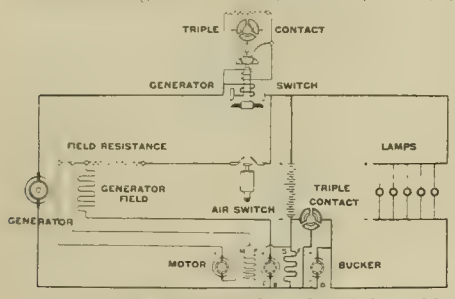


FIG. 2. RAILROAD TRAIN LIGHTING.—DIAGRAM OF CONNECTIONS OF BLISS SYSTEM.

current flows through this series field electromotive forces are generated in the "bucker," and in almost exact proportion to the strength of the field. (After the closing of the automatic generator switch, the motor runs at almost constant speed, its slight acceleration as the generator voltage rises from 64 to 80 volts being an advantage, as it compensates for the drooping curve of magnetization in the series field.)

Only one condition obtains when regulation is necessary, and that is when the generator speed and voltage have risen and the battery is being charged, e. g., running above 25 miles per hour day or night. Then the voltage at the lamps rises, and it must be kept constant, whether the lamps are lighted or not. The voltage at the terminals of battery rises about in proportion to the current forced through them. The magnetism of the series field increases in proportion to this current. The electromotive forces of the "bucker" (its speed being nearly constant) increase in proportion to its field magnetism. Hence, the electromotive forces of the "bucker" increase in proportion to the rise of electromotive force at the battery terminals. If the winding connected in the lamp circuit be proportioned correctly, its electromotive force can be made equal at all times to the increase of electromotive force at the battery, and so if this winding be connected inversely in series with the lamps, it will produce a counter electromotive force in the lamp circuit always equal to the excess electromotive force necessary to impress on the batteries to charge them. The result will be a constant lamp voltage, independent of the number of lamps in use, or the speed of the train, since the latter now affects the charging current only.

The other winding of the "bucker" is connected

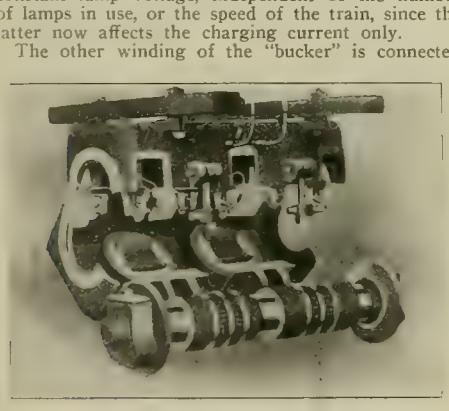


FIG. 3. RAILROAD TRAIN LIGHTING.—"BUCKER" USED IN BLISS SYSTEM.

inversely in series with the field of the generator, and generates a counter electromotive force, which weakens the field of the latter to such a degree that the electromotive force of the generator is just sufficient at the maximum train speed to force the maximum predetermined current through the battery and series field. The regulation tends to maintain constant current through the battery and series field at a given train speed. The lamp load is carried by the generator precisely as in the case of a constant potential machine and does not affect the charging current flowing through the battery.

Since the "bucker" receives or absorbs energy from the lamp circuit and the field circuit of the generator, such energy is transformed into mechanical power and tends to revolve the shaft and thus relieve the motor of that work. In fact, when the apparatus is fully loaded, the motor becomes a generator and puts back into the system about 60 per cent. of the energy consumed by the "bucker" in effecting regulation.

An Axle-light System of Train Lighting.

BY ARTHUR J. FARNSWORTH.

For the generation of electricity for train lighting it is possible to make use of power developed in a stationary plant and stored in electric storage batteries; to utilize small independent steam motors, operated by live steam from the locomotive; or to generate the power directly and economically in the large locomotive cylinders and transmit it through the car axles of the train.

The first two of these can only be made use of in special service confined to certain territory and runs. It is the axle system alone that has an unlimited field of operation. This generating car-unit system, therefore, possesses an inherent advantage that should bring it into universal use, provided the apparatus is constructed to fulfill the severe duty imposed upon it. Each car thus equipped contains its own complete electric-lighting plant with economical power available and independent of any service and all other equipment.

The essential requirements of an axle electric-lighting system are reliability, automatic operation, close control of voltage at all times, negligible drag upon the locomotive and small total cost of operation.

There are several axle electric-lighting systems in use. The main differences between these are in the transmission of power from the revolving car axle to the generator; the means employed to maintain a constant voltage at the lamps at all speeds, and the design of the apparatus, so as to make it as automatic as possible and at the same time so simple that it can be readily understood and taken care of by cheap labor.

For the transmission of power, a large number of devices have been tried, including gears, sprocket chains, friction pulleys and belts. At the present time belts appear to be in greatest favor, and are used on probably more than 90 per cent. of existing axle-lighting devices throughout the world to-day. They have a certain elasticity, that is lacking with gears, and vibration and shock are not transmitted by them to any great extent. They do not require lubrication, and if the belt drive is properly designed will run a long time and pull the load.

The principle upon which the system here described is based is to control the output of the generator and keep it constant by varying the resistance in the field circuit to correspond to the train speed. The regulating mechanism which accomplishes this is thrown into action by any variation of the generator current whenever the generator current varies from normal. It is designed, first, to maintain a constant output of the generator at all train speeds above the "critical speed," or the speed at which it becomes operative; and, secondly, to maintain a constant voltage at the lamps, whether they are being fed from the battery alone, or whether they are connected in multiple with both the generator and battery at speeds above the critical speed.

The equipment of this system consists essentially of a generator installed upon the truck of the car and driven from the axle by means of a belt; a regulator installed in any convenient location in the interior of the car, and a storage battery hung in a suitable box from the car body.

The generator is a bipolar, laminated-field, shunt-wound machine. It is ironclad and provided with self-oiling and self-aligning bearings. It is completely enclosed, with dust-tight covers, which may be easily removed for purposes of inspection. It is installed on suspension irons hung on the truck timbers, one method being shown in Fig. 4, and is pivoted parallel with the axle, on adjustable pivot shoes to provide for perfect alignment. A tension rod and spring maintain the proper tension on the belt, the machine being free to swing on its pivot, so that any movement of the axle from its normal position will not affect the belt tension. The generator is provided with a flanged crown pulley, and on the axle is clamped a flat-faced flanged driving pulley, the two being belted together with a rubber belt. The armature shaft carries a worm operating gear and cam, which throws a switch when the direction of rotation of the armature is reversed. The polarity of the generator is thus maintained correct, independent of the direction in which the train is moving. Carbon brushes are used and the design and proportions are such that if the machine is maintained in good condition it will run cool and sparkless under any ordinary conditions of service. The laminated fields contain a few sheets of hard steel, which retain sufficient residual magnetism to cause the generator to build up its voltage promptly at low speeds. The machine is constructed throughout to meet the severe requirements of railway service and to operate successfully with a minimum amount of care and attention.

The regulator (Fig. 5) contains a solenoid (S) with spring-balanced plunger to control its operation; the generator-field rheostat (R); a small electric motor (M), connected by means of worm gear and a ratchet mechanism to the rheostat to operate it; an automatic switch or cut-out (C), for automatically switching the generator in multiple, with the lamps and battery at the critical speed, when the speed is rising, and for cutting it out at the same speed when the speed is falling, and a variable lamp resistance (E), operated by the same mechanism that works the field rheostat. All the operations of the regulator are automatic. The motor is provided with self-oiling bearings, and requires only occasional attention. Readjustment of the regulator, when it is once properly set, is seldom necessary.

The battery used is admirably adapted for this class of service, requiring little attention and not subject to rapid depreciation. It is usually proportioned to provide for about 10 hours' continuous burning of all the lamps, although in the case of cars subject to long lay-overs, this capacity may be increased. Current for the lamps is thus insured under all ordinary circumstances arising in practice.

The curves shown in Fig. 6 represent a shop test of this apparatus. There was, however, no effort made to make the adjustments with unusual care and the battery at the time was pretty well discharged. The jumps in the lamp curve just after the generator has "cut in" are due to the lamp resistance being inserted. This effect could, of course, be reduced by splitting up the resistance into a larger number of steps. The variation in the light, however, is very slight, and ordinarily is not complained of. Except for those few moments when the lamp resistance is being inserted, the voltage variation at the lamps can easily be kept within four or five per cent., which is very close for this class of service. The close regulation of voltage is also demonstrated by the fact that the lamps ordinarily furnished with these equipments are very high efficiency, consuming only 2½ watts per candlepower.

The following table gives approximate data of the equipment:

Equipment.	Capacity.	Space Occupied.	Weight
		Inches.	Lbs.
Generator	75.8 c. p. lamps	33x14x13	500
Regulator	76.8 c. p. lamps	17x19x9½	75
9 E Battery (single) 24 lamps for 10 hours	160 ampere-hours	54x20x21	865
13 E Battery (single) 36 lamps for 10 hours	240 ampere-hours	72x20x22	1,280
9 E Battery (double) 48 lamps for 10 hours	320 ampere-hours	85x20x27	1,730
13 E Battery (double) 72 lamps for 10 hours.	480 ampere-hours	91x20x36	2,560

Some of the Problems of Electric Train Lighting.

BY GEORGE D. SHEPARDSON.

Electric lights were applied to a Pullman sleeper running betwen Vendon and Brighton, England, in

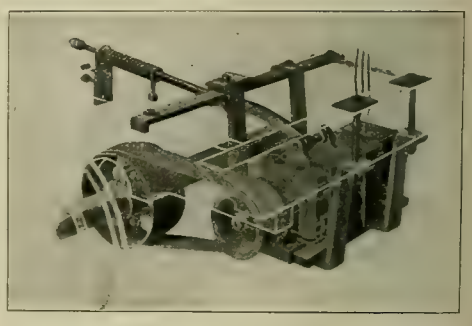


FIG. 4. RAILROAD TRAIN LIGHTING.—CONSOLIDATED SYSTEM.

October, 1881. The car had 12 small lamps, supplied from 32 Faure cells. As early as 1879 Hinkefus and Wesel took out a German patent on a car-axle train-lighting system. In 1885 the Pennsylvania Railroad began the regular operation of electric-lighted cars. From this beginning the company has continually increased its electrical equipment, until recently it has adopted the electric light as standard for all passenger service.

All of the various systems of car lighting which have been put into practical application have adopted constant-potential direct current as the only satisfactory source of supply. The voltage varies from 30 to 110. The number and strength of lights varies through wide limits, some advocating 10 to 80 eight-candle lamps per car, or 80 to 640 candlepower per car, some cars having as high as 26 50-candle lamps, or 1,300 candlepower per car. Tests made by the writer in 1900 showed an illumination in different cars varying from 0.008 to 7.5 candle-feet. The stronger illumination is not only more pleasing to patrons and a conspicuous advertising agency, but further, the flood of light effectually masks ordinary variations due to imperfect regulation.

The weight of battery, including boxes, etc., on a car with "full-battery" equipment, is about 3,000 pounds, which is not a very large proportion of the total 91,000 pounds weight of a coach, or the 116,000 pounds weight of a sleeper. The first cost of about $600 per car for "full-battery" equipment, in addition to $300 to $400 for wiring, is not great in comparison with $8,000 to $10,000, the cost of a coach, or in comparison with $16,000 to $20,000, expended for a sleeper.

All sorts of figures are given in connection with the cost of electric train-lighting systems, some showing that each electric system is more expensive than any other, others showing that some particular electric system is the cheapest. In any case, the entire cost of maintaining the electric-lighting system is a very small proportion of the entire cost of running the train, including not only the "operating expenses" but also that part of the general expenses chargeable to the particular train. The latter part

of the cost, which is no inconsiderable part, is not usually obtainable. From the cost of operating the electric lights should be deducted the net profit from the added traffic which is attracted from other roads or which is created by the improved luxury of travel on electric-lighted cars.

DISCUSSION (IN ABSTRACT).

Professor H. S. Carhart, Ann Arbor, Mich.: The thought occurred to me while we were hearing about these elaborate systems to secure constant voltage, Why is it not possible to use the mercury-vapor lamp, which does not require a constant potential? Mr. Steinmetz tells us in a recent paper that his mercury-vapor lamps will work between a very wide range of potential without any particular difference in the light given out. If that is so, we do not need

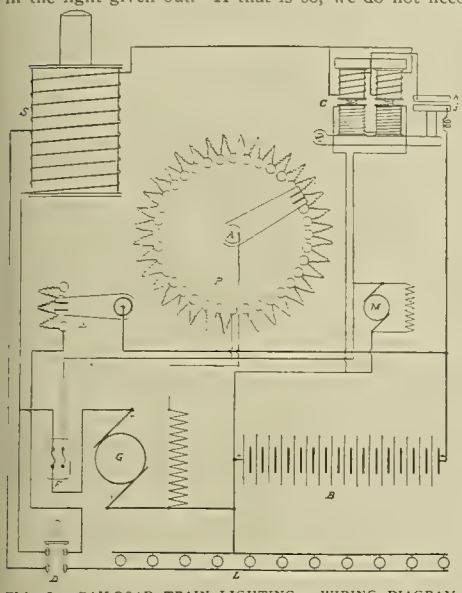


FIG. 5. RAILROAD TRAIN LIGHTING.—WIRING DIAGRAM OF CONSOLIDATED SYSTEM.

these elaborate devices for maintaining constant potential.

B. J. Arnold, Chicago: The systems are too well worked out for me to attempt to criticize them. I think, however, the suggestion of the mercury lamp eliminating the necessity for obtaining a constant voltage is a little vague, because we must first get the perfected vapor lamp to take the place of the constant-potential one. It promises well, however.

Lamar Lyndon, New York: There seems to be a disposition on the part of designers to take it for granted a battery will maintain about two volts. It will not. A battery will require, in order that it shall be properly taken care of, a charging current that will run as high as 2.5 volts. It must be discharged down to 1.8 volts. That is a variation of 0.7 volt, or about 30.5 per cent., taking two volts as the normal. Those constant-current systems or systems which assume a constant current will not maintain the battery in good condition. It must be what is technically known as "boiled" at times to overcharge.

M. Von Recklinghausen, New York: A few of the gentlemen have mentioned the mercury-vapor lamp to-night in connection with its possible use for train lighting. I am afraid they will be up against the same problem that we of the Cooper Hewitt company are up against in trying to persuade the public, especially the ladies, to consider the mercury-vapor lamp a nice light. As to the lamp being put to such use under the varying voltages which are met with in train lighting, that is a thing I cannot say very much about, practically nothing, except that it is a very ticklish question, and not at all as simple as it may seem to be from present indications. I do not think we are in a position to say anything about the vapor converter just now.

C. W. Hogan, Harrison, N. J.: Mr. Farnsworth stated in his paper that the voltage variation can be kept within four or five per cent. I think in central-station arrangements the variation is two per cent., or thereabouts, that is, with lamps requiring from 3.1 to 3.5 watts per candle. In train lighting, where they use such an efficiency as Mr. Farnsworth states, 2.5 watts per candle, such a variation would bring the lamps to two watts per candle, and such a variation would have an appreciable effect on the life of a lamp, on its maintenance of candlepower, and its general appearance in the car. I think if the system of train lighting is to become a success, that variation of four or five per cent. will have to be materially improved, from the standpoint of the life and maintenance of the candlepower of the lamps.

Mr. Farnsworth: In regard to the point just brought up, the voltage of the lamp plays a very important part. For instance, a low-voltage lamp, 30-volt lamp, has a harder filament, and is not as delicate as a higher-voltage lamp, yet has the same candlepower and efficiency, and although the life of the lamp is not particularly long, it is sufficiently long. The main thing in car lighting is to get a light battery and light equipment generally, and cheap cost in regard to inspection, and that kind of thing. The cost of lamp renewals is not a very important feature.

H. G. Stott, New York: In Mr. Sperry's paper reference is made to a new system. That is all we have heard in a definite way, and I would like to have a little further information on that point.

Mr. Lyndon: I should like very much to say all that I can about this system, which has kept Mr. Sperry and myself very much engaged for the last 18 months, but we were told to-day by our attorneys that we could not do it.

W. N. Smith, New York: Nearly all of the subject-matter of the discussion to-night has been on axle-driven systems. The credulity the members have displayed is truly remarkable. At the same time, quite a little car lighting is done by the old-fashioned steam engine driving a direct-coupled generator in the baggage car.

Mr. Bliss: The system on the Pennsylvania Limited, which is the most celebrated train in this country in regard to its train lighting, consists simply of an engine-generator in the baggage car, train lines through the train and storage batteries on the car. For many years they have operated that train with a Brotherhood three-cylinder engine, direct-connected to an Eickmeyer dynamo, making 800 revolutions per minute. The system is not complete. At the best these generators could furnish just about enough current to overcharge the storage batteries alone or else light the lamps alone, and they have never been able to accomplish both objects with these engines on account of insufficient power. When that engine was in good condition, it developed a horsepower with something like 80 pounds of steam; but something like 500 pounds of steam have actually been consumed per horsepower-hour in actual test. Within the last few months there has been installed a De Laval turbine, driving a generator furnished by that company. The apparatus runs very satisfactorily, and has considerable economy in steam consumption. This equipment takes up more room than the original plant; it occupies at least one-quarter of the space in the baggage car.

James F. McElroy, Albany, N. Y.: I have seen leather belts [for axle drive] in which there was no more flexibility than in a piece of wood. A little moisture gets into it, and then it freezes, and becomes more like a piece of copper than a piece of flexible leather. The result was we resolved we would get down to the use of gears, and I put on a set of gears which ran for a year and five months with every indication that it would run for three or four years, and we did not have the slightest difficulty with it until a nut came off and dropped in between the gear and the pinion. Then it was all over very quickly. There is one word I want to say in regard to the proper manner in which to charge storage batteries. I agree fully with what has been said, that a storage battery should not be charged with a constant current. There should not be provided a means of charging which increases the charging rate as the battery approaches complete charge, but just the reverse should be the case.

Meeting in St. Louis.

A meeting of the St. Louis chapter of the Institute was held on the evening of February 27th in the rooms of the Engineers' Club, and over a score of members and guests discussed railroad train lighting. H. H. Humphrey occupied the chair in the absence of Professor Goldsborough. "Axle Light-

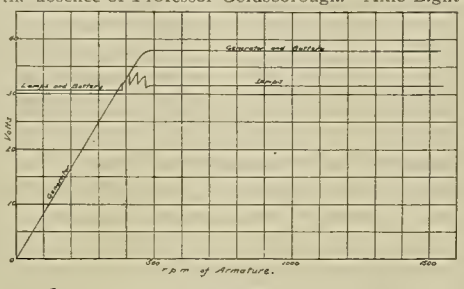


FIG. 6. RAILROAD TRAIN LIGHTING.—CURVES OF SHOP TEST ON CONSOLIDATED SYSTEM.

ing," by E. A. Sperry, was read by Mr. Schwedtmann, and in the spirited discussion that followed exception was taken to several statements in the paper, particularly that regarding the power developed by a locomotive under ordinary conditions of passenger service, which was, according to Mr. Roach, three times too great. The paper was regarded as too ambiguous, little or no information being given regarding the system in question.

The paper by A. J. Farnsworth, on "An Axle-light System of Axle Lighting," was read by P. E. Fansler, and the apparent complexity of the controlling and regulating mechanism brought out an interesting discussion. It was pointed out that the large number of moving parts subjected to the vibration and jar incident to its operation constituted the most important objection to the system, although advices from railroads using the equipment indicate that the operation is very satisfactory.

"An Electric Car-lighting System," by W. L. Bliss, was read by Mr. Bausch, and it was suggested that this scheme was even more complicated than the preceding one, the main difference being in the means employed to keep the generator voltage below a certain maximum, this being accomplished in the former case by rheostatic control of the field, and in the latter by the introduction of a counter electromotive force in the generator field.

Franz Welz, lately from Germany, gave a brief outline of the methods of train lighting used in Europe. He said: "The electric lighting of railway trains in Europe is, as yet, in its infancy, and, until very recently, none but the postal cars in Germany were so illuminated. This result was obtained by the use of storage batteries, which were changed after each run. Since the railroad accident in Offenbach in 1900, in which a train and nearly all of the passengers were destroyed by fire, as a result of an explosion of the gas tanks, the Prussian government, which owns nearly all the railroads in the kingdom, took up the question of lighting, and decided to employ electric light exclusively. Considerable attention has since been given to the development of a simple economic system of train lighting, and the Vicarino system, introduced by a Frankfort company and now known as the Frankfort system, has been much improved and promises to come into extensive use in Germany.

"In this system each car is equipped with a 40-volt Vicarino dynamo, two small storage batteries connected in parallel, an automatic switch, and an automatic regulator for charging and discharging the batteries. The connections are shown in the accom-

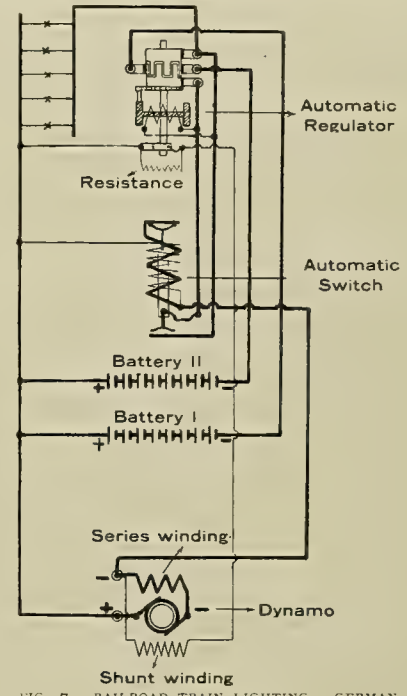


FIG. 7. RAILROAD TRAIN LIGHTING.—GERMAN (FRANKFORT) SYSTEM.

panying diagram (Fig. 7). The dynamo has a differential winding, the series turns opposing the shunt winding. This automatically cuts down the excess voltage generated when the train is running at a high speed. In case the train changes direction, the potential of the machine is automatically maintained by a reversal of the brushes. The automatic switch connects the dynamo in parallel with the batteries and lamps as soon as the voltage of the generator approximates that of the batteries. The automatic regulator connects the two batteries, alternately charging the one and discharging the other, the charged battery being automatically switched over onto the load when its electromotive force has reached a certain definite maximum. This device assures a constant voltage on the lamps and in actual operation is very satisfactory.

"In Germany it is hoped that the new osmium lamps can be extensively used for train lighting, as these lamps have a very high economy (1.5 watts per candle) and burn on a low voltage—from 25 to 55 volts. The Stone system is employed extensively in Belgium. Only the international trains of France are electrically lighted, and most of the trains in Denmark are equipped with one of the several new systems. The system which the Prussian government has recently decided to employ on its railroads is as follows: A steam turbine of 20 horsepower, running from 2,000 to 20,000 revolutions per minute, is direct-connected to a dynamo, and the set installed on the locomotive under control of the engineer. The dynamo has a capacity of 180 amperes at 68 volts, and each car is equipped with a storage battery of 32 cells, capable of lighting the car for three hours. The cost of operation of this system is said to be three times that of the Pintsch-gas system."

Concluding, Mr. Klauder brought out some interesting figures gleaned from an exhaustive series of tests, covering oil, gas, and electric systems, made by one of the large railroads, which results showed that the system employing a generator located either on the engine, or in the baggage car, and used in conjunction with a small storage battery, was by far the most economical.

Secretary Swope then announced that Mr. B. J. Arnold would address the chapter at the March meeting on the subject of his Chicago street-railway report. As the local-transportation question is one now confronting St. Louis, the coming World's Fair making it imperative that the accommodations be greatly increased and bettered, the chapter is already receiving congratulations on this score.

Electrical Apparatus to Provide Means of Seeing at a Distance.[1]

By S. Schneider.

For years members of the profession have been striving to transmit telegraphically written words and drawings. While the earlier experiments were crowned with but slight success, this problem may now be regarded as solved. Gruhn's writing telegraph may be mentioned as the most practical representative of this idea. Pollák and Virág have succeeded in a most ingenious way in sending telegrams

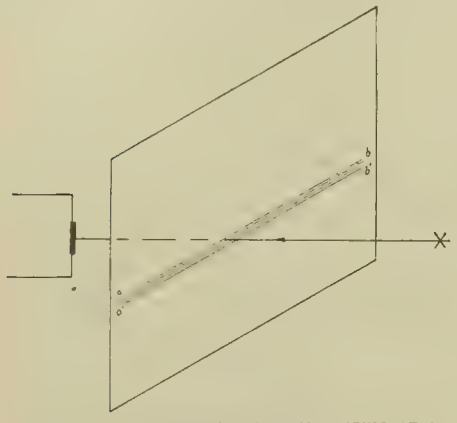


FIG. 1. ELECTRICAL APPARATUS FOR SEEING AT A DISTANCE.

in the form of printed letters. It has also been tried in many ways to telegraph pictures. To the class of contrivances tried for this purpose belongs the electrical "far-seer" (fernseher). While the picture telegraph allows only of the transmission of fixed objects, the fernseher enables us to observe a distant scene in all phases of motion. In this field, too, there has been no lack of experiments and attempted solutions, and that of Sczepanik (the telectroscope) may be regarded as the best-known and most ingenious of all that have thus far been evolved.

To transmit pictures in their natural colors is a very difficult undertaking; far easier is it to make use of the contrast between light and shade, as in photography.

The writer, having of late experimented in this direction, gives an account, as follows, of the results achieved and the apparatus used by him.

As shown in the wireless telephoning of Ruhmer, and also in his phonograph, it is possible, by using the selenium cell, not only to observe the most delicate changes of intensity, but to make these changes audible by telephone.

If we move at the same time a ray of light and a selenium cell over both sides of a photographic plate (Fig. 1), a continuous variation of the current takes place in the cell circuit, the plate representing a different degree of intensity at each point of direction of the movement. If we suppose the ray of light and the cell to move to and fro always in a direction parallel to (a b) the whole picture is being searched over, so to speak, a certain resistance of the selenium characterizing each different point. Professor Simon has shown how, by variations of the current, we may produce variations of intensity in an arc light, and Ruhmer has fixed these photographically. These changes of intensity, produced by the varying resistance of the selenium cell depending on the varying intensity of the photographic plate, are made use of by the writer in his apparatus for producing the picture.

If, at the receiving station, there is moved simultaneously with the transmissory ray, the ray of an arc light influenced by the selenium-current circuit, and therefore varying in its intensity, it will produce on an opaque-glass pane a trace of light showing exactly the shadings of the original. If, at the transmitting station, the light trace (a′ b′) be drawn, and a corresponding one simultaneously with, and parallel to the first light trace of the receiver, this will also show all the shadings of the original. Thus the picture is first cut up into lines, and then reconstructed from lines by the receiver. Naturally, in order to have the picture appear as a united whole, both reproduction and dissection must be effected with great rapidity. The achievement of this, and the necessary simultaneous action of the apparatus form the main difficulties of the problem. How we may surmount these in an easy way we are taught by the Pollák-Virág system of rapid telegraphy, and by the handwriting telegraph of Gruhn.

By current impulses a very considerable number of vibrations may be caused in a telephone diaphragm. We make use, as in rapid telegraphy, of a small mirror suspended magnetically. This, in consequence of the vibrations in the membrane, will rotate around the (y y) axis, Fig. 2; and influenced by (b), it rotates around the (x x) axis just far enough after each completion of the horizontal motion, so that each succeeding light trace will be drawn in immediate juxtaposition to the preceding one. Thus the complete surface and the whole picture are secured.

The arrangement of the transmitter is as follows: From the arc light (B) a ray falls on the small mirror (G), Fig. 3, thence reflected through the correcting lenses (C), through the plate (P); from there it is thrown by the collecting lens (L) on the selenium cell (S).

At the receiving station the selenium cell influences an arc light switched according to the Simon-Ruhmer system, from which the ray falls on the small mirror, that in turn reflects it on the opaque-glass pane. To produce the vibrations of the two mirrors, the principle of current impulses, according to Pollák-Virág, and that of the changing of resistance applied by Gruhn, are followed. The former causes the swinging of the mirrors in the horizontal direction, while by the latter the gradual rotation around the (x x) axis is effected. To this end an interrupter is placed in one circuit of the corresponding diaphragms, and a changer of resistance in the other. These two contrivances are put on a common axis and turned by a small electric motor. The interrupter causes, by one rotation, current impulses of a number equal to that of the lines into which the picture is to be dissected. The second contrivance changes the resistance in as many degrees as there are lines. After a full rotation the resistance equals 0, the ray of light jumping back to its starting point. It is easily possible to produce by the interrupter the number of impulses required in a second, i. e., the number of the light lines into which the picture is to be dissected, multiplied by the number of re-

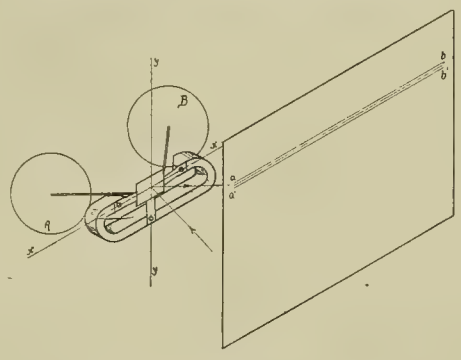


FIG. 2. ELECTRICAL APPARATUS FOR SEEING AT A DISTANCE.

productions wanted of the whole picture in a second. The changer of resistance must in the same time cause as many changes—from zero to maximum—as the number of reproductions in a second amounts to.

For example, let us suppose that a picture 100 millimeters in height is to be reconstructed of strips one millimeter in width. If the picture is to appear 10 times in a second, we require 1,000 interruptions in a second. If we use for an interrupter a wheel with 100 projections, we need 10 rotations in a second (equal to 600 of the motor), out of which follow 10 variations of resistance from zero to maximum per second. Instead of the current impulses an alternating current of a corresponding number of periods (Mercadier's tuning-fork telegraph) may also be used. In this manner it is possible to transmit by wire photographic views to a distant place, where they may either be shown temporarily to the eye or be retained photographically.

The switching of the whole apparatus may be simplified, as in the case of Gruhn's handwriting telegraph and in the rapid telegraph of Pollák-Virág, so that one can get along with two or three wires, if large distances are to be covered.

By a very simple method of the writer, any picture, even a moving one, provided it can be projected with a camera, may be transmitted by this apparatus, which means some little progress, perhaps, in the solution of the problem of seeing at long distances.

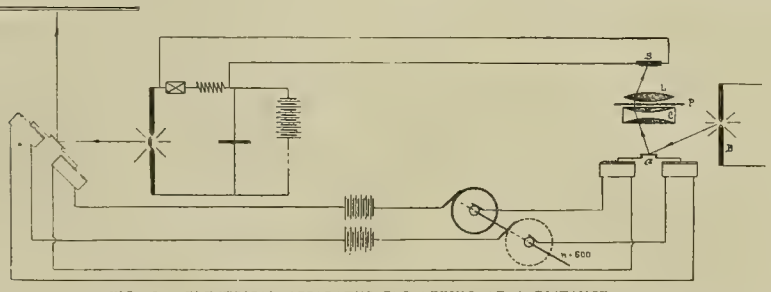


FIG. 3. ELECTRICAL APPARATUS FOR SEEING AT A DISTANCE.

1. From the Elektrotechnischer Anzeiger, Berlin.

American Street Railway Association.

At a meeting of the executive committee of the American Street Railway Association at Saratoga, N. Y., on February 23d it was decided to hold the next annual convention in that city on Wednesday, Thursday and Friday, September 2d, 3d and 4th. New York, Chicago and Saratoga were considered, and the last-named place was selected. The convention headquarters will be at Grand Union Hotel, which has accommodations for about 1,700 guests. Meeting rooms for the American Street Railway Association, the Accountants' Association and the American Railway Mechanical and Electrical Association will be provided in this hotel, and the exhibits will be placed in the piazzas and court of the hotel, the court to be covered. The following subjects were selected to be discussed at the convention: Steam turbines; electrically welded joints; the evils of maintenance and champerty in personal-injury cases; train orders and train signals on interurban roads; freight and express on electric railways; the manufacture and distribution of alternating currents for large cities; comparative merits of single and double-truck cars for street service; the right-of-way—is not the public entitled to it in the use of streets? The companies to whom these topics are assigned will be announced later. Only morning sessions will be held, the afternoons and evenings being devoted to excursions and inspection of exhibits.

The first annual convention of the newly organized American Railway Mechanical and Electrical Association will be held at Saratoga on Tuesday, September 1st, immediately preceding the convention of the larger association. The membership fee of this association is $20, not $5, as stated in the account of the organization of this society in the Western Electrician of February 21st.

Chicago Institute Meetings.

The following programme has been adopted by the local committee of the Chicago chapter of the American Institute of Electrical Engineers:

March 10th—An informal "smoker," which is intended to promote sociability between the members, and at which the new members and recent applicants for membership will have an opportunity to get acquainted. There will be a short discussion upon "Railway Train Lighting," which will be led by Mr. Locke Etheridge, electrical engineer for the Pullman company.

March 24th—A joint meeting will be held with the Western Society of Engineers, at which Mr. Bion J. Arnold will present a resumé of his report upon the Chicago transportation problem. This will be illustrated with lantern slides. A large hall will be secured to take care of the attendance. This hall has not yet been determined upon.

April 7th—Papers which have been published upon "High-tension Lines" will be discussed.

May 5th—The papers upon "Central-station Developments" will be discussed.

May 19th—This will be a special "telephone meeting," the programme for which is being arranged by Mr. A. S. Hibbard of the Chicago Telephone Company and Mr. Kempster B. Miller of the Kellogg Switchboard and Supply Company.

National Electric Light Association.

The twenty-sixth convention of the National Electric Light Association will be held at the Auditorium, Chicago, on May 26th, 27th and 28th next. President L. A. Ferguson of Chicago and Secretary J. B. Cahoon of New York are preparing a programme of unusual interest, in which the special reports arranged for at the convention of last year in Cincinnati will play a conspicuous part. Every indication points to a most successful convention. The first meeting of this association was held in Chicago in 1885, and the one of this year will be the fifth to be held in this city. Next year the association will go to St. Louis.

Bids for Dynamos for Chicago Government Building.

Bids for the electrical generators to be used in the lighting and power plant of the new Chicago government building have been opened in Washington. It is stated that these bids are as follows: Chicago Edison Company, $53,881; Westinghouse Electric and Manufacturing Company, $52,875; Sprague Electric Company, $47,700; Christensen Engineering Company, $41,100; Crocker-Wheeler Company, $38,750. The specifications call for alternate bids on three 600-kilowatt direct-current dynamos or six 300-kilowatt direct-current machines, and there is some doubt as to which combination of generators the bids mentioned above refer.

It is now practically certain that this year's international automobile race for James Gordon Bennett's cup will be run in Ireland. The Irish people are taking a lively interest in the event. The nations entered for the race so far are America, England, France and Germany.

The Intramural Road at the St. Louis Exposition.

Plans for the intramural railroad of the St. Louis Exposition, which have been revised by Mr. Charles V. Weston, the Chicago engineer who is designing the road, have been submitted to the Exposition committee on buildings and grounds for approval, and, if passed on by this body, will at once go to the executive committee, and arrangements will be made for the construction of the road.

The plans, as submitted by Mr. Weston, show a number of changes from the original idea, which contemplated three loops of widening circumference at the eastern end. The new plan, however, involves but a single loop skirting the main buildings and reaching every point of interest on the ground. Starting near the Lindell Pavilion, the intramural will pass close to the fence at the northern end of the site as an elevated structure; passing the Transportation Building, it will turn, crossing a corner of the Washington University site, and then run directly west to a point just beyond the University power house, where it will change from elevated to surface. It will hold to the surface, passing close to the gymnasium, and will then turn east to a point just west of the French reservation, where it will deflect from the south, becoming an elevated structure again as it crosses the low place just south of the French reservation.

Passing the north entrance of the Agricultural Building the line re-enters a Forest Park section of the site and parallels the Street of Concessions as a surface road. It will continue as a surface road until close to the southern edge of the grounds, where it will make a wide loop until its course is directly north. Swinging to the east it crosses a deep ravine just back of the Art Palace on an elevated structure, and a bend to the southeast across another ravine brings it to the Plateau of the States. Through this district it will run close to the fence as a surface road, crossing Government Hill and back to the place of beginning.

The maximum service for which the system is designed calls for 12 trains of four cars each, operating in one direction at a schedule speed of 14 miles an hour. At this speed the time required to make one complete circuit will be 25 minutes; the interval between trains under this maximum condition of service will be a little less than two minutes.

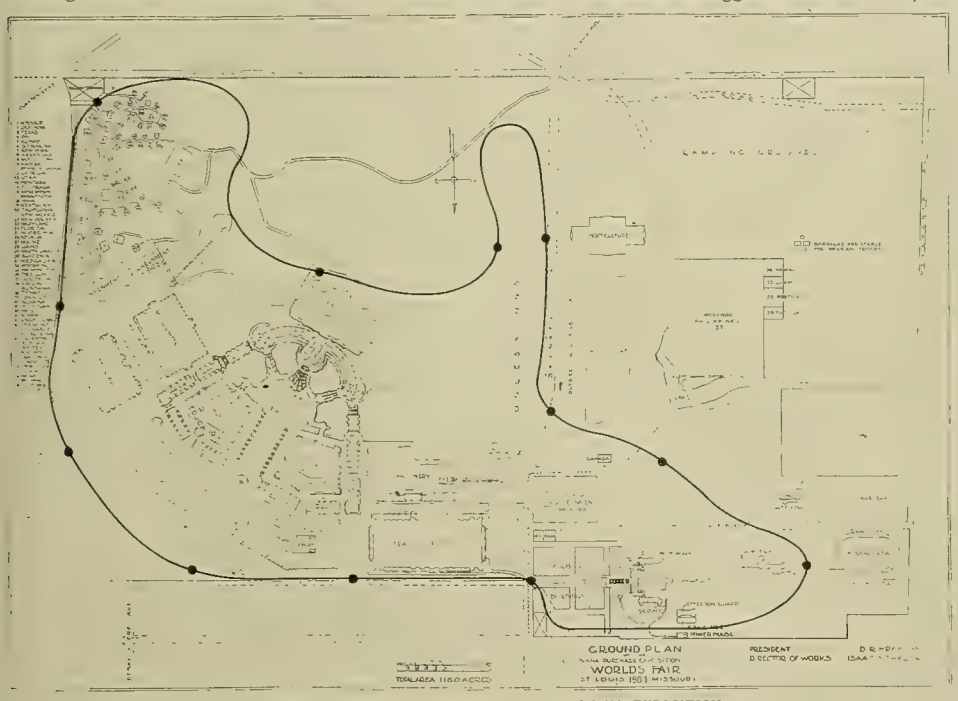
The rolling stock will consist of 48 open cars, each having a capacity of 65 passengers. There will be 13 seats running transversely through the car, each seat accommodating five passengers. Doors will be provided on both sides at each opening between the seats, and all doors of each car will be opened or closed simultaneously by a single movement of a lever operated by a guard.

The familiar third-rail system will be employed, and this will necessitate fencing in the surface portion of the system, which aggregates about two miles. The third rail will consist of a steel rail carried on insulated supports, and will be placed just outside the rails. This rail will terminate at each side of all grade crossings and an underground cable provided to make connection. At all such crossings safety guards will be placed preventing access to those portions of the road operated from the rail. In many cases, the train will be of such length as to span the open section, but, where this is impossible, the train must, of its momentum, coast by the gap.

The elevated structure will be of wood supported on a series of towers with deck spans or Howe trusses between them. The towers will be about 15 feet square, in most cases 42 feet between centers. The time available for the construction of the road is too short to allow the use of steel. The elevated portion of the road will consist of four sections, aggregating over 16,000 feet, making a total loop somewhat over 5½ miles.

Mr. Weston has recommended a block system for eliminating collisions in the operation of the road. He proposes that the entire line be equipped with a system of automatic block signals so arranged that the spacing of the trains will be uniform; and so that when trains are standing at stations they will be protected from rear-end collisions. The signals will be so arranged that should a train disobey a signal and attempt to enter a block which is already occupied by another train, the air-brake appliance on the train so violating the signal will be automatically operated and the brake applied, bringing the offending train to a stop. The installation of this system of signals will insure the correct spacing of the trains in respect to time and furnish immunity from collisions.

Twelve stations are suggested for the road, the locations of which, together with the route of the intramural itself, are shown on the accompanying plan of the grounds. The plans for handling the crowds are similar to those employed by the Illinois Central at the Chicago World's Fair; the discharging platform being on one side of the car and the receiving on the other. This permits of the discharge of passengers from one door and the reception through the other; and a stop will consume only a few moments. These arrangements are especially elaborate at the stations located at the main gates of the Exposition and at the big railway terminal. The maximum gradiant of the railway will be three per cent., ascending in the direction of traffic. Power will be supplied from the Exposition power house located in Machinery Hall. The cost of construction is estimated at $650,000.



ROUTE OF INTRAMURAL RAILWAY AT ST. LOUIS EXPOSITION.

Advertising as an Exhibit.

For the first time in the history of expositions there will be an advertising exhibit at the St. Louis World's Fair in 1904. The St. Louis Advertising Men's League has signified its intention of acting as sponsor for an exhibit of the world's development of advertising in the last century, and the organization is now taking steps to secure co-operation of advertising men throughout the world. Upon the invitation of the league Mr. S. W. Bolles, superintendent of the Graphic Arts of the Exposition, delivered an address on February 19th to the members on the subject of such an exhibit. Superintendent Bolles bore to the Advertising Men's League the assurance of Chief J. A. Ockerson of the Liberal Arts Department that a reasonable amount of space would be granted for such a display. It is designed to cover the world and to make this one of the most interesting historical and educational exhibits of the exposition.

As to Municipal Lighting in Chicago.

[From the Chicago Record Herald.]

Two widely divergent estimates have been made as to the cost per lamp per year for municipal electric lighting in Chicago. City Electrician Ellicott, in his report to the City Council February 2d, estimates that it costs the city only $53.51 a lamp, while the arc lamps rented from the Chicago Edison Company cost $103 a year. Haskins & Sells, the expert accountants, who unraveled the intricacies of poor City Hall bookkeeping, made a report that the cost per lamp in 1900 was $99.88. Mr. Ellicott bases his estimate on the expenditures last year, and if the Haskins & Sells report were carried out to December 31, 1902, it is probable that their estimate might be reduced to at least $97.

The wide discrepancy between the two estimates is due to the fact that the city electrician does not take into account the water used free of charge, taxes, interest on investment, depreciation of plants and insurance.

All these items are considered by a private concern. The city electrician makes a better showing on the surface than would a private company, because his department is engaged in a co-operative business with the city water department. The latter furnishes him with water and does not send in a bill. He furnishes the water department with lights and never sends in a bill.

In taking up the report of Haskins & Sells, Mr. Ellicott yesterday estimated charges along the lines of the expert accountants, but he could only bring the total cost per lamp to the city under municipal ownership up to $74.56. He made this total under protest, maintaining all the time that the city should not be required to take into account whatever help it received from other arms of the municipal government. He maintained that even with a saving of $3.12 over rented lights, as shown by the Haskins & Sells report, municipal ownership was a success. With an extra appropriation of $200,000 a year for six years the city electrician says it would be possible to install 16,000 arc lamps for $50 a year, exclusive of the charges estimated by the expert accountants. He holds that a saving of $3 a year on this number of lamps would be satisfactory, but insists that the city would gain at least $30 a lamp every year, as compared with the price for rented lights.

The Haskins & Sells estimate of cost per lamp for 1900 under city control is as follows:

Maintenance and operation, cost per lamp:	1900.
Coal	$22.32
Oil, waste and boiler compound	.97
Operating labor	19.29
Repairs to buildings and equipments	4.06
Rent	.65
Circuits	1.53
Conduits	1.15
Lamps	3.90
Globes	.50
Carbons	4.84
Posts	.11
Teams	.23
Miscellaneous	1.19
Office salaries	1.35
Total maintenance and operation	$62.09
Estimated charges, cost per lamp:	1900.
Water	$ 4.14
Taxes	4.81
Insurance	.15
Interest	13.50
Depreciation	15.90
Total estimated charges	$37.79
Total cost per lamp per year	$99.88

The official report of the city electrician, with his added estimates of charges, is as follows:

Coal	$79,805.37
Carbons	22,338.49
Globes	2,328.07
Repairs to steam plants	9,802.08
Repairs to electric plants	4,986.05
Repairs to lamps	11,846.97
Repairs to underground circuits and aerial circuits	15,061.14
Other operation	7,728.97
Total material	$153,897.14
Salaries for operation of plants	31,485.09
Arc lamp trimming	43,272.15
General superintendence of electric-lighting system	8,242.05
Total labor	$ 82,999.29
Material, as above	153,897.14
Labor, as above	82,999.29
Total cost of plants	$236,896.43
Total cost, per lamp	52.55
Per cent. of office salaries	.96
Grand total cost, per lamp	$53.51
Estimated charges, cost per lamp:	1902.
Water	$ 2.75
Taxes	3.30
Insurance	None.
Interest	10.00
Depreciation	5.00
Total estimated charges	$21.05
Total cost per lamp per year	$74.56

The deal for the sale of the Annapolis, Washington and Baltimore Railroad Company to the syndicate engaged in building the trolley line between Baltimore, Annapolis and Washington, D. C., has been closed, and the final payment for the property has been made. This deal is the sale of the $358,000 of the capital stock of the company. A new board of directors was elected as follows: William H. Lamprecht, Cleveland, Ohio; Alfred R. Horr, Cleveland; Harry A. Garfield, Cleveland; Calvary Morris, Cleveland; Frank Gosnell, Baltimore.

WESTERN ELECTRICIAN

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

National Electric Light Association, Auditorium Hotel, Chicago, May 26th to 28th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y. June 29th to July 3d.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

A SLIGHT falling off in electrical exports from the United States is shown by the report of the Bureau of Statistics of the Treasury Department for January, 1903, compared with the corresponding month last year, the figures being, respectively $795,549 and $828,574. The decrease is caused by a shrinkage of exports of electrical appliances from $419,098 in January, 1902, to $239,234 in January, 1903. This is nearly made up, however, by a gain in the exports of electrical machinery from $409,476 in January, 1902, to $556,315 in January, 1903. These monthly fluctuations are interesting, but hardly indicate the trend of our export trade, a survey of a considerable extent of time, such as a year, or six months at least, being necessary for that. The year 1902 was a good one for American electrical exporters, and there is no reason at the preesnt time for believing that this year will fall behind it. Compared with the $795,549 of January, 1903, it is of some interest to note that the electrical exports of December, 1902, were $760,981, and of November, 1902, $712,160.

NOT satisfied with the "Jim Crow" law, separating black and white-skinned passengers, patrons of the New Orleans street railways may make more trouble in the same direction for the operating companies. It is now reported that society women of that city have begun a movement to induce the street-railway company to put on palace cars for their convenience and comfort. They say that they cannot ride in the present cars when they are in afternoon or evening dress, as the cars are dirty and their seatmate may be an objectionable person. It is true that riding in the street cars is a democratic convenience, in which every nickel-paying passenger is supposed to be on equal terms with his fellows—unless he is a black man traveling in a state where discriminating laws are in vogue. But then the fare is only five cents, and street cars are run on business principles to carry the greatest possible number of passengers. Fastidious persons who object to rubbing elbows with Tom, Dick and Harry usually employ a carriage and say nothing about it. It is a novel idea, in this country, to operate "palace" street cars for the select few, and one that does not seem to be practicable, as the very essence of the transportation industry in American cities is carrying the multitude at the popular price.

THERE is a curious discrepancy between the practice of American and Canadian fire underwriters in relation to the inspection of electrical wiring if we are to believe the annual report of the Lachine Rapids Hydraulic and Land Company of Montreal. This company actually complains that "little or no progress has been made by the Canadian fire underwriters to insure proper inspection of electric wiring and a better class of work." Imagine an electrical company in New York or Chicago having a complaint on the score of the indifference of the underwriters in the matter of wiring requirements! Over here the underwriters are commonly supposed to be a little too alert on all electrical matters, if anything. A view of the other side of the question is novel and refreshing. As is well known, the Lachine Rapids company supplies and distributes, electrically, in Montreal a large amount of power derived from waterpowers. But one of its troubles is this matter of wiring inspection. The company is, it asserts, continuing to exercise, in so far as its interests are concerned, the greatest possible care, but its efforts seem to be fruitless and not appreciated by the fire underwriters, nor, in some cases, by the consumers. A direct quotation from the annual report for 1902 (dated February 12, 1903) will be appreciated:

"While there is no law compelling this company to make inspections, yet for the sake of safety to its own apparatus, and to avoid interruption to its customers, it is absolutely necessary that some inspection and tests should be made. During the past year 2,743 inspections of interior wiring have been made by our employes. We have written 400 letters to the interested parties, out of which, we are pleased to state, 351 have had the defects complained of remedied, 13 have work under way, and 36 will do nothing. Now as the strength of the chain may be measured by its weakest link, so is the risk we are subjected to measured by a few customers who refuse to remedy defects. The question arises, What are we to do under the circumstances? Can we absolutely refuse to continue to supply these customers with light or power, because their interior wiring is, in our opinion, not what it should be? Or, if we connect them up, have we any recourse for damages that such defective wiring may cause our system? We think the remedy is largely in the hands of the insurance companies. If they would thoroughly inspect each building they insure, and decline the risk when interior installations are not up to their own standard, then matters would soon right themselves."

Surely this is an unusual situation. Evidently the wiring complained of was not done by the Lachine Rapids company, although it may suffer by its poor quality. Apparently, also, there is no municipal wire department or electrical department to appeal to, as would be the case in most large American cities. So the company naturally turns to the insurance men, but they are lethargic or inert. Sometimes American electrical contractors wish that the underwriters on this side would be to their faults a little blind, but find, instead, that the insurance interests are argus-eyed. Over the border, on the contrary, the fire-office men appear to be not only blind but torpid.

THE state of Illinois can well afford to be generous to the College of Engineering of the University of Illinois, which is asking it for a special appropriation of $300,000. This sum is needed for new buildings and equipment in engineering line, for providing illustrative apparatus, and in many instances for duplicate machines and instruments, required by the rapidly increasing classes. The engineering college is doing good work and has now over 600 students. The point is made that Illinois is the third state in the Union in the value of its manufacturing industries, and should not neglect the institution which it has established to educate those who are to take the lead in the industrial expansion of the state. Except to replace fire losses, the expenditures for equipment of the college have not exceeded $20,000 in the last four years, while nearly all of the engineering colleges of the country have in the meantime greatly increased their facilities for instruction. The time has come when new apparatus is urgently needed if the state university is to retain its rank among similar institutions, and we trust that the Legislature will heed the appeal made to it and make a liberal appropriation.

IN AN article in one of the "popular" magazines a recent writer seems to be unduly exercised over the extent and variety of German electrical engineering. We are told that "Germany is making great strides every year in electrical engineering. She is marching side by side with the United States in this respect, and is without question our greatest competitor, not only in supplying electrical machinery to the different nations of the world, but also in devising new inventions in both weak and strong-current electrology." There is much truth in the general statement that the electrical engineers of Germany are among the foremost in the world, although the reference to "new inventions in both weak and strong-current electrology" is so sweeping and so curiously worded as to be of dubious value. If the comparison related to the merits of physicists, rather than engineers, the praise of German achievement would be even more generous. But why make comparisons at all? Why go on, for instance, like this: "The progress of the German electrical industry is so marked that many eminent electrical engineers of this country are expressing anxiety lest Germany wrest from us the laurels we now wear"? Who are the eminent American electrical engineers who fear the consequences of German electrical advancement so keenly? We believe that it would be difficult to name one. American engineers are too busy working out the many problems thrust upon them to entertain or express any such childish anxiety. They will continue to devote themselves to their work—development, application, construction, or whatever may be the immediate task in hand—with such mental resources as they are blessed with, noting and appreciating the accomplishments of their co-workers in other countries with the open-eyed appreciation of manly men, but without a particle of trepidation.

Tesla Split-phase Patents Not Infringed.

Meter manufacturers and electrical men generally are greatly interested in the litigation based on the Tesla split-phase patents. On February 26th, by a decision handed down in New York city, the United States Circuit Court of Appeals for the Second Circuit reversed the decision of the court below and declared that invention by Tesla prior to April 22, 1888, had not been proved, thus deciding against the patents and in favor of the defendant. The case was that of the Westinghouse Electric and Manufacturing Company, appellee and owner of the patents, against the Catskill (N. Y.) Illuminating and Power Company, appellant, which was a user of the well-known Scheeffer meter, the device complained of as infringing the patents. The manufacturer of this meter, the Diamond Meter Company of Peoria, was the real defendant, and is receiving congratulations on the strong and successful defense made on its behalf.

The opinion of the court in this important case was written by Judge Townsend, Judges Wallace and Coxe concurring. It is as follows:

Appeal by defendant in the court below from its decree on bill alleging infringement of complainant's patents, Nos. 511,559 and 511,560, granted to Nikola Tesla on December 26, 1893. The court below sustained both patents and found infringement of both claims of patent No. 511,559 and of the first claim of patent No. 511,560.

Inasmuch as we have reached a conclusion adverse to the complainant upon the question of priority of invention, the other issues will not be discussed.

The claims of patent No. 511,559 are as follows:

"1. The method of operating motors having independent energizing circuits, as herein set forth, which consists in passing alternating currents through both of the said circuits and retarding the phases of the current in one circuit to a greater or less extent than in the other.

"2. The method of operating motors having independent energizing circuits, as herein set forth, which consists in directing an alternating current from a single source through both circuits of the motor and varying or modifying the relative resistance or self-induction of the motor circuits and thereby producing in the currents differences of phase, as set forth."

The first claim of No. 511,560 is as follows:

"1. The combination with a source of alternating currents, and a circuit from the same, of a motor having independent energizing circuits connected with the said circuit, and means for rendering the magnetic effects due to said energizing circuits of different phase, and an armature within the influence of said energizing circuits."

The claims of the former patent cover a certain method, and of the latter certain means of operating electrical motors by means of alternating currents from a single original source. This system is known as the "split-phase" system.

Nikola Tesla, the patentee herein, was the inventor of what is known as the polyphase system of transmission of power, and had covered by his earlier patents, Nos. 381,968, 382,279 and 382,280, said system when operated by means of currents of varying phase from independent lines or circuits. The applications for these earlier patents were filed during the fall and winter of 1887, and the winter and spring of 1888, the final fees were mailed on April 8, 1888, and said patents issued May 1, 1888.

Up to April 8th Tesla had not intimated to his solicitor that his broad invention of the rotary-field motor could be practiced by any means which did not involve the use of two independent circuits from the generator to the motor.

The applications for the patents in suit were filed December 8, 1888. By the method and means therein described Tesla dispensed with one of the line circuits and was able to run the motor by means of alternating currents from a single original source. This was accomplished, as appears from the foregoing claims, by means which so retarded the phases of the current in all circuits or so varied the relative resistance of the motor circuits as to maintain the necessary difference of phase in the currents. Such utilization of a single original source by thus splitting a single current into two currents, was an improvement of great practical value.

But on April 22, 1888, there had been published at Milan, in an Italian journal, a report of a lecture by Professor Galileo Ferraris, in which the system covered by the patents in suit was fully described. This printed publication is such a disclosure of the subject-matter of the patents in suit that if prior thereto would constitute an anticipation.

To support the burden thus cast upon it of proving to the satisfaction of the court that the supposed inventions in suit were made prior to April 22, 1888, complainant has introduced a photograph and the evidence of two witnesses, Messrs. Brown and Page. One of said witnesses has testified that said photograph represented a motor which was in Tesla's shop in the fall of 1887, and in which the difference in phase was secured by the introduction in one of the circuits of a coil having self-induction. There is nothing in the photograph, however, to indicate the means by which said motor was operated, nor whether it was adapted to receive a single or double current from the generator. Its construction is at least as suggestive of use in connection with the earlier polyphase as with the latter split-phase patents. We are, therefore, confined to a consideration of the testimony of said two witnesses.

Mr. Brown furnished capital to Tesla to make his experiments at the date here in question, and afterward sold his interest in the Tesla inventions to this complainant. On May 25, 1900, he testified that in 1887 Tesla disclosed to him certain inventions made by him relating to split-phase alternating-current motors and showed him such motors in operation in his shop in Liberty Street (in 1887), and that the shop was afterward moved and destroyed by fire, and he thought all the motors were destroyed in said fire. He further stated that he had had no experience with alternating currents beyond that which he had had through his connection with Tesla. He failed to identify the date of the disclosure or to account for the loss of said motors further than as hereinbefore shown, and complicated his vague general description of said apparatus by contradictory statements as to the specific means used in their operation. But, apart from all this, he failed to so describe the said apparatus that this court can determine whether they did, in fact, embody in structure and practical operation the specific form of apparatus used by the defendant. Such evidence, under the familiar rule, called either for corroboration or for some explanation why corroboration was impossible.

The complainant failed to comply with said rule. It failed to show that Tesla alone constructed said motors, or to produce anyone employed in said shop in 1887 who might have seen said motors or taken part in their construction, or to account for their absence. It failed to put Tesla himself, a resident of New York, on the stand to show to the court the precise nature of the inventions disclosed and practiced by him in 1887.

Farther than this, other uncontradicted testimony strongly tends to show that the witness must have been mistaken as to the date of this disclosure and of the operation of said motors. It appears that in 1888 Tesla spent nearly two weeks at the factory of the Mather Electric Company, explaining his new alternating-current motor inventions, with a view to interesting said company in their development and manufacture; that one of the objections made to their operation was the fact that they required a special generator and extra wires, but that Mr. Tesla did not then claim that he had made any invention whereby two currents of different phase could be derived from a single source. Again, complainant's other witness to the date of invention, Page, who was Tesla's attorney, and who, during 1887 and 1888, prepared the Tesla applications for the polyphase and other patents, including those here in suit, testified that up to a few days after April 8, 1888, "Mr. Tesla had never intimated in any way to me that his invention of the rotary-field motor could be practiced by any means which did not involve the use of two independent circuits from the generator to the motor."

We are forced to the conclusion that Brown, testifying at this distance of 13 years, must have had in mind the year 1888, during which year also, as he testifies, he saw said motors in said shop.

We are brought, then, to a consideration of the testimony of said Page, the witness chiefly relied on to carry the date of invention back of April 22, 1888. The material parts of his testimony are as follows, namely, that having been employed as aforesaid, Tesla "explained that he had other ideas about the operation of these motors, and thereupon disclosed to me his scheme for operating the motors by connecting them with single circuits; that when he first described the scheme of patent 555,190 (application filed May 15, 1888), Mr. Tesla also described to me the plan of operating these motors which involves the splitting of a circuit, * * * upon which patent 511,560, which is one of the patents in suit, is based; and that I understood fully from his description, not only the principal and essential features of the inventions involved in the patents in suit, but also another plan which he had at that time developed for effecting the same result by making the poles of a motor of different magnetic susceptibility, * * * the subject of an application filed October 20, 1888, and which became patent No. 524,426."

It further appeared on the hearing in this court that Mr. Page filed three other Tesla applications on April 23, 24, and 25, 1888, respectively, and which issued in October, 1888, as patents Nos. 390,414, 390,820 and 390,721, respectively. Neither these patents nor Nos. 555,190 and 524,426 are in suit herein. Some of the patents cover modifications of the polyphase, others of the split-phase invention. The applications which resulted in the patents in suit were not filed until December 8, 1888. As to the character and date of said disclosures, the witness further testified as follows:

"I cannot say, from present recollection, how many of the specific arrangements for producing artificially the necessary differences of phase which are described in the two patents in suit Mr. Tesla described to me in the early part of April, 1888, but my recollection is clear to the fact that between April, 8, and April 18, 1888, on which latter date I entered a charge in my diary for services in this particular matter."

The diary was not produced. The witness stated: "I had occasion several years ago to look up the facts in connection with the matter about which I have just testified, and at that time I had this book in my possession;" that he then used it in giving certain testimony; that he had since searched for it, but had been unable to find it; and that his present testimony was based upon his recollection of the matter and upon the records of previous testimony given on this point.

This evidence is clear, direct and persuasive as to a disclosure by Tesla of various schemes for operating motors on the split-phase principle. But it falls far short of the requirement in such a case.

"The burden which rested upon the defendant in the first instance has been transferred to the complainant, and it must furnish the court with convincing proof that the anticipation has been anticipated." (The Westinghouse Electric and Manufacturing Company v. Saranac Lake Electric Light Company, 108 Fed., 221, 222; Clark Thread Company v. Willimantic Linen Company, 140 U. S., 481.)

It is to be noted that this testimony relates to events which occurred 12 years before; that the only means which the witness had for refreshing his recollection is the lost diary. The witness could not be expected to have any independent recollection as to what was covered by the charge, entered four days before the date of the anticipating publication, for "services in this particular matter," nor whether the date and character of said charge was correctly entered. The evidence fails to show the specific character of said disclosure, whether it covered the constructions herein held to be infringed or some of the other constructions embraced in the patents in suit or in said other patents not in suit on which the witness was then engaged. Nor does it appear with satisfactory definiteness that the disclosure was a sufficiently full and complete disclosure of the particular claims involved herein, or, if so, which were thus disclosed. The witness does not state what Tesla said to him. Apparently, all that he learned from Tesla was the "principal and essential features of the inventions involved in the patents in suit."

The fact that the applications for the patents in suit were not filed until December 8, 1888, while said applications for other specific phases of said invention were filed on May 15th and October 20th, tends to support the claim that the "particular services" were rendered in regard to said earlier specific inventions and that Tesla did not perfect and complete the inventions in suit until a later date.

In these circumstances it was incumbent upon complainant to furnish additional evidence in order to remove these uncertainties or to account for its failure so to do. No attempt was made, however, to further fix the date or character of Page's services, either by the books of his firm, the bills rendered, the testimony of his partners or of his Washington associates, with both of whom he consulted, or by the date of the trip taken to Washington in regard to the matter, or by the testimony of Tesla himself. Complainant has failed to comply with the fundamental rule that the best evidence of which the case is, in itself, susceptible, must be produced.

In these circumstances we are constrained to hold that invention by Tesla prior to April 22, 1888, has not been proved.

The decree is reversed with costs and with instructions to the court below to dismiss the bill with costs.

Charles A. Brown, the well-known patent lawyer of Chicago, in commenting on the decision for the benefit of the readers of the Western Electrician, expressed himself as follows:

"The patents involved in this suit are known as the Tesla split-phase patents. The claims which are quoted in the opinion of the court show that the patents are very broad in their apparent scope—so broad, in fact, that unless limited to the particular mode of operation of the so-called Tesla rotating field, they are anticipated by many devices of the prior art.

"The anticipating reference on which the Tesla patents were found to be invalid by the Circuit Court of Appeals was the well-known Ferraris publication. Ferraris' lecture, which fully described the construction and mode of operation set forth in the Tesla patents, was delivered in Turin on the 16th of March, 1888. Publication of this lecture occurred in the Italian journal l'Eletricitta, April 22, 1888, and other technical journals in Europe and America published the lecture soon afterward. Shallenberger and others also made the improvements set forth in the patents independently of Tesla, and before December 8, 1888, the date of filing the applications for the patents under consideration.

"As the court's opinion shows, it was necessary for complainant to establish a date for Tesla's invention earlier than April 22, 1888, and to do this clearly. The failure to do this was fatal to complainant's case and to the patents.

"Tesla's claim was based solely upon a legal technicality. He was not in any case the one who gave the split-phase motor to the world. Ferraris did that. Not only was the Ferraris publication earlier, but he undoubtedly made the improvement actually long before Tesla thought of it. Tesla could get no patents in Europe on account of Ferraris' work. But in this country, under our laws, the use of an improvement in a foreign country does not anticipate an invention. It is the publication that counts as an anticipation in such a case. It was upon this legal technicality that the Tesla patents were based. The Westinghouse company bought the Ferraris rights in this country.

"An interesting fact in connection with this matter is not referred to in the opinion of the court. In

the latter part of February, 1888, Tesla went to Manchester, Conn., to show his rotating-field motors (it was Ferraris, by the way, and not Tesla, who gave the name 'rotating field' to these motors) to Professor Anthony, with a view of getting a report from him. When Professor Anthony saw and understood the polyphase motor, he promptly thought of operating the motor on a split-phase circuit, and he wrote to his friend, Dugald C. Jackson, now professor of electrical engineering in the University of Wisconsin, explaining both the polyphase and split-phase modes of operation. Professor Jackson replied, giving descriptions of other ways of operating the rotating-field motor. It was some nine months later that Tesla applied for patents showing precisely the plans and methods of operation set forth in this correspondence between Professor Anthony and Professor Jackson. The patents thus applied for are those which have just been declared invalid by the Circuit Court of Appeals.

"The point upon which the decision turns lies at the threshold of the defense in this case. That other and serious defenses were presented may be appreciated from the fact that the record comprises between 2,300 and 2,400 printed pages."

Fundamental Brush Storage-battery Patents Expire.

On March 2d the two fundamental electric storage-battery patents which have affected more or less the storage-battery industry of this country expired by time limitation. These patents were granted by the United State Patent Office on March 2, 1886, to Charles F. Brush of Cleveland, Ohio. They were both entitled "Secondary Battery" and their numbers were 337,298 and 337,299. The patents covered broadly a pasted type of plate and the first claims were as follows:

337,298.—"A suitable plate or support provided with mechanically applied absorptive substance and adapted for use as a secondary-battery element or electrode after being rendered active by an electric current."

337,299.—"A secondary-battery element or electrode consisting of a plate or suitable support primarily coated or combined with mechanically applied active material or material adapted to become active."

In the specification of his second patent Mr. Brush says: "I do not restrict myself to any particular form of active or absorptive material or to any particular method of applying it to or combining it with the plate or support, as my invention consists, broadly, in a secondary-battery plate or element having active or absorptive material primarily and mechanically applied thereto, or combined therewith, as contradistinguished from a plate or element having the active material produced by the disintegrating action of electricity, as in the well-known Planté process."

These patents have been the subject of much litigation and after being sustained by the courts were purchased for a large sum of money by the Electric Storage Battery Company of Philadelphia, which now owns all the Brush storage-battery patents. The two patents mentioned apply only to the pasted form of battery electrodes, and consequently will affect only the batteries used in automobiles, which are practically the only pasted batteries used to-day. Chicago storage-battery men maintain that the expiration of the patents will have little effect on the battery business, although it gives vehicle-battery makers opportunity to use the pasted plate without restriction.

Alaska Space-telegraph System.

Work on the Marconi space-telegraph system which the United States government is installing in Alaska is progressing favorably. The work of putting up the poles and the installation of the instruments was begun last August, and will be finished next July. The steamer Ohio took the first consignment of packages of machinery and instruments for the stations, the value of the consignment, according to The Nome News, being $65,000. Other shipments have since arrived, and poles of great length from the forests of Oregon are now being cut and prepared for shipment this spring.

The route of the system will start at Nome, with an ocean cable under Norton Sound, a distance of 85 miles, to St. Michael's, where the first wireless station will be situated. From St. Michael's messages will be sent to Holy Cross, on the Yukon River, a distance of 410 miles, and from there to Tanana, passing through Andraefski, Anvik, and Naulato, adding 490 miles to the route. These towns are on the Yukon River, the only path through the wilderness of Alaska. From Tanana the route still follows the river to Rampart City. This station is 75 miles from Tanana, and the next receiving and sending station will be erected at Fort Yukon, 330 miles further. Then comes Circle City, 85 miles; Eagle City, 145 miles; Fort Cudahy, 65 miles, and Dawson City, 65 miles, the last station on the system. The total distance covered by the system is 1,665 miles. From Dawson messages will be transmitted by commercial and railroad wires to Vancouver and to Seattle. It is stated a charge of $3 a word will be made for the wireless messages.

Municipal Ownership Convention in New York.

Under the name of the National Convention on Municipal Ownership and Public Franchises a well-attended meeting of municipal and public-utility experts was held at the rooms of the Reform Club in New York city last week on Wednesday, Thursday and Friday, February 25th, 26th and 27th.

The first paper was on "Recent History of Municipal Ownership in the United States," and had been prepared under the direction of the late Dean Charles Waldo Haskins of New York University.

Clinton Rogers Woodruff of Philadelphia, secretary of the National Municipal League, read a paper on "Political Influence of Corporations Holding Public Franchises." "If, as is now generally admitted," he said, "the grant of a monopoly or special privilege to an individual is unsound public policy, if not immoral, why should such a grant be considered right when made to a group of individuals, associating themselves together in a corporation?"

James Urquhart, mayor of Toronto, Canada, told how his city had the best water on the American continent, because it owned the water-supply rights. It also had bought the street railways and leased them, and the finances of the city had improved as a result.

Robert P. Porter, director of the Eleventh Census, sent his paper, being unable to attend the convention on account of his wife's illness. He dealt with European and American methods and results, devoting much of his paper to attacking the municipal-ownership experiments in Great Britain. Robert Donald, editor of The Municipal Journal of London, sent a paper written in reply to Mr. Porter's, upholding public ownership and citing Glasgow as an example of financial success in such a venture. He also cited the one-cent fare in the Metropolitan Underground Railway of London. Dr. M. R. Maltbie of New York city, editor of Municipal Affairs, supported Mr. Donald's views.

A paper sent by Burgermeister Edward T. Heyn of Berlin contained many interesting facts about German advance in the theory of public ownership. The cities of that country had decided on the public ownership of slaughter houses as a health protection, and in many cases cities had acquired electric railways.

Transportation.

The afternoon session of Wednesday had for its subject "Transportation." It had been planned that the meeting should begin with a discussion of municipal ownership of street railways, the affirmative side being taken by Charles R. Bellamy, general manager of the Municipal Street Railways of Liverpool, and the negative by Charles T. Yerkes of London and New York. Mr. Bellamy read his paper, having come all the way across the Atlantic for the purpose Mr. Yerkes, though unable to be present in person, sent an argument, which was read by the secretary of the convention.

Mr. Bellamy told how his city, acting under a parliamentary act that empowered it to purchase the street railroads after the lapse of a 21-year franchise to a company, decided to make all the urban roads public property. He described what he called "parental government" as having proved successful from the start. The bogy that municipal indebtedness in Great Britain had increased because of public ownership was disproved, he said, by the records.

Facts, as shown in Liverpool, said Mr. Bellamy, proved more than any amount of speculative opinion In 1897 a company rented the city's tramway lines, which belonged to the municipality. The service was inadequate. The city bought the concern's rights for $2,723,400. Electric traction was adopted throughout the system, and other improvements were made. The carrying capacity was doubled. This table was quoted to show the results:

	1897.	1902.	Pe centage Increase.
Passengers	58,409,084	109,335,585	184.66
Mileage	6,013,180	11,790,815	96.08
Receipts	$1,395,552	$2,431,320	74.25

The city had developed its system so that many times more passengers were transported annually than under the company's management. The city had grown until it had a population of 700,000. A unit fare of one cent had been established, carrying a passenger an average distance of 2½ miles, and a large percentage of passengers were obliged to pay only this small fare, the double fare for long rides not affecting many travelers. In the last year of the company's old horse traction the fatalities had numbered eight out of 6,000,000 passengers; under city regulation, the number had come to be eight out of 13,000,000.

Mr. Bellamy continued:

"The gain to the traveling public during last year amounted to £320,000 (or $1,536,000) as a result of lower fares. The employes gained £40,000 (or $192,000), with free uniform clothing. Notwithstanding these important concessions, the gross profits amounted to 9½ per cent., after maintaining the rolling stock, permanent way and machinery in the highest state of efficiency. Six per cent. of this amount has gone to interest and sinking fund, 2½ to a general reserve, or depreciation fund, and the remainder, amounting to £25,000 (or $120,000), transferred to the relief of the local taxes.

"The capital expenditure of the complete undertaking has been shown to be $8,756,280. In addition to the building up of the sinking fund, which will extinguish the debt within 25 years, a renewal or depreciation fund of nearly $1,056,000 has been set aside, an amount equal to 12 per cent. of the capital, which will continue to grow."

Mr. Yerkes' paper, arguing against municipal ownership, was in part as follows:

"The subject of municipal control is one which is now intently studied both in this country and in England, and it is surprising how varied are the opinions in regard to it. In my opinion, it is right that a man should be permitted to succeed in this strife, that his success should be rewarded, and that he should be allowed to leave as an inheritance the fruits of the acts of his life. To place him in a position of that kind he should be able to own himself, or in company with others, not only private industries, but public industries—if I may term them as such.

"Here we see what a slight difference there really is in these terms. A large dry-goods establishment is a private industry. A small railroad is a public industry, both striving in the same manner—one to clothe and the other to furnish transportation. So it is really difficult, when thoroughly considered, to draw the line between the two. The one is generally a close corporation, while the other is very extended. It would be difficult to consider the fact that municipal control could be extended to the former. It is readily appreciated that the municipality would have a difficult task in handling an establishment of that kind. In reality the railroad company would be even more difficult to handle than the large store.

"There are several reasons, however, why I am sure that municipal control should rarely exist. First, all business ventures should be taken hold of intelligently and with due consideration for economy. How ridiculous to think that a municipality could run a railroad economically or wisely. The people who are connected with our railroads are, with few exceptions, men who have been brought up at the business, many of them having large interests in the companies.

"The little details are understood, and everything done to the ends that the roads may be profitable. Economies are practiced, extensions are well considered, improvements are carefully looked into, and the business is carried on in a profitable and economical way. Can we for a moment imagine one of our railroads being managed by our City Council or the state Legislature?

"The results would be really amusing, if they were not so serious. And I now ask the question, 'Who owns our railroads?' and I answer, 'The people.' I may safely say that millions of the population of our country have interests in our railroads throughout the land. They are, however, that class of people generally who have earned the right to that ownership. I fail to see any attempt at municipal ownership, in Europe particularly, but is a failure as considered with what it might be with private ownership. Take Glasgow, for instance, which is looked upon as being one of the best instances of municipal ownership in the world, and we find the expenses of construction and operation amounting to such a sum as would shame any private corporation. And the people who are in charge of the Glasgow works are most honorable gentlemen, and I believe did the best that their abilities permitted.

"We look through Europe, and find railroad lines operated by the government, and where such is the case we can rest assured that the operation is not only most expensive but extremely poor. Who would have the hardihood to think that if we had had municipal control in this country for the last 20 years we would have had this great system of railroads that now exists. It is a fact that every state by its laws promotes the growth of railroads and encourages private ownership and makes our country teem with the rails and its accompaniments. That this private ownership can be abused there is no doubt, but what cannot be? No matter what the abuses have been as relates to the country, it is far ahead of anything like municipal control."

Edward M. Shepard made an address on "City Owning and Leasing." He reviewed the history of rapid transit in New York since 1891. The feature of the contracts with the Belmont-McDonald subway syndicate, he said, was that they protected the city from all possibility of loss. He added:

"Those who criticise the commission for having granted too long a lease to the contractor in the case of the present tunnel must remember that until three years ago not one financier dared to undertake the construction of such a subway. It is no secret I tell you when I say that I, as counsel for the Rapid Transit Commission, consulted with the Vanderbilts, the Goulds, and many others. Without exception they said the plan was impossible."

He estimated that there was a profit of $30,000,000 already in sight on the contract for the construction and operation of the Manhattan-Bronx subway and an ultimate profit of $50,000,000 on the agreement. Mr. Shepard then explained that since that proof had come it was easier for the city to get advantageous terms in building its tunnels. The Brooklyn extension had shown this.

"We are committed to municipal construction," said the speaker. "Undoubtedly, it will be our course in future. I've no doubt that the terms of future leases to contractors will be abridged. For my part, I see no reason why we should not have one soon with a 20-year limit, instead of the 50 and 35-year terms of the Manhattan-Bronx and Brooklyn contracts."

He compared the building of tunnels with the

building of courthouses or reservoirs. The city in each case let the contract for construction because it was more economical than to do the work itself.

"There has been a public misapprehension about the city's powers," he said. "The city does not abdicate its rights, even during the time it leases the underground road to the builder. During the 50 or 35 years it will control absolutely the conditions of the road's operation. If the contractor fails to come up to requirements in every detail the city can even take over the control of the line. The contracts provide how the road shall be operated down to the minutest particular."

Mr. Shepard said he was not prepared to say the time was ripe for American municipalities to buy, build and run their railroads from the start. He considered New York's present form of municipal ownership adequate.

Louis D. Brandeis of Boston read a paper on "Massachusetts' Experience in Street Railways." August Lewis of New York city talked on the general topic of city ownership. "If I were an Englishman," he said, "I'd want public control, but I do not favor it as an American. We are in the position to say to those who govern us that if they will be faithful in a few things we may in time make them rulers over many things."

ELECTRIC LIGHTING AND TELEPHONES.

Thursday morning's session was devoted to "Gas and Electric Lighting." The subject of "Municipal Ownership of Electric-lighting Plants" was treated in the affirmative in a paper sent in by Victor Rosewater, editor of the Omaha Daily Bee. The negative side of the question was treated by Lieutenant James Blake Cahoon, secretary of the National Electric Light Association, whose paper appears elsewhere in this issue. Discussions of the question were participated in by Edward B. Ellicott, city electrician of Chicago; A. L. Pierce, superintendent of the electrical works in Wallingford, Conn.; Frederick F. Ingram, president of the Board of Unpaid Lighting Commissioners of Detroit, and Joseph E. Lockwood, president of the Michigan Electric Company of Detroit.

Mr. Ellicott said in part: "When theoretical charges are added to the cost of operating municipal lighting plants, it leaves small inducement for a city to engage in furnishing such service, and if the same charges are applied to private ownership there is no inducement for the investment of capital. However, the existence of private plants and their prosperity seem to indicate that theoretical charges are not necessary in the successful conduct of the electric-light business. Such being the case, why should such charges be used as an argument against similar plants when operated by a municipality? The most important difference in conditions is that a municipality does not have to earn dividends for stockholders, and, in most instances, on a greater valuation than the actual money invested would warrant. The most important point on which advocates of municipal ownership and their natural enemies—the private companies—disagree, is that of depreciation."

Mr. Ellicott claimed that the city of Chicago had not only paid for its plants, but had been able to save money besides during the 15 years the plants had been in operation. He pointed out that the rented service for 15 years would have cost the city $3,535,875, while the building, operating and maintenance of the city plants during the same period had only cost $3,400,000.

Mr. Ingram stated that Detroit's municipal electric-lighting plant has been in operation seven years, since 1895. Except Chicago, it is the largest lighting plant in this country. "As a business proposition," said Mr. Ingram, "it have proven a good investment for Detroit, for it will have paid for itself in the next three years, based on the lowest 10-year contract offer from a private company. The city will have both the service and the plant at no greater cost than would have been the service alone, had it been done by a private company. Moreover, a great improvement in the service has followed municipal ownership. Detroit's public plant pays the union scale of wages and runs on the eight-hour day. It has demonstrated that this can be done and at the same time improve the service and lessen the cost by removing a public utility from private exploitation."

A paper, prepared by Alton D. Adams, engineer of Boston, was read by the secretary on the subject of the "Municipal Ownership of Gas-lighting Plants." Walter R. Allen, also of Boston, read a paper on the same subject, and there was a discussion by Edward W. Bemis, water commissioner of Cleveland, Ohio.

John De Witt Warner, president of the Art Commission of New York city, in a paper which he read at the afternoon session, told of the tendency of all utilities in American cities to pass into the control of a single company or syndicate. He cited several examples, among them the transportation lines of New York. The eventual merging of all franchises under one head, either municipal or private, Mr. Warner believed to be inevitable. He said he believed it would be more economical and on the whole more satisfactory to secure a combination of the franchises. The only question, therefore, he said, was as to whether the ownership shall be that of the city or of a private coterie of financiers. He gave it as his opinion that a private syndicate could acceptably protect the city from fire, police the municipality, and even dispense justice in the courts.

Thomas Fulton, secretary of the Citizens' Union, told of the investigations he had made of municipal affairs in New York city, and of the great waste of public moneys they had revealed to him.

A spirited controversy arose on the question of the public or private ownership of telephones. The introductory address on this subject was made by U. N. Bethell, general superintendent of the New York Telephone Company, on the topic, "The Superiority of Corporation Ownership of Telephones." A number of statements made by Mr. Bethell in support of his position were combated by Professor Frank Parsons of the Boston Law School, who, going over the same ground that Mr. Bethell had traversed in the address, drew entirely different conclusions. Professor Parsons favored municipal ownership. He submitted charts showing reductions in the cost to the public where independent concerns had entered a monopolized field, and said that greater reductions could be made by the municipalities. A paper, prepared by A. R. Bennett, on "European Experience of Public Ownership of Telephones" was read by the secretary. Mr. Bennett is engineer for Glasgow and other British municipal telephone systems.

At the last day's session of the convention a paper on the subject of "Regulation and Taxation of Public-service Corporations," by Allen Ripley Foote of Chicago, was read. Other speakers were Dr. Charles T. Lewis, Raymond Y. Ingersoll, George H. Shibley, chairman of the National Federation for the National Direct Legislation League; Wheeler H. Peckham and Professor Edwin R. A. Seligman, former president of the American Economic Association.

The convention closed with a banquet on Friday evening at the Reform Club, at which Mayor Ignatius A. Sullivan of Hartford, Conn., presided. Professor Hawkins of Syracuse University and Charles R. Bellamy of England also spoke.

Novel Exciter Combination.

During the construction of the main flume of the Colgate generating station of the Bay Counties Power Company in California considerable trouble was experienced in maintaining a reliable power for driving the exciter. Shutdowns on account of waterwheel troubles, especially by reason of the nozzle choking with small blocks of wood from the carpenters' saws, had become much too numerous. The water had to be continually adjusted to suit the exciter load, which, at times, was changing every few minutes. This, together with the excessive noise of the water when partly deflected from the wheel, made some radical change necessary. After careful consideration, it was decided that an induction motor connected to the exciter unit would, as a motor, take care of any disturbances on the waterwheel end, and in passing from the extreme as a motor to the other extreme as a generator would control the whole unit and give what was specially lacking, a governor.

This design, which was made by L. M. Hancock and was described by him in the Wisconsin Engineer, is somewhat clumsy on account of adapting commercial machines to meet the conditions without making a complete new design. The operation is as follows: The unit can be started either by water or by the induction motor. If water is used, the speed of the unit is brought up to normal as indicated by a tachometer, the motor switch is closed and afterward water is put full on the wheel. If the motor is used to start the unit, its switch is closed and the unit brought up to speed with the auto-starter. Water is then turned full on the waterwheel. The induction motor, as the water strikes the wheel, changes to an induction generator, and, as the water comes full on the wheel, delivers to the station bus-bars the power of the waterwheel not needed by the exciter. Load can now be put on or taken off the exciter without any attention to the unit, the induction generator-motor acting as an almost perfect governor. The importance of this fact, says the designer, can be better appreciated when it is remembered that there is not on the market any suitable governor for small waterwheels, and that the variation in speed of a waterwheel of the Pelton type from no load to full load is nearly 50 per cent.

The variation of the speed of the induction motor from no load to full load does not cause any serious drop in the station voltage; and should there be a serious drop in the station voltage that is infinitely better than a shutdown. In fact, under the conditions as they exist in the Colgate station, water has been entirely choked from the wheel by small sticks and trash without causing the company's customers any inconvenience, and, in fact, without the station attendants knowing it, the induction motor changing from generator to motor instantly, and going ahead with the load until the waterwheel nozzle was found choked and could be cleaned.

The Bay Counties company is so well pleased with this method of driving its exciters that it is installing, in a new 8,000-kilowatt power house, now building, a specially designed duplicate exciter outfit, which is to have the exciter and induction motor on the same bed-plate with three bearings, the waterwheel to be overhung at one end of the induction motor, which is wound for the bus-bar voltage of the station, thus making a very simple, compact and complete exciter outfit.

Purifying Water by Ozone in Germany.

Excellent results have recently been obtained at Wiesbaden and Paderborn, Germany, with the purification of water by the use of ozonized air. Water of an inferior value is thus turned into a very good drinking water. Ozonizers of the Siemens type are used to treat the air. The plant at Wiesbaden contains 48 of these ozonizers, forming duplicate groups of 24 each. A set of eight ozonizers receives an alternating current of 8,000 volts from a step-up transformer. One pole of the apparatus consists of the cooling water of the glass tube, and is earthed, while the other pole, connected to the transformers, is placed in an inaccessible position, and therefore causes no danger to the attendant. The ozonizing tubes are enclosed in a cast-iron case, consisting of three parts: A completely closed central portion, into which are firmly screwed the eight ozone tubes; an upper part, acting as a reservoir and distributer of the air; and a lower part, forming the ozone-collecting chamber. In the upper chamber, removed from all possible touch of the attendant, are fixed the terminals from the transformers. On the floor of the lower compartment are placed the high-potential cylinders with their insulating glass rods, and, in addition, an automatic device to prevent a short-circuit through any leakage of the cooling water. This consists simply of a strip of filter paper stretched across a metal spring. If the filter paper gets moist it tears, the spring opens out and automatically places the particular ozonizer out of work.

The cover, bottom and front wall of cast-iron case are made of thick plate glass, so that the blue shimmer of the silent charge, a certain sign of the proper working of the apparatus, can be watched by the man in charge of the room, which is kept dark. Owing to the careful protection of the high-potential terminal, the apparatus can be fearlessly and safely handled by the workmen. The air supply is fed by means of a main pipe running along the row of ozonizers and sending branches to them severally.

The brickwork sterilized towers receive from a common feed pipe the unpurified water above. They are about 13 feet high, and are filled to a height of some six feet with coarse gravel. The water trickles in a fine stream down this gravel, meeting a slow current of ozonized air ascending under a slight excess of pressure. The feed pipe is provided with a conical valve which automatically stops the supply of water if at any time any part of the ozonizers is out of order. The quantity of water passing down through each tower is 11,000 gallons per hour, and the volume of air passing up in the same time is 21,000 gallons. At the bottom of each tower there is a collecting tank for the sterilized water, from which the latter is pumped to the high-level reservoir.

Due provisions are made against accidents interfering with the working of any particular portion of the ozonizing plant.

Each half of the plant, yielding a supply of 33,000 gallons, expends 50 horsepower, of which 27 goes to the ozonizers and about 22 to the pumping plant, the remainder being used up for the air blast, for feeding the boiler, etc.

The cost of the plant, says the Scientific American, figures out to 1 1-3 cents per 1,000 gallons of sterilized water, of which about one-third of a cent falls to the coal consumed in effecting the ozonization. (The price of one ton of coal yielding 7.7 times its weight of steam being reckoned at $5.) To this must be added about two-thirds of a cent in payment of interest and for keeping in repair. It is stated that ozone, in the concentration in which it issues from the Siemens apparatus, will destroy all pathogenic bacteria, and nearly all harmless microbes, excepting just a few highly resistant and innocent forms, provided a suitable gravel filling is used in the sterilizing towers.

New Electric Heater.

According to the Pall Mall Gazette of London the employment of electricity for heating purposes has received its most recent demonstration in an invention of E. G. Rivers, M. I. C. E. Mr. Rivers has taken advantage of the power of high resistance offered by finely ground carbon, which he receives from the "cake" found on the inside of gas retorts. A layer of the powdered carbon is placed between two china-enameled iron plates and held in position by a border of asbestos cardboard, the whole being screwed together with brass bolts. Conductors of copper are led into the carbon, one at each end of the plate and another in the middle, two circuits thus being formed in a pair of plates two feet six inches long. The advantages of Mr. Rivers' invention are its simplicity, durability and accessibility.

Uniform Electrical Equipment for English Roads.

Information from London is to the effect that important conferences between the consulting engineers of all the railroads of Great Britain are being held with the object of deciding on a uniform scheme for electric equipment, whereby the rolling stock and electric motors of the various companies will be able to travel indiscriminately on all the lines. It is stated that all the trunk companies practically have decided to use electric motors, and the suburban lines are only awaiting an agreement on the uniformity of plant.

DEVELOPMENT OF THE TELEPHONE FIELD.

Measured Telephone Service Recommended for Chicago.

Chief among a special committee, consisting of Alderman Young and Comery and City Electrician [illegible] was appointed by the Chicago City Council to consider the question of an equitable adjustment of telephone rates and the improvement of telephone service. This committee, after a thorough investigation of the telephone systems in other cities and in Europe, made its report on March 2d. Among other reforms, the committee recommends the substitution of a "message rate" or "measured-service" schedule of telephone charges in place of the present "flat-rate" system; an increase in compensation to the city from three per cent. of the annual gross earnings, the present rate, to five per cent., and an action by the corporation counsel to force the company to stop collecting unreasonable toll charges.

The report classifies users of telephones by the number of calls made, and fixes a minimum charge for each, with a price for each call in excess of the call limit. In business houses where the calls average 600 or less the price per year is $60, and for each call in excess of 600 and under 800 the user is required to pay five cents a call. The rates above that are $70 for 800 calls, $80 for 1,000 calls, $88 for 1,200 calls, with four cents a call excess, $100 for 1,500 calls, $109 for 1,800 calls and $118 for 2,100 calls. For a two-party line the charges vary from $44 for 600 calls to $80 for 1,500 calls and for four-party lines from $28 to $68 for the same number. It is recommended that the 10-party-line service be abolished if it cannot be improved. A rate of $18 for 300 calls is fixed for this service.

"The division is necessarily an arbitrary one, but it represents a material decrease in rates to at least 85 per cent. of the present telephone users, based on their present average use of the telephone," says the report. "If it were possible to secure more accurate information of the number of calls made from telephones on the different classes of service, a reduction of charges in some classes, a proportional increase in other classes might be made and result in a more equitable rate throughout.

"We believe that the application of the message-rate system will have a favorable effect in increasing the efficiency of the service. It is the application of the old principle, 'pay for what you get.' Unquestionably, the imposition of this system will limit the number of messages sent in many instances. This will result in quicker and more reliable service in the case of important conversations over the telephone, the use for which it is primarily designed."

As to the business affairs of the Chicago Telephone Company, the committee reports: "The actual earnings of the company are now on a basis of 10 per cent. on the capital stock, with a depreciation charge set aside and apparently used for the purpose intended. All extensions to the system seem to have been made by money derived from the issue of new stock at par. The expenses are chiefly for operation and repairs—salaries constituting the larger amount."

Illinois Telephone Company Receives Permit for Building Connections.

Permission has been given by the Chicago City Council to the Illinois Telephone and Telegraph Company so that the company may now go ahead and make connections between its tunnels and the various buildings in the district bounded by the lake, the river on the north and west and Twelfth Street on the south. The connections are to be so constructed that they will not interfere with any future street-railway subways. The company has put a large force of men at work making the necessary connections and wiring the buildings, and it is expected that an exchange of 10,000 instruments will be in operation by next July. The plan for connecting the buildings is to run a horizontal conduit, three feet in diameter, from the tunnels to inside the curb line, and then to carry the wires to the surface through pipes.

Michigan Independent Telephone Association.

The annual meeting of the Michigan Independent Telephone Association was held at the Hudson House in Lansing, Mich., on February 26th. About 60 delegates and guests were in attendance, and a very enthusiastic meeting resulted. Among the papers presented were the following: "Indiana Independent Situation," by Thomas Bromley, Muncie, Ind.; "Clearing House," by R. F. Johnson, Saginaw; "Night Rate and Three-minute Service," by C. E. Tarte of Grand Rapids; "Necessity of Independent Connection to Detroit Business Men," by Stanley Parkhill of Owosso; "Toledo Exchange," by H. E. Adams of Toledo, Ohio; "Rural Telephone Connections," by W. O. Hunt of Adrian, Mich.

Attorney C. H. Merriam is circulating a petition among business men of Spokane, Wash., asking the council to grant the Telephone Company of America a franchise to do business in that city. The company is said to have $200,000 to invest. Franchises will be also asked for in Tacoma, Seattle and other Sound cities.

Telephone News from the Northwest.

A. B. Ferdinand has been successful in securing a permit to establish an Independent telephone exchange at Oshkosh, Wis. The Board of Public Works has laid out a route for the new line, and has issued a permit.

The ownership of telephone poles in Minneapolis is the subject of more or less confusion, owing to the fact that some poles were originally set by the city and were replaced by the Northwestern Telephone Exchange Company. Hence when the Twin City Telephone Company sought to run a line to the city reservoir at Columbia Heights, the line was run on the pole line. The Northwestern Telephone Exchange Company asserted the ownership of the line and tore down the wire. But now a receipt has been found from the Northwestern of payment for the work of erecting the line in question, which establishes that the ownership lies with the city. The Twin City Telephone Company will therefore proceed to re-establish the line which was torn down.

The Northwestern Telephone Exchange Company will expend $30,000 to $40,000 in rebuilding its exchange in Stillwater, Minn.

A compromise has been reached at Ada, Minn., in the matter of lower rates for telephone service. The demand was for a reduction of the present rate of $2.50 for business houses and $1.50 for residences to $2 and $1, respectively. The company made the residence rate $1 and left the business rate $2.50.

A bill is before the Minnesota Legislature to legalize the serving of subpœnas in large cities by telephone.

L. D. Richardson, for 12 years manager of the Wisconsin Telephone Company at La Crosse, Wis., has resigned and has gone to Duluth, Minn., where he engages in carriage manufacturing.

A bill is before the Minnesota Legislature requiring telephone companies to make connections with other lines and exchanges.

The White Bear (Minn.) Telephone Company has increased its capital stock from $10,000 to $30,000.

The Hawkeye and the Southern Iowa Telephone Companies claim equal rights on the streets of Des Moines, as a result of the recent decision of the Supreme Court, having occupied the streets of Des Moines prior to October of 1897.

The Minburn (Iowa) Mutual Telephone Company has been incorporated with $20,000 capital.

The Johnson County Telephone Company has been sold to C. H. Brown of Grinnell, Ia., and others, and will be known as the Iowa City Telephone Company hereafter. R.

Ohio Telephone Notes.

The Bell Telephone Company has just completed a line from Athens to Pomeroy, on the Ohio River, which gives that section of the country direct communication with Columbus and Northern Ohio points.

The Celina and Mercer County Telephone Company, Celina, has been incorporated with a capital stock of $80,000, to build a telephone system in that town and county. The incorporators are G. E. Nungester, C. G. O. Miller and others.

The story that the North American Company of Philadelphia will enter the Independent telephone field is again going the rounds, but Randal Morgan, general counsel and a member of the syndicate controlling that company, states in a letter to Bayard L. Kilgour, general manager of the City and Suburban Telegraph Company of Cincinnati, that he nor none of his associates have ever entertained the idea of going into the telephone business in this section of the country. He says the reports have no foundation whatever.

Corporation Counsel Hunt of Cincinnati has expressed the opinion that Philip Fitzsimmons, doing business as the Fitzsimmons Telephone Company, cannot be granted a permit to lay underground conduits in the several streets he has designated. He says that the franchise was granted to Fitzsimmons individually, and that the law says that permits for underground conduits may be granted to a corporation, but makes no provision for making such a grant to an individual.

The Springfield and Xenia Telephone Company will complete the plant at Springfield as soon as possible. There has already been about $60,000 spent on the plant, which was left uncompleted on account of the failure of the Everett-Moore syndicate. Governor Bushnell now owns the controlling interest in the company, which also operates a plant at Xenia.

C. R. Shuter has secured a five-year lease on all the lines of the Northwest Telephone Company in Defiance County and will organize the Home Telephone Company to operate them.

The lines and plant of the Martel Telephone Company, Caledonia, have been purchased by John Pommert, who now has about 400 subscribers for the Caledonia Telephone Company. O. M. C.

Indiana Telephone Items.

The following Indiana telephone companies filed articles of incorporation with the secretary of state last week: Sweetser Telephone Company (capital stock, $10,000), to install an exchange in Sweetser and construct lines in Grant, Wabash and Miami Counties; James E. Carry, president. Home Mutual Telephone Company of Stony Point, Kosciusko County (capital, $10,000), to erect an exchange in Stony Point and extend its lines in Kosciusko, Elkhart and Marshall Counties; Joel Hall, chairman board of directors. Anderson and Fall Creek Telephone Company (capital stock, $4,000), to establish an exchange in Anderson Township and construct lines throughout Madison County; Winfield Scott of Anderson, president. Posey Mutual Telephone Company (capital stock, $25,000), to construct and operate telephone exchanges and telephone lines in Switzerland and Ohio Counties; Edward R. Meal, director.

The Thorntown Telephone Company and the Winchester Telephone Company have each, by resolution of their stockholders, increased their capital stock, the former from $2,500 to $6,000; the latter from $2,700 to $25,000. Both companies will make extensive improvements.

The Legislature was induced to reconsider the bill which it refused to pass early in the week permitting telephone companies to erect poles and lines along public highways and streams outside cities and towns, without obtaining anybody's consent. The reconsideration and subsequent passage of the bill was hastened by the decision of Judge Hord of the Bartholomew Circuit Court. Hundreds of telephone men came to the Legislature to urge the passage of the bill, fearing that numerous similar suits would be brought. F.

Independent Telephone Project in Woodlawn.

At a recent meeting of the Chicago City Council Alderman Bennett introduced an ordinance granting the Woodlawn Park Telephone Company a 50-year franchise to build and maintain a telephone exchange in the territory bounded by Jackson Park, the lake, Fifty-seventh Street, Seventy-first Street and the tracks of the Lake Shore and Michigan Southern Railroad. The rates are to be $3 a month for business telephones and $2 a month for residences. Four-party lines will be $2 to each business house in the territory and $1.50 for residences. No cash compensation is offered the city. The measure, which is meant to be restricted to Woodlawn Park, was referred to the committee on streets and alleys south.

TELEPHONE MEN.

A. E. Barker of the Kellogg Switchboard and Supply Company of Chicago has returned from a trip to New York and Philadelphia. J. B. Edwards of the same company is also back in Chicago after spending a few days in the eastern metropolis.

H. H. Robinson of Cleveland, Ohio, has been promoted to be general manager of the United States Telephone Company, the long-distance branch of the Federal Telephone Company. Mr. Robinson will have jurisdiction over the entire system in Ohio, Michigan, Indiana, Kentucky and West Virginia.

Bayard L. Kilgour has been made general manager of the City and Suburban Telephone Company of Cincinnati. John Kilgour retains the office of president, but relinquishes the management. Charles L. Kilgour is the owner of a large part of the stock. The matter of erecting an additional exchange building has not been definitely decided.

MANUFACTURERS AND DEALERS.

The Calhoun County Telephone Company of Kampsville, Ill., the Kilbourne Telephone Company of Kilbourne, Ill., the Shelby County Mutual Telephone Company of Strasburg, Ill., the Secor Telephone Company of Secor, Ill., and the Danforth Telephone Company of Danforth, Ill., have recently purchased telephone equipment from the Stromberg-Carlson Telephone Manufacturing Company of Chi-

The Automatic Electric Company of Chicago has received an order, for immediate delivery, from the Imperial Telephone Exchange, which is managed by the Postal Department of the German government, for 1,070 automatic telephones and switches to be used in extending the automatic telephone service in Berlin, the German capital. The exchange which is to be enlarged has been in operation since May 20, 1900. It was built by the American company, and operated until July, 1901, under the auspices of German telephone engineers, at which time it was purchased by the government.

Telephone managers will be interested in the telephone counter manufactured by the Veeder Manufacturing Company of Hartford, Conn. This counter enables a telephone manager to learn periodically the amount of work performed by the operators, as well as the total number of calls answered daily. The holders for the Veeder counter can be attached to the switchboard in front, but slightly to the right of the operator and remain there permanently, or it can be removed at will and attached at such periods as it is decided to make a day's record. The count is made by the operator pressing the button on end of lever for each call received. Every time the button is pressed the counter registers, and thus a daily total for each operator is secured. The Chicago depot for the Veeder company is located at 58 and 60 Wabash Avenue, and is in charge of T. H. Cranston & Co.

Municipal Electric Lighting Opposed.[1]

By James Blake Cahoon.

When discussing the question of municipal ownership in the United States I shall not take up the experience of countries other than our own, for the customs of foreign countries are so radically different from our own that we cannot base what we should do upon what has been, or is being, done in other countries. We must be a law unto ourselves and look at the matter in the full light of our political system, and take up the question of conserving the interests of the community in the broadest minded spirit.

As to depreciation, the municipal plant does not differ from the private plant, and it has been found by actual experience, extending over some 20 years, that we must take into account depreciation of the apparatus, building, lines, lamps and everything connected with the manufacture and distribution of electricity, with the exception of the land. It has been argued that modern apparatus is so much better than that formerly put out, that it is not now necessary to charge as much for depreciation as would have been the case 10 years ago. But it is not the simple wearing out of the apparatus that must be taken into account. We are progressing constantly; changes are being made even to-day in electrical apparatus, and what was all right 10 years ago, five years ago, two years ago, must be discarded and thrown into the junk heap because new inventions bring about economies which render it imperative for us to throw away the old apparatus, though it may be in good operative condition. It is useless to say that electrical apparatus has reached its highest point of development or even that electrical apparatus will be used 10 years from now. We simply know that we have had to throw away apparatus and probably will have to do so in the future. When electricity came in, cities practically did away with gas as an illuminant; their lamp posts became worthless and went into the scrap heap; so in like manner the next 10 years may bring something to the front that will cause us to throw away all our electrical apparatus and take up a new method of lighting. For these reasons we must consider depreciation.

	Price of Coal. Average.	C. P. per Hour for OneCent. Average.	Price of Gas per M.	Average Cost per Lamp-hour.
Alabama	$1.82	759	$ 1.72	$ 0.0229
Arizona	8.00	250	2.00	.0489
Arkansas	2.87	509	2.00	.0423
California	8.29	578	2.24	.0370
Colorado	3.37	894	.....	.0279
Connecticut	4.08	429	1.48	.0344
Delaware	3.25	1,232	.....	.0162
District of Columbia	.....	1,111	.....	.0180
Florida	2.45	680	2.00	.0268
Georgia	2.89	689	1.63	.0261
Idaho	.....	833	.....	.0292
Illinois	1.57	705	1.49	.0296
Indiana	2.01	682	1.33	.0270
Iowa	1.66	679	1.58	.0284
Kansas	2.48	565	.96	.0355
Kentucky	1.92	799	1.54	.0272
Louisiana	3.37	661	2.50	.0245
Maine	4.85	782	1.95	.0277
Maryland	2.00	849	2.00	.0352
Massachusetts	4.58	449	1.58	.0363
Michigan	2.77	633	1.37	.0315
Minnesota	3.91	699	1.32	.0282
Mississippi	2.41	610	2.22	.0323
Missouri	2.32	594	1.76	.0331
Montana	7.50	734	2.00	.0281
Nebraska	2.93	581	2.07	.0373
New Hampshire	5.46	531	1.66	.0341
New Jersey	3.34	689	1.35	.0244
New Mexico	3.00	450	2.25	.0444
New York	3.07	735	1.68	.0264
North Carolina	3.40	580	1.80	.0280
North Dakota	5 50	1,219	2.00	.0164
Ohio	1.78	829	.92	.0249
Oklahoma	4.00	688	.....	.0325
Oregon	.....	915	.....	.0193
Pennsylvania	2.18	902	1.27	.0221
Rhode Island	4.16	289	1.45	.0429
South Carolina	3.34	884	2.25	.0228
South Dakota	6.00	242	.....	.0826
Tennessee	2.01	916	1.18	.0208
Texas	4.12	609	1.97	.0319
Utah	3.00	1,062	1.65	.0189
Vermont	5.82	144	1.98	.0308
Virginia	3.36	1,001	1.19	.0189
Washington	3.83	985	1.93	.0210
West Virginia	1.45	694	.50	.0268
Wisconsin	3.41	691	1.58	.0281
Wyoming	.....	597	3.00	.0334
Av. for United States.	3.43	655	1.72	$ 0.0288

I have had prepared the above table giving the average cost per lamp-hour in the different states and candlepower-hour for one cent, the price of coal and the price of gas. The cost per lamp-hour includes both 2,000 and 1,200-candlepower arc lamps. At the bottom of the table is given an average for the whole country. This data are obtained from approximately 800 plants in the United States. I put it this way simply to show the fallacy of using the lamp-hour basis as a method of comparison between cities. If we refer to the candlepower-hours furnished for one cent, this gives us a more accurate method of comparison, but even this should not be used by cities to determnie the relative cost, but the method followed by Nathan Matthews, Jr., should be used; i. e., taking into consideration all the local conditions, the candlepower furnished for one cent might be used simply as a preliminary comparison, as it will show whether it is worth while to go further into details. For instance, take the state of Illinois. We find that the private plants throughout the state furnished 705 candlepower for one cent, and these are divided into various small plants in the different cities of the state, no one of which is supplying any great number of lamps, the plants not being large enough to obtain the economies that may be practiced by a single company furnishing the number of lamps demanded by Chicago. The number of candlepower-hours for one cent furnished by the Chicago plant for the year ending December 31, 1900, was 782, whereas the average candlepower-hours furnished for one cent in Delaware is 1,232; District of Columbia, 1,111; North Dakota, 1,219; Utah, 1,062; Virginia, 1,001; Pennsylvania, 902; Washington, 985; Oregon, 915; Tennessee, 916, etc.; while, of course, where the plants are small and coal is high, as in some states the candlepower-hour furnished for one cent runs low.

The cost of fuel must be taken into account, and for practical purposes of comparison we would get a better result were we to divide the candlepower-hours by the cost of coal per ton and compare the results thus obtained for determining whether it would be advisable from a financial standpoint for a city further to consider the question of undertaking to light its own streets. The cost of coal in Chicago is given as $2.25; dividing 782 by this gives 347. Comparing this with the average throughout the state, cost of coal as $1.57 and average candlepower-hours as 705, we get 440. The comparison should be made in the following manner: The results obtained from the divisions should be inversely proportional to the prices of coal: or 1.57:2.25::3.47:500. But dividing 705, the average candlepower for one hour throughout the state by 1.57 gives only 440, whereas in order to do as well as the city of Chicago, other things being equal, the result should be 500. In other words, the big plant in Chicago is only doing about 12 per cent. better than the average of the small plants throughout the state, when we might fairly look for at least 30 per cent. In other words, if a big plant with an approximate capacity of 5,000 lamps cannot show a better economy than 12 per cent. over the average country plant in the same state, we may fairly assert that this plant has failed to effect any saving to the city.

But let us assume that the municipal plant can furnish lights as cheaply as the private plant or even a little cheaper, and look at a totally different phase of the matter of municipal ownership and operation. The United States leads the world today in the manufacturing field, and it does so by reason of the fact that the people have encouraged in every way possible the development and perfection of machines and processes, whereby greater economy in and the maximum of production of manufactured articles is obtained. Looking at electricity in the sense of a product, it may strictly be classified as a manufactured article; and as such every encouragement should be extended to those who have entered upon its manufacture and distribution to cheapen their product. This was done at first, with the result that the price of this product has been more than cut in two since its first advent in a commercial way 25 years ago.

Electric-light companies found this to be the situation: "We have placed a price upon our product which is only a reasonable return upon the investment, if we get a certain amount of business; but our losses are so great between the coal pile and the consumer that we are only getting pay for one-third to one-half of the whole product." As soon as this was realized, every central-station man in the country became interested in how he could deliver a much greater portion of his product. As one problem after another was solved, he found he could cut down the price to the consumer, and by making such a cut sell enough of his product to offset the reduction in price. To-day, it has become an accepted axiom among central-station men that the profits of electric-lighting enterprises are enhanced by keeping up the economy of the plant to the highest degree and selling the product at as low a figure as possible to get a fair return on the investment.

If electric-light plants are municipalized we will take away the incentive to progress toward a cheaper method of production and a cheapening of price accordingly; for it is a well-known fact that where municipalities have started into any such enterprise, so far as they were concerned, progress has ceased. Electricity is by no means fully developed, even at the present time, great as has been the improvements over the crude apparatus of several years ago, and the only way in which further improvements can be made is by the private companies forcing the manufacturers to improve apparatus. Therefore, the people at large for their own interests should do everything they can to encourage electric-light companies in their efforts to secure better apparatus, with the resulting economy and lower prices to the consumer. If we remove the pressure upon the manufacturing companies through municipalizing the plants, they will cease their efforts toward improving apparatus that produces greater efficiency. They might continue to improve apparatus to cheapen manufacturing cost so that they could make larger profits, but that is not what is wanted. The electric-lighting man more than any other wants the best apparatus that can be made, and by best I mean apparatus requiring least repairs and showing greatest economy.

The trend of all argument on municipal ownership has been along the lines as to whether or no the municipal plant can be operated so as to furnish lights for the city at a less cost than the same quality and number of lights can be furnished by the existing company in that city. I say frankly that if the municipalities will adopt the same system of accounting as that in use by members of the National Electric Light Association, and which has been formally adopted by that association, and carry such a system out faithfully in all its details, the municipal plant cannot furnish light at as low cost, all things considered, as the city can obtain the same light from the local private company. The day of secrecy in the matter of accounting by electric-light companies has gone by and there is not a single, modern, up-to-date plant in the whole United States which does not stand ready and willing to show to the municipality just what it costs to furnish them with their street lights, and all they ask in addition to the actual cost is a reasonable mercantile profit. That every fair-minded citizen is willing they should have.

Aside from the cost and profit question, pro or con, there is a broad-minded view to be taken of the situation which may be summed up in a few words. Here is a comparatively new industry which is in process of development. Do the people of the United States as a whole want to encourage this industry and build it up and keep the United States in the van of progress by so encouraging it, or do they want to throttle it? I believe that when people come to look at it in this light, the concensus of opinion will be strongly in favor of helping the industry in every reasonable way. If I am right in my belief, the question of municipal ownership of electric-light plants disappears.

1. Abstract of paper presented at the recent municipal-ownership convention in New York. The author is secretary of the National Electric Light Association and is a well-known authority on the subject of this paper.

The Name "Babcock & Wilcox" Sustained.

Judge E. Henry Lacombe of the United States Circuit Court for the Southern District of New York has issued a decree in the suit of the Babcock & Wilcox Company against the Aultman & Taylor Machinery Company and Thayer & Co., perpetually enjoining the defendants from using the name "Babcock & Wilcox" or the initials "B. & W." "or any substantial part or imitation of the same, or either of them, either alone or combined with other word or words upon, or in connection with the sale or offering for sale or advertisement for sale, of any boiler or other steam apparatus not manufactured by the complainant, and from employing any phrase containing said name or initials, except in connection with or reference to boilers or steam apparatus manufactured by the complainant, and from stating or representing any boiler or other steam apparatus manufactured, sold or dealt in by them, or either of them, and not manufactured by the complainant as a 'Babcock & Wilcox' or 'B. & W.' boiler, and from selling, or offering for sale, or passing off, any such boiler or other steam apparatus as and for a boiler or steam apparatus manufactured or sold by the complainant and from using said name or initials or any substantial part or imitation thereof, for the description or designation of the type, design, or construction, of any steam apparatus manufactured or sold by the defendants, or either of them, or similar thereto."

Space Telegraphy in the West Indies.

Under date of January 24, 1903, United States Consul L. H. Aymé of Guadeloupe reports: "Regular daily communication has been established between this colony and Martinique by a system of wireless telegraphy. The station in Guadeloupe is situated near to Gosier lighthouse, and that in Martinique, I am informed, somewhere on the peninsula of La Caravelle, on the east side of that island, so that the air line between the two stations passes entirely over the sea. These stations have been installed by a detachment of army engineers, and only official messages between the governors of the two colonies have thus far been exchanged. The officer in charge informs me that the system used is not the Marconi, but is one devised by the French engineer corps. The spark used is about four inches long, and the power is obtained from a small dynamo driven by an engine using vaporized naphtha. Four wires are used, separated at the top and bottom, forming a long, rectangular cage. The mast is said to be 170 feet high. As all cable communication with Martinique has been interrupted for several months, this is the only means of sending telegraphic messages."

Lodge-Muirhead System of Space Telegraphy.

London advices of recent date are to the effect that a system of wireless telegraphy, which has been for some time experimentally operated for a short distance and at sea, is about to be brought forward, apparently in competition with the Marconi system. It is the outcome of the joint labors of Sir Oliver Lodge, principal of the University of Birmingham, and Dr. Alexander Muirhead, a well-known telegraphic expert. It employs Professor Lodge's inventions, and also one, at least, of Lord Kelvin's inventions. Experts who have seen the present Lodge-Muirhead system working pronounce it to be more rapid and clearer than anything yet exhibited. Professor Lodge's new coherer, which is the integral feature of the system, consists of a small steel disk, rotating in light contact with a column of mercury through an oil film. It is stated that the sensitiveness of the coherer is remarkable, as is its simplicity and freedom from derangements.

Electricians at Artillery Posts.[1]

By Capt. Henry C. Davis, U. S. A.

Not long since an artillery officer, a pioneer in the study of electricity as applied to artillery, in a letter to me, remarked, "the engineers are turning over electrical plants to the artillery, and if, in a few years, these are not found in good condition it will reflect on us." The officer making this remark understood very well that without special attention and study the artillery would fail in this matter. He also recognized that this fact is probably not fully appreciated by the corps at large.

The electrical apparatus at our seacoast forts comprises boilers, engines, both steam and oil, dynamos, motors, storage batteries, primary batteries, telephones and searchlights, and of late there has been added the telautograph. All these require attendants with special training to insure their efficiency. Electrician sergeants have been appointed, and one is assigned to each post regardless of its size and equipment. For small posts this is ample, but for larger posts, it is impossible for one electrician sergeant alone to attend properly to all the electrical plant. He must have assistants.

At one post there are six storage batteries in commission, one not yet set up, and still others in contemplation. These are scattered over a distance of about a mile and a quarter in a straight line, with two charging stations. The communications cover the same distance. There are many telephones now in use, and telautographs are soon to be added. The H. P. F. system when completed will require still other instruments.

This is enough plant for the electrician sergeant to superintend. The word superintend is used advisedly, as he can do little else than see that the whole is kept in good condition by his assistants. He can scarcely do the work of running the engines, charging the batteries, attending to the lights at the different emplacements and to the searchlights, and keeping in order the telephones and telautographs. His assistants must be able to do these things while he is the general "trouble man." These details are cited merely to indicate the necessity for skilled assistants to the electrician sergeants.

A study of the methods of the other branches of the service may be of advantage. When the engineers have a dummy engine to run, they employ an engineer and fireman; when the quartermaster's department installs a pumping plant of any importance, an engineer and fireman are engaged for that work alone, and if this station requires a night shift, an additional engineer and fireman are necessary. These engineers are skilled men employed at $75 to $100 per month. When the mines were turned over to the artillery, the chief of engineers wisely employed an electrician at $100 a month to care for the material until such time as the artillery could take care of it.

The employment of these men is a necessity, and they should be skilled operatives. In the commercial world a man who runs an engine must have a license; moreover, he runs the engine, and, as a rule, does nothing else.

What lesson is to be learned from this survey of our surroundings? It is this: Skilled men are required in all technical work, and they usually attend to the work assigned to them and to nothing else. Applying this lesson to the case of the artillery, we find that whenever there is more than the electrician sergeant can attend to himself, he must have assistants who are capable of doing the work assigned them under his supervision. I do not believe it is either necessary or wise to employ civilians for this purpose, as we can find in the ranks of the artillery corps men abundantly able to care for our plants as specified above. The question is how can we bring these men and the work together?

In answer to this question, I suggest that the first step is to make systematic search for the proper men, and if they are not to be found at the post where they are needed, effect a transfer from some other post. A search through the enlistment papers is a first step toward accomplishing this, and a trial of the men so indicated is next in order.

Men who possess the necessary qualifications are, as a rule, valuable in the organization to which they belong, and the captains are generally loth, and naturally so, to give them up for a duty that will, or ought to, take them away from the company. Again, the work assigned usually requires these men to be occupied during the greater part of the day. Major Anderson, in his handbook, states that if an attendant has not all of his apparatus in perfect order and has not worked 10 hours a day, he is not doing his duty.

In the company, soldiers who can do skilled work command detachments, point the guns, take charge of the company property, do the mechanics' work around the battery, or cook the food for the company and are set aside from others by giving them chevrons and extra pay, while the assistants to the electrician sergeants have neither rank nor extra pay. Under the present conditions, the corps of electrical "experts" is panoramic in its character, for which there must be some reason. I believe it is a recognized fact that, as a rule, the artillery soldier does not re-enlist, and the task of keeping the electrical detail full of even moderately well qualified men is certainly difficult.

Suppose in action the generators or engines fail to do the work because of unskilled attendants, or the storage battery fails to light the emplacement, or the searchlight to illuminate the field of fire, or the telephones and telautographs fail to convey orders and ballistic data from the same cause; what becomes of our complicated system? A chain is no stronger than its weakest link. The electrical appliances are the nerves of the system, and if they are out of order, the whole combination fails.

It seems very clear that the electrical detachment should receive more attention as to its personnel and handling than it now receives, and I might add, than is generally thought necessary. There are two methods that may be adopted to improve matters as they now stand, either one of which would, I believe, attain the desired end.

The first plan consists in organizing at each post an electrical detachment under the charge of the electrician sergeant composed of men who are qualified or give promise of qualification for electrical work. The detail to such duty will be made on application of the man after he has passed an examination as to his ability. The requirement that the detail shall be on application of the soldier insures the selection of men who have a taste for the work, and who probably desire to perfect themselves in it. They should be in the second year of service at least, so that they may have had company discipline and all the necessary drill to appreciate the connection of their work with the service of the guns.

If a post does not furnish enough men of this class, or if a man desires such a detail and there is no vacancy for him at his post, the facts should be reported to the district commander. The latter should, by communication with others, effect a transfer when necessary, but a man should not, as a rule, be transferred for this purpose unless he assents thereto. The underlying idea in the whole plan is to make the detail popular and so induce men of this class to re-enlist.

The members of this detachment should not be required to do any routine company or post duty, or attend drills at the guns. They should be inspected at their place of work at the same time as the plant is. They should receive the rank of electrician, wear a distinctive chevron and receive extra pay. They should be attached for rations, quarters and muster to one or more of the companies, but should attend only such roll calls as the engineer officer under whom they serve shall designate as not interfering with their work.

The strength of this detachment will depend entirely on the equipment of the post considered. There should be one man for every detached storage battery and one for each engine of less than 15 horsepower. For a plant of greater horsepower, and with a storage battery, two men are needed. If there are three or more storage batteries to the generator, and hence considerable length of line of communication, there should be a lineman in addition to those mentioned, while the electrician sergeant should supervise the whole. Although not stated, it is intended also, that this detachment embrace those soldiers assigned to the care and preservation of the submarine defense material. The number necessary for this purpose will be suggested by the amount of plant.

The second plan differs from the first in a minor point, and is offered only for the reason that to carry it out does not require an act of Congress or, it is believed, anything more than a post order, provided the co-operation of the company commanders is obtained. It consists in forming the detachment of corporals detailed to it under the same restrictions mentioned above. These corporals will be under the same regulations as to drills, etc., as the members of the detachment in the first plan, but in so far as practicable, their work will be in connection with the electrical appliances pertaining to the battery to which their company is assigned. The co-operation of the company commanders is necessary in order that at least one such qualified man is appointed corporal in each company.

There is a third alternative suggested by me in a report of some two years ago; namely, to appoint electrician corporals in the same manner as electrician sergeants are now appointed, but in sufficient numbers to allow of a full complement of electrician non-commissioned officers at each post, one of whom is an electrician sergeant. If this plan be adopted, I would suggest that the graduates of the present school for electrician sergeant be each given a warrant as electrician corporal, and that vacancies in the grade of electrician sergeant be filled by selection by examination from the grade of electrician corporal.

This plan will not provide for the detachment for submarine defense. To cover that case, there may be one additional electrician non-commissioned officer detailed to each post to take charge of this work, having under him a detachment of men detailed on special duty under regulations as to other duty, the same as other special-duty details at the post. This non-commissioned officer should have had a special course at the School of Submarine Defense.

It is proposed that the electrician detachment, however organized, be under the command of the engineer officer, who should also be signal officer and in charge of the submarine-defense material. This concentrates all electrical work under one officer, who, it is scarcely necessary to add, should be selected with regard to his suitability to the position.

1. From the Journal of the United States Artillery.

CORRESPONDENCE.

London Letter.

London, February 21.—A great interest has at all times been manifest concerning the atmospheric purity or otherwise of the tunnels of the Central London railway, and a report has just been issued of a chemical and bacteriological examination made by the medical officer of the London County Council. The air in the passages leading to and from the stations was generally found to be better than that in the elevators, in which the organic matter present underwent considerable variation. The platforms and passages generally gave better results than the air in the streets, while the tunnels were found to be but little worse. The absolutely worst examples were taken from the elevators and cars, but the medical officer's conclusions are that the proportion of micro-organisms present generally was not so considerable as to cause uneasiness, or to compare unfavorably with the conditions known to exist in habitated dwellings, although there were a considerable number of organisms capable of growing at the temperature of the body. Why so many of these efforts at investigation should be directed at the Central London railway it is difficult to perceive, as there is no reason to anticipate that the conditions existing on other tube electric railways are in any way more ideal.

Although the National Physical Laboratory has not been in existence, metaphorically speaking, five minutes, it is making rapid progress in many important branches of science. Only a month or two ago attention was called to the lack of any standard authority to which we could apply in respect of photometric measurements, and at that time the director of the laboratory mentioned that this want would very soon be filled. Now the photometric room is practically ready; all the apparatus is ordered and much has been delivered. In this arises the old complaint of the insufficiency of the government grant, and the generosity of many contractors and private individuals is responsible for much of the equipment.

Since the disagreement between the Messrs. Morgan and the London United Tramway Company last year—a partnership which promised much but accomplished little toward a solution of the London traffic question—the relations between the tramway company and Mr. Yerkes have gradually assumed a more important aspect. Mr. Clifton Robinson, the managing director of the tramways company has been elected to a seat on the board of the District Railway Company, and Mr. C. T. Yerkes has been appointed chairman of the tramway company. A system of through fares from the electric tramways over the "electrified" District company's lines is to be propounded, and unless the new American millionaire friends of the tramway company assume a similarly autocratic attitude to that adopted by the Messrs. Morgan, some sensible working arrangements may be looked for.

The relationship between Mr. Marconi and the cable companies on this side is fully exemplified at the meetings of the latter, where it is the invariable practice of the chairman to endeavor to score a laugh at Marconi's expense. One of the most amusing efforts of this kind was that of the chairman of the Anglo-American Telegraph Company, who regaled his shareholders with extracts from an apparently sensational article in the Boston Herald for January 23d. It is to be feared that the technical press, at any rate on this side, is hardly as generous as they might be to Mr. Marconi. A more congenial item apropos of the Marconi system, however, is an application which has just been made to the courts for sanction to an alteration in the articles of association of the company to enable the fuller development of the original patents. Lighting and traction were mentioned as potentialities of the invention, and the court's sanction was immediately forthcoming.

The way of the tube railway in London is not always a smooth one, as the Great Northern and City Railway Company has just discovered. This company has just been ordered to pay $20,750 to a dressmaker for structural damages to her premises occasioned by the tubes of the company resulting in a subsidence of the subsoil.

Double-current generators are not much in evidence in the United Kingdom in practical use, but it is not generally known that there are a few machines of this type in operation. A small Scotch manufacturing works which supplies current to the local authority has them, the Trafford Park Power Company at Manchester has one, and the new generating station for working the "electrified" Mersey railway is equipped with them. It is proposed, also, to instal them at the Wellesden (London) municipal electricity works now in course of construction. None of these machines is, however, of British make.

It is stated that the Central London railway is to replace its electric elevators by hydraulic machines, and that a start has already been made at the Shepherds Bush terminus station.

Work on the electrification of the Lancashire and Yorkshire (steam) railway has commenced, and is expected to be finished by the end of the year. One power house is to be erected with three transformer stations.

An important through-booking arrangement, ap-

plicable to both passengers and freight, has just been concluded between the South Lancashire Electric Tramsway Company and the Great Central Railway Company, one of the main steam lines of the country. W.

New York Notes.

New York, February 28.—Actual work was begun on the great Pennsylvania tunnel on Wednesday when a gang of workmen began to tear down some old tenements and warehouses at the foot of West Thirty-second Street. The shaft which was begun at that point will extend down to the level of the tunnel, and then the work will be pushed west under the river and east under the city to connect with other sections. There are four of these—one extending from the terminal east to a point under the center of the East River, one on Long Island, and one in New Jersey, besides the one which is now under construction.

A bill introduced in the state Legislature at Albany during the week provides for enlarged powers for the Rapid Transit Commission of New York city, and makes provision for the construction of transit lines by the municipality. Assemblyman Agnew of New York has introduced a bill, which would repeal that part of the rapid-transit law which prevents the Rapid Transit Commission from permitting an extension of the elevated system in Battery Park and provides that the commission may grant such privilege to the elevated railroad companies, but to no other corporation. The bill, if enacted, would prevent the granting of any terminal privileges in Battery Park to any underground railway. Mr. McEwan has introduced a bill which provides that the governor, controller, state engineer, and Messrs. Steinmetz and Buck of the old commission, constitute a state electrical commission, to choose a site and expend the $275,000 appropriated by the bill to establish a state electrical laboratory.

The State Board of Railroad Commissioners has authorized the Interurban Street Railway Company, the Westchester Electric Railway Company, the New York, Westchester and Connecticut Traction Company, and the Tarrytown, White Plains and Mamaroneck Railway Company to use the overhead trolley system on certain of their lines.

Fire destroyed two electric cars in the car barns of the Metropolitan Street Railway Company at One-hundred-and-thirtieth Street and Lexington Avenue last Saturday. The loss is estimated at $2,000.

The Manhattan Bridge planned for the East River between Manhattan and Brooklyn will be the longest city bridge in the world. It will have a total length including approaches of 9,900 feet and the river span will be 1,470 feet. The capacity of the bridge will be as follows: On the lower deck: 1. One roadway 35 feet and six inches between guardrails. The roadway will be wide enough to permit four three-horse teams to pass abreast. There are no braces or girders of any kind above the roadway, making it free from occasional drippings or icicles. 2. Four trolley tracks, two on each side of the roadway, and completely separated from it. 3. Two promenades, 11 feet and nine inches each, carried by brackets on each side of the bridge and affording a clear view of the river. On the upper deck: 4. Four elevated railroad tracks located in pairs between the outside chains.

Andrew Carnegie has added $125,000 to the endowment fund of the Carnegie laboratory of engineering at Stevens Institute of Technology. Mr. Carnegie in 1900 gave $65,000 for the erection of the laboratory. When the building was dedicated a year ago he gave $100,000 as an endowment fund.

The Automobile Club of America expects to hold a contest in the spring for commercial vehicles of all types, including heavy trucks and delivery wagons, as well as light delivery wagons, propelled by gasoline, steam or electricity. It is the intention of the club to determine by this contest whether the time has arrived when it can be satisfactorily demonstrated that self-propelled vehicles can be used in commerce at less cost and to greater advantage than the present horse-drawn vehicles. O.

New England News.

Boston, Mass., February 28.—The show of the New England Automobile Dealers' Association was opened last Tuesday evening and will continue until to-night.

The Bristol and Norfolk and the Easton Street Railway Companies have voted to consolidate. The former company has petitioned for authority to issue five per cent. bonds running 20 years and amounting to $110,000, the proceeds to be used in purchasing the controlling interest in the Easton company.

The Old Colony Street Railway Company has purchased 80,000 feet of wharf property in Fall River, Mass., on which it proposes to build a power house to supply power for all purposes on its electric railways between Quincy, Mass., and the Rhode Island state line. The plant will contain three turbine engines capable of developing 10,000 horsepower and will be equipped with automatic stokers. It will take the place of 10 small power stations. The new engines and boilers have been ordered. The boiler houses will be located at tidewater to lessen the cost of coal.

The Windsor Locks and Rainbow Street Railway Company has filed a certificate of organization. Its capital is $100,000. Henry A. Huntington is its president, and Frank E. Healy is its secretary. It is authorized to build an electric railway between Windsor and Suffield, Conn., via Windsor Locks, and it can carry freight.

The Rhode Island Legislature is considering a bill prohibiting the consolidation of gas, electric-light, electric-power, electric-heating, electric-railway, telephone or telegraph companies in that state.

The Fitchburg, Nashua and Lowell Street Railway Company has petitioned for incorporation. It desires to build an electric railway between Fitchburg and Lowell, Mass., a distance of 23 miles, and a branch between Groton, Mass., and Nashua, N. H., at a probable cost of $150,000.

In his recommendations for appropriations, Mayor Collins of Boston calls for $60,000 for the Wire Department during the ensuing fiscal year.

High-potential experiments with long-distance transmission of power by means of currents of extremely high voltage, are being continued by seniors and post-graduate students at the Worcester (Mass.) Polytechnic Institute. Professor H. B. Smith, the head of the electrical-engineering department of the institute, is making electrolysis tests of the Worcester city water.

The Telephonic Tube Company has filed its certificate of organization with the Maine secretary of state. It was organized at Portland, Maine, with a capital of $100,000; $5 paid in. F. A. Newell of Boston is president, and Harry L. Cram of Portland is treasurer.

The trustees of the Boston-Worcester Electric Companies have completed their organization by the election of James F. Shaw as secretary, and George A. Butman as treasurer. The company owns the Boston and Worcester, the Framingham Union, and the Framingham, Southboro and Middleboro Street Railway Companies, and it expects to have electric cars running between Boston and Worcester, Mass., by July 1st next.

The Edison Electric Illuminating Company of Boston is negotiating for the purchase of a portion of House of Correction property at South Boston. The company desires 312 feet front.

The Maine Legislature is considering the granting of a charter to an electric-railway company which proposes to build a road from Hampden to Stockton Springs, on Penobscott Bay, in that state, passing through the towns of Winterport, Frankfort and Prospect. This is part of the scheme to connect Bangor and Thomaston by electric railways.

The Netherlands Tramway Company has been incorporated in Connecticut. It has a capital of $3,500,000 and proposes to exploit electric-railway enterprises in Holland.

The Old Colony Street Railway Company will probably meet considerable opposition in its endeavor to obtain authority to carry freight within the city limits of Fall River, Mass. It desires to lay tracks wherever it may be necessary in order to haul freight from the railroads and wharves to the mills. But the Fall River Electric Freight Railway Company, which is seeking incorporation, desires to cover the same territory. It proposes to build a railway in Fall River, 11½ miles long—three-fourths of a mile to be through public highways and the remainder on private lands—and to connect 38 mills and other manufacturing plants. Exclusive of land damages, it will cost $350,000 to equip this road. B.

From the Buckeye State.

Cleveland, Ohio, February 28.—The small stockholders of the Lake Shore Electric Railway Company are holding back on the re-financing plan to such an extent that it is feared it will fail entirely.

The Cleveland, Geneva and Meadville Railway Company, Geneva, has been incorporated for the purpose of building an electric line from Geneva to Jefferson and Meadville, Pa. The capital stock is nominal and D. E. Warner, O. C. Pinney and others are interested.

Attorney Henry W. Huggins of Cincinnati is organizing a company in Cincinnati to build an electric line from Maysville, Ky., through Georgetown, Ohio, to Hillsboro, where it will connect with the Cincinnati and Columbus line, and with the Springfield line projected by Harry Frey of Springfield and Attorney J. D. DeWitt of Cincinnati.

The Miami Heat, Light and Power Company of Piqua has been incorporated, with a capital stock of $150,000, to operate an electric-light and power plant. W. V. Baker and F. W. C. Bailey of Columbus and Homer T. Bailey, John W. Brown and A. E. Clark of Piqua are interested.

The Davis-Elkins syndicate of West Virginia has purchased the waterworks and electric-light plant at Charleston, that state, the consideration supposed to be about $80,000. Senator Stephen B. Elkins and former Senator Henry G. Davis, with a number of other capitalists, make up the syndicate, which has been acquiring banking and railroad interests in the state. It is said they are negotiating for the street-railway lines in Charleston also.

The Leesburg Manufacturing, Light, Power and Water Company, Leesburg, has been incorporated with a capital stock of $25,000 by M. Reaky, J. Worthington and others.

The Consolidated Heat and Light Company of Wauseon has been incorporated with a capital stock of $100,000 by Fred J. Ballmeyer, F. J. Spencer, G. P. Campbell, J. C. King and H. G. Struble.

The Columbus, Buckeye Lake and Newark Traction Company has purchased ground along the line in Newark where car barns and a repair shop will be located. This will be a division point of the Appleyard roads.

J. C. Trask and George T. Bishop of Cleveland have secured control of the Ohio and Pennsylvania Traction Company, which owns trolley lines from Ashtabula to Conneaut and Ashtabula to Jefferson. They will build a line from the town to the lake shore, where the Lake Shore Railway Company is building a park. A company was recently incorporated by the Lake Shore officials to build this line, but since others are willing to undertake it this may be dropped by them.

The Medina Electric and Illuminating Company of Medina has been incorporated with a capital stock of $25,000. G. C. Stephens, H. V. Lake, T. Lloyd and others are interested in the new company.

A report comes from Marion that the Columbus, Delaware and Marion line has been taken over by a big syndicate which has aspirations to connect four of the largest cities of the state by electric lines.

The company formed to build the electric line from Williamstown to Moundsville, W. Va., has made arrangements for financing, and the surveys will be made at once.

The Springfield Southern and Cincinnati Railway Company, Springfield, has been incorporated with a capital stock of $25,000, to build a line from Springfield to Hillsboro, by way of Xenia and Jamestown. George H. Frey, James Johnson, E. B. Hopkins, C. R. Crain and J. D. DeWitt are the incorporators.

The Allen-Stone syndicate has been formed in Cleveland for the purpose of building a line from South Bend, Ind., to Chicago, a distance of 70 miles. The amount of money to be expended is about $2,000,000, and J. B. Hanna has been selected as the manager of construction. It will be known as the Chicago and Indiana Air Line Railway Company. Mr. Hanna has been connected with the Everett-Moore syndicate for some time. The Toledo and Western, in which Mr. Allen is president, will form a part of the line. A line will have to be built between Goshen, Ind., and Angola, and a company is being formed for this purpose. A traffic agreement has been arranged between the Chicago-South Bend line and the proposed Goshen-Angola line, so that there will be a continuous line from Toledo to Chicago when it is all completed. The road will be financed in Cleveland and the East. O. M. C.

Michigan.

Detroit, February 28.—At a recent board meeting of the Detroit United Railway, which was attended by H. A. Everett, an expenditure of over $400,000 was authorized for new equipment, including six new suburban cars, a number of additional double-truck cars, etc. A quarterly dividend of one per cent. was declared. Mr. Everett said that there was no truth in the rumor that right-of-way was being secured between Detroit and Toledo for the purpose of building a competing line in opposition to the Detroit, Monroe and Toledo Short Line.

The Council of Royal Oak, Mich., will hold a special meeting to decide the question of the bonding of the village for the establishment of an electric-lighting plant. It will probably be submitted to the people at the next election which occurs in the spring. The amount of bonds to be issued is $4,000.

The Central Heating and Lighting Company has asked the city of Detroit for a 30-year franchise, the city to fix the price to be charged for the service. The rates are to be readjusted every five years.

For several years Congressman S. W. Smith and J. Sawyer of Pontiac and G. E. Taylor of Flint have been trying to build an electric road between Flint and Pontiac. They now have a party of capitalists from the East interested and are driving them over the route. They will also investigate the route to Saginaw. New Yorkers will furnish the capital.

Municipal lighting has proved successful at Newberry, Mich., apparently, for the City Council has placed orders for a second engine and generator at a cost of about $6,000. The dynamo will be a 2,500-light machine.

The city of Benton Harbor will vote in the spring on the proposition to establish a $40,000 electric-lighting plant.

Schoolcraft citizens will vote this spring on a proposition to bond the village for $11,450, the money to be used in installing an electric-lighting plant.

The business men of Pontiac are making an effort to have the United States mails handled between Detroit and Pontiac by electric roads instead of steam. It is claimed that much better service would be given in that manner. It is understood that the postal authorities have the matter under advisement and will no doubt grant the request.

A pulp mill, one of the largest in the country, will be erected near Marquette by I. Stevenson at Chandlers Falls, three miles from Wells on the Escanaba River. The plant will be operated by waterpower. It is proposed to install in connection with the pulp mill an electrical plant of sufficient capacity to furnish light to the city of Escanaba and other communities in Delta County. C. G. W.

Information from Indiana.

Indianapolis, March 2.—The Indiana Northern Traction Company filed articles of incorporation with the secretary of state last week. The capital stock is $25,000. The company declares its purpose to build and operate an interurban line connecting Marion, Lafountain, Wabash, North Manchester and Warsaw, and to build and operate lines in the said cities.

The Indianapolis and Northern Traction Company is claiming a victory by reason of having been granted a franchise on February 26th to enter the city of Crawfordsville. The franchise is similar to the franchise granted some time ago to the Consolidated Traction Company. The latter company opposed the grant to the Indianapolis and Northern company and sought to compel its rival to use its tracks. The council's next trouble will be to parcel out the streets to the companies, and satisfaction is scarcely expected. These two companies have gone to law over the right-of-way to 10 miles of public highway, each claiming a prior grant. The case has been changed to the Putnam Circuit Court.

Terre Haute people are rejoicing over the prospect of being connected by trolley line with St. Louis. The St. Louis and Eastern Electric Railway was incorporated last week at Springfield, Ill., to build from St. Louis to St. Elmo, and another company will be incorporated to build from St. Elmo to Terre Haute. Johnson Brothers of St. Elmo are the promoters.

Considerable interest is manifest in the purposes of the Wabash Oil and Gas Company, in connection with Lafayette and Chicago capitalists, to utilize the Tippecanoe River to generate electricity. Work will be begun this month on the construction of a dam and a $250,000 electric-power plant at Horseshoe Bend. The company controls six miles of river front, the river making a bend six miles round and only half a mile across where the power race will be constructed. A 40-foot fall is obtainable in that distance. The company will furnish light and power to Lafayette, Monticello, Delphi and numerous smaller towns, and possibly power for the Logansport, Delphi and Lafayette Traction Company.

Chicago capitalists, headed by George Mayer, have bought the Hartford City municipal lighting plant and will enlarge and improve it.

The Indiana Legislature has amended the city charter of Indianapolis so as to permit it to enter into long-time contracts for electric lighting. This change will doubtless invite numerous bidders for the contract, to be let in July. F.

Texas and Mexico.

Austin, Texas, February 28.—Stone & Webster of Boston, Mass., who organized the Metropolitan Street Railway Company of Dallas, Texas, and which owns the electric-railway lines of the latter city, are contemplating the construction of several interurban electric roads between Dallas and neighboring towns. An investigation is being made of the feasibility of building lines between Dallas and McKinney, Greenville, Corsicana and other thriving towns of that section.

A company of local capitalists is being organized to establish an electric-light and power plant at Floresville, Texas.

The Mexican government has granted a concession to Emilio Saenz to construct and operate a system of suburban street railway at Morelia, Mexico. It is stated that Governor Mercado is interested in the project.

The Muncipal Council of the city of Morelia, Mexico, has appropriated a large amount of money for enlarging and improving the electric-lighting system of that city.

The electric generating plant which the Mexican Light and Power Company of the City of Mexico is constructing on the Necaxa River, 85 miles from the City of Mexico, is one of the largest projects of its kind ever undertaken in Mexico. The plant will have a capacity of 40,000 horsepower. The electrical energy will be transmitted to the City of Mexico and other points of that section. Hugh L. Cooper of Dayton, Ohio, is superintendent of construction of the big plant.

It is officially announced that a concession has been granted by the Mexican government to Lauro Barra to construct the hydraulic works necessary to utilize 8,000 liters of water per second for motive power, from the Del Valle River, in the district of Valle de Bravo, about 45 miles west of the city of Toluca. Mr. Barra agrees to commence the surveys within six months and to begin the construction of the plant within two years.

The street-railway system of Jalapa, Mexico, is to be converted into electric lines. In addition to the change in motive power of the existing lines, it is proposed to construct about 50 miles of additional road, which will be operated by electric power.

The work of changing the street-railway system of the city of Guadalajara from mule to electric traction is now in progress, and it is expected that it will be finished about June 1st.

Richard Honey, a millionaire manufacturer and mining man of Mexico, has taken steps looking to erect a large electric power-generating plant on the Santa Catarina River, state of Puebla.

The property of the Beaumont Street Railway Company has been acquired by the Beaumont Traction Company of Beaumont, Texas. The lines of the consolidated company will be extended in several directions, and other important improvements made. H.

Northwestern Notations.

Minneapolis, February 28.—Cando (N. D.) citizens are discussing the purchase of the electric-light plant and consolidating it with the waterworks system to be constructed.

The Iowa Construction Company of Ottumwa, Iowa, seeks a franchise for gas and electric lighting and waterworks. The company is formed by Chicago men.

The electric-light plant at Lanesboro, Minn., has been sold by the owner, George P. Bradish, to the village for $2,500.

A. B. Herrick, an eastern electrical expert, has been selected by the St. Paul City Railway Company to represent its interests in the investigation as to the amount of damage done by electrolysis originating from stray current. The water board of St. Paul, which has the claim for damages to its pipes from electrolysis, has named Professor D. C. Jackson of the University of Wisconsin. If the two experts fail to agree, a third is to be called in.

Munising, Mich., will install an electric fire alarm.

Extensive improvements are necessary to the electric-light plant of Negaunee, Mich. A larger generator is necessary and new boilers are needed.

A bill is before the Legislature of North Dakota for the construction of an electric-car line from the business section of Bismarck to the state-capitol building, a distance of over a mile. The estimated cost, with equipment, is $40,000. R.

Among the Rockies.

Salt Lake City, Utah, February 27.—It has been officially announced at Butte, Mont., that the Marcus Daly estate has purchased the Boston and Great Falls Land Company, the Great Falls Street Railway Company and the Boston and Great Falls Electric Light Company. Negotiations looking toward the purchase of the properties have been going on for some time, and the purchase has now been confirmed. The price paid amounted to over half a million dollars, and besides this sum, the new owners will expend some $75,000 in improvements, particularly new machinery. The present lighting capacity will be practically doubled, but few improvements will be made in the street-railway property, as it is in good condition. The light company has no bonded debt, has paid eight per cent. dividends on the $186,000 of issued stock per year, besides all expenses, and the cost of extensions.

The annual ball of the International Brotherhood of Electrical Workers at Salt Lake City was a brilliant success. Over 2,000 incandescent lights were used in the fantastic decorations of the hall, and the effect was dazzling.

W. M. Chandler of Orifino, Idaho, says that a power plant will be installed at the Orifino Falls. The capacity of the power has been determined, and all land rights secured. The power can be developed at a small cost, and the facilities are the best in the whole Clearwater country. There is a fine grade for 13 miles along the Orifino River, and the company plans to put in an electric line for that distance, with branch lines to run to the different mining districts.

J. W. Yates has asked the council of Bozeman, Mont., for a 90-year franchise for an electric-light and street-railway company. G.

PERSONAL.

F. S. Hunting, manager of sales of the Fort Wayne Electric Works of Fort Wayne, Ind., was in Chicago last week.

W. A. Bell of Colorado Springs has secured control of the waterworks plant and electric-lighting plant of Excelsior Springs, Mo.

At a recent meeting of the Postal Telegraph-cable Company Edwin Hawley was elected a director, to succeed the late John W. Mackay.

Mrs. Thomas Jackson, mother of George W. Jackson, the well-known engineer of the Illinois Telephone and Telegraph Company, died at her home in Chicago on February 28th.

Edward P. Burch, consulting engineer of Minneapolis, lectured before the senior classes in mechanical and electrical engineers at the University of Minnesota on February 26th on "Electric-railway Powerhouse Design."

Mr. Cloyd Marshall, well known in Chicago, has been appointed superintendent of electrical machinery in the Department of Electrical Exhibits at the St. Louis Exposition, his appointment to date from March 1st.

Walter A. Huston, for 15 years superintendent of the People's Light and Power Company's plant at Orange, N. J., died on February 21st. He was 50 years of age and was born in Pennsylvania. He leaves a widow and three daughters.

Merrill Van G. Smith has been appointed associate professor of mechanical engineering by the Board of Trustees of the Clarkson School of Technology, Potsdam, N. Y., to fill the chair made vacant by the resignation of Professor Robinson, last November. Mr. Smith graduated from the Stevens Institute of Technology, with the degree of mechanical engineer in 1896, and has served on the faculties of the University of Pennsylvania and Delaware College.

Allen M. Pennock, who was connected with the electrical department of the Western Union Telegraph Company for several years, died of pneumonia on February 26th in his home in Brooklyn, N. Y., at the age of 45 years. He was a native of Bordentown, N. J.

John A. Abbott has resigned his position as vice-president and general manager of the Consolidated Railway, Lighting and Refrigerator Company of New York city. He also dissolved his connections with the subsidiary companies, including the Consolidated Lighting and Equipment Company.

Charles S. Powell, who has been associated with the Westinghouse electric interests since 1893, and who, for the last six years, has been manager of the Cleveland office of the Westinghouse Electric and Manufacturing Company, has changed the scene of his activities from the United States to Europe. He has been appointed assistant manager of the British Westinghouse Electric and Manufacturing Company, and has already entered upon the duties of his new position. Mr. Powell, who is popular among electrical men in the United States, is bound to be equally well liked in Great Britain. His headquarters are in the Westinghouse Building, Norfolk Street, Strand, London, W. C.

Lieutenant Edward R. Mason, son of W. R. Mason, well known to the electrical fraternity of the West, has been made vice-president of the newly incorporated Porter & Berg Company of Chicago. Lieutenant Mason has many friends among the younger electrical men and is making an excellent reputation for himself by his technical and business ability and unfailing courtesy. He has been with Porter & Berg and their predecessors for four years and before that had several years' practical experience with his father. He is considered one of the best electric-railway-supply salesmen in the West. During the Spanish war he served on the U. S. S. Cincinnati and is now a lieutenant in the Naval Militia of Illinois.

James F. Nathan, chief clerk and general solicitor under J. C. Smith, local manager of the Western Union Telegraph Company, Chicago, left on February 27th for Boston, to assume the position of manager of the Western Union Telegraph Company of that city, made vacant by the promotion of Charles F. Ames to the superintendency of the New England district, which embraces all the New England states. Mr. Nathan is a native of Baltimore, and although young in years, is a man of much ability. He came to Chicago about 10 years ago. He was promoted after two years' service to the position of chief clerk and solicitor. His appointment to the Boston office is a deserved recognition of his integrity, ability and affability. Mr. Nathan is at the head of the Royal League of Illinois, and is popular throughout the state. He was made the recipient of a handsome gold watch, presented by members of the organization as a testimonial of their regard and esteem.

ELECTRIC LIGHTING.

The electors of Berlin, Canada, have taken steps for the purchase of the electric-light plant for $80,000.

The Board of Trustees of the village of Hammondsport, N. Y., will present a proposition to the voters at the coming election in regard to lighting the streets of the village with electricity.

The city of Dyersburg, Tenn., will hold an election on March 18th to decide upon issuance of $33,000 water and light extension bonds and $25,000 sewer bonds. William A. Fowlkes, Jr., is the mayor.

The Gray's Harbor Power and Light Company has been formed at Aberdeen, Wash., with capital stock of $250,000. It is proposed to furnish light and establish an electric car system for Gray's Harbor cities.

The Box Elder Power and Light Company has been incorporated with headquarters at Evanston, Wyo. The company announces its intention of doing an extensive business in Box Elder County. The capital stock is $100,000.

The drafting rooms of the engineering department, Pennsylvania Railroad, in the Union Station, Pittsburg, have recently been fitted throughout with the Nernst lamp. The quality of this illuminant is said to be peculiarly suited to the requirements of draftsmen, having a downward distribution of light of daylight quality, with an absence of shadow or flicker.

St. Louis is fast developing into a Nernst-lamp center, the Commercial Electrical Supply Company, with the co-operation of the Missouri-Edison Electric Company, having put in the last five months over 20 installations of large size, besides many individual lights in small stores, offices, residences, etc. The Nernst-lamp business in St. Louis has grown to the extent that the Commercial Electrical Supply Company has been called upon to start a maintenance department. Its method provides for inspection at least once a week, or when notified, and for renewing glowers and keeping lamps clean and in general good

condition for a small nominal rate per lamp per week. This system has worked out very satisfactorily, and is said to be popular with the firms which have their own electricians as well as those who have not.

ELECTRIC RAILWAYS.

W. L. Johnson of Seattle, Wash., will ask the City Council of Everett, Wash., for an electric-railway franchise in that city. Conditions of the franchise are that the cars and all material must be of the latest and most approved style.

The Aurora, Elgin and Chicago Railway Company has just received from the Stephenson Car Works at Elizabeth, N. J., 10 new high-speed cars for its third-rail road. The cars are 47 feet long and seat 56 passengers. Owing to their size, the cars made the trip on their own wheels over the tracks of the steam roads.

A big trolley scheme is on foot in Southwestern New York and Western Pennsylvania. It is the purpose of the company to build trolley lines between Erie, Cambridge Springs, Union City and Corry, Pa., and a connecting line with the Warren and Jamestown lines. Eventually, it is claimed, the lines will be extended to Cleveland, Pittsburg and Buffalo.

The St. Louis City Council has received from the railroad committee unanimously adverse reports on all the bills authorizing elevated railways in the city. The reports recognize the fact that additional facilities must be had to accommodate the public, but in the opinion of the committee, it is not wise to erect elevated railways east of Seventeenth Street. The committee believes that the proper solution of the matter is to resort to subways.

The Southwestern Elevated Railroad Company has been incorporated in Illinois with a capital stock of $100,000. The company has applied to the Chicago City Council for a 50-year franchise. The road is to begin either in Justine Street or Ashland Avenue, near Fifty-fifth Street, thence go north to Forty-ninth Street, thence east to Center Avenue and then connect with the tracks of the Chicago Junction Railroad Company when these are elevated. No compensation beyond a license fee of $50 for every car is offered. Provision is made that the road shall connect with the proposed branch line of the South Side Elevated Railroad Company to the stockyards, and that a five-cent fare only shall be charged for a continuous ride. The first board of directors of the company are John A. Spoor, F. S. Winston, S. R. Flynn, James Miles, J. D. Black and William Raymond.

POWER TRANSMISSION.

Congressman Brick has succeeded in getting his bill through Congress legalizing the construction of dams in the St. Joseph River. This will enable a speedy completion of the great electric power-generating dam near South Bend, Ind., which has been held in check by commercial interests and other opponents.

A company in Warren, Pa., has just received a contract for a penstock pipe nine feet in diameter and about 450 feet long, to be erected at Shawinigan Falls, Quebec. The pipe will be constructed of three-eighths and seven-sixteenths-inch steel and will probably be shipped in sections of 30 feet. This is the third large penstock pipe installed by the Canadian company at this point. The water is conveyed through the pipe under a head of 90 feet, and by the employment of turbine wheels is used to generate power, a portion of which is used at the falls, but the larger portion of which is to be conveyed to Montreal, approximately 90 miles distant, for lighting and power purposes.

SOCIETIES AND SCHOOLS.

Locke Etheridge, electrical engineer for the Pullman Palace Car Works, will give a talk on "Hot-water Heating as an Auxiliary to Central-station Plants" before the Robert Fulton Association of Stationary Engineers, at 309 Masonic Temple, Chicago, on Saturday evening, March 7th.

The address on "Technical Education and The Higher Industrial Life" delivered by Holbrook F. J. Porter of the Bethlehem Steel Company, on Founders' Day of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., last December, has been issued in pamphlet form.

The engineering department of the University of Michigan is making more rapid gains, as regards students, than any other department of the university. The number of persons studying engineering this year is about 600, while during the year 1898-1899 there were only 245 students registered.

Arthur Williams, who has been appointed by President Ferguson to report on decorative lighting at the coming convention of the National Electric Light Association, has sent out a letter to all the active members, asking them to send him illustrations of the different designs of display lighting installed by them. Mr. Williams will have half-tone engravings made from these designs for use in connection with his report. Replies already received indicate a wide-spread interest in this attractive and profitable department of electric lighting, and the very complete report to be presented by Mr. Williams will add greatly to the value of the programme of the convention.

TELEGRAPH.

A 20-year franchise has been granted by the Chicago City Council to the United Pneumatic Fire Alarm Telegraph Company. The compensation is to be at the rate of 2½ per cent. of the gross receipts for the second five years; five per cent. for the third five years, and 10 per cent. for the remaining period. The company has been operating a fire-alarm system without a franchise.

A bill has been introduced in Congress by Senator Mitchell, granting authority to the North American Telegraph and Cable Company, a corporation organized under the laws of Washington, to construct a submarine cable from some point or points on the mainland of Alaska or the Aleutian Islands to a connection with other submarine-cable companies at some point to be determined upon in Siberia or Manchuria.

ELECTRICAL SECURITIES.

Wall Street gossip is to the effect that the General Electric Company has earned 12¾ per cent. on all its listed stock during the last nine months. Its income was $27,586,843 and its profits $7,473,202, it is said.

The National Carbon Company reports net earnings of $594,371 for the year ended January 21, 1903. Of this amount $315,000 was paid in seven per cent. dividends on the preferred stock. The total assets are $10,324,028.

PUBLICATIONS.

The Electric Appliance Company, Chicago, is sending out an up-to-date transformer catalogue, which describes the new Packard vacuum process of transformer insulation.

A booklet containing copies of a few letters received from customers using Ebonite commutator compound is being distributed by E. W. Ashmore & Co. of Detroit, Mich.

The Northern Electrical Manufacturing Company of Madison, Wis., in its booklet No. 31, recently issued, illustrates some of its direct-current generators, both for belt and direct connection.

In a recent catalogue the Buffalo Electric Carriage Company of Buffalo, N. Y., illustrates its stanhope, golf brake and touring car. Group views are also shown of several of the company's electric vehicles.

The H. W. Johns-Manville Company of Milwaukee, Chicago and other cities has issued a pamphlet descriptive of the Keystone hair insulator, which is said to be an ideal structural insulator, sound deadener and cold preserver.

In its last monthly stock list of new and second-hand machinery, Wickes Brothers of Saginaw, Mich., quote a great quantity of boilers, engines, pumps, saw-mill machinery, etc., and also a number of electric dynamos, motors, lamps and meters.

The Industrial Water Company of New York city, manufacturer of water-softening and purifying apparatus, issues a catalogue descriptive of its apparatus and showing a few of its plants recently installed in various parts of the country.

The results of "A Comprehensive Engine Test" at Worcester (Mass.) Polytechnic Institute, made by Professor Sidney A. Reeve, are given in a booklet recently issued by the Buffalo Forge Company. Pictures are given of the Buffalo engine tested.

A souvenir is being distributed to its friends by the Peerless Electric Company of Warren, Ohio, that should be highly prized and should find a conspicuous resting place in the office of every recipient. It is a bas-relief bust in white papier-maché of the late President William McKinley, and its execution is excellent. The bust is mounted on a dull-black background, and when hung in suitable light it stands out as plainly and boldly as if chiseled from marble.

An interesting catalogue on "Cooking and Heating by Electricity" has been issued by the Prometheus Electric Company of New York. It illustrates the company's heating and cooking apparatus and resistances, embodying a wireless electric-heating system. Among the utensils illustrated are food and water heaters, teakettles, plate warmers, ovens, urns, coffee pots, chafing dishes, cooking stoves, toasters and broilers. A complete electric kitchen equipment is also illustrated, as well as sad irons, electric radiators, wall and floor heaters, solder and glue pots, milk and instrument sterilizers, etc. The catalogue is neatly printed and tastefully arranged.

SPACE TELEGRAPHY.

A joint resolution was introduced in Congress directing the secretary of the navy to ascertain and submit a report and estimate of the cost of purchase and establishment of a system of wireless telegraphy and signaling from the Marconi Wireless Telegraph Company, the De Forest American Wireless Telegraph Company and the Consolidated Wireless Telegraph and Telephone Company, for the use of the several departments of the government of the United States, and also to report upon the desirability of such purchase.

All the fast steamers of the International Mercantile Marine Company are to be equipped with Marconi space-telegraph plants, and contracts have been concluded for the St. Louis, St. Paul and New York. The Marconi Wireless Telegraph Company of America has obtained a concession from the Cuban government, and will establish a system of stations in Cuba, the first of which will be put up at Havana. A new station will also be erected at Key West.

MISCELLANEOUS.

Champion billiard players who are thirsting for new difficulties to conquer and those who find handling the cue a fascinating pastime will be pleased with a report which comes from Paris of a new amusement known as "electric billiards." The balls are made of a material which is easily attracted by a magnetic plate in the center of the table. It is said to be purely a game of skill, and probably it will be introduced in this country soon.

The Winchester Repeating Arms Company has recently increased the capacity of its gas-power plant at New Haven by the purchase of two 165-horsepower Westinghouse three-cylinder producer-gas engines. The plant is said to be the first American installation of gas-power apparatus for industrial work. The present equipment comprises about 500 horsepower in Westinghouse gas-engine-generator units and Loomis-Pettibone producers. The plant supplies electric power and light for operating the entire manufacturing establishment.

TRADE NEWS.

The Wyland Manufacturing Company, Williamsport, Pa., wants to buy a 25-horsepower plant, consisting of boiler, engine, dynamo, switchboard and motors.

The Star Dynamo Brush Company of New York city has been incorporated with a capital of $1,000. The directors are W. L. Webb, Karl Ambrock and Alexander Schilling of New York.

The Capital Printing Company of Raleigh, N. C., wants a small direct-current dynamo (second-hand) to supply 40 or 50 16-candlepower incandescent lamps with field rheostat and accessories.

The firm of Brown & Leasure, contracting electrical engineers, with offices in the Fisher Building, Chicago, has been dissolved and the business is being continued under the able management of Mr. Charles L. Brown, senior member of the firm. Mr. Brown says that business has never been as good as at present, and to care for it he will move into larger offices about March 15th.

The Mackie Steel Tube Manufacturing Company, Chicago, with factories at Hammond, Ind., announces that it has joined interests with the Clifton Manufacturing Company of Boston and Buffalo, manufacturer of the well-known Clinton fireproof insulating conduit. This conduit, the Mackie company says, is pronounced by the National Underwriters' Association to be the best conduit on the market.

The Birmingham (England) Post in an article in a recent issue, calls the attention of British manufacturers to the fact that contracts involving the sum of $65,000,000 have been obtained by American interests during the last few weeks for the construction of electric-traction systems in England, Russia and Holland. These contracts include the conversion of all of the horse tramways of St. Petersburg into electric roads, the construction of an underground railway, and the erection of 16 iron bridges across the Neva.

The fine new plant of the Dickey-Sutton Carbon Company at Lancaster, Ohio, is located on the Hocking Valley Railroad, just on the outskirts of Lancaster, giving excellent railroad connections. The factory is at present running with a full force of hands on electric-light carbons. However, the company will soon be ready to fill orders for enclosed-arc carbons, dry and other battery carbons, carbon brushes, carbon specialties, and also electrolytic carbons. The factory has been equipped under the experienced management of Mr. Edmund Dickey. It is furnished with every scientific appliance that can be brought to the aid of the modern carbon maker. With the use of natural gas to insure uniform results in baking, the company may be expected to present a product of the highest quality. The Dickey-Sutton Carbon Company is incorporated under the laws of Ohio, with the following-named gentlemen as officers: President and treasurer, H. M. Sutton; vice-president and general manager, Edmund Dickey; secretary, U. S. Kolby; assistant secretary, S. S. Wilson; superintendent, Robert R. Dickey.

BUSINESS.

A complete line of Faries shades is carried in Chicago stock by the Central Electric Company, which is, therefore, in a position to make prompt shipments. This company has also a large stock of Duplex lamp guards, for which it is quoting attractive prices.

The Central Electric Company of Chicago asserts that I.X.L. weatherproof occupies the same relative position to other weatherproof wires that Okonite does to other rubber-covered wires. In order to confirm this declaration it invites prospective customers to send for samples of the I.X.L. weatherproof.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) February 24, 1903.

721,147. Overhead Trolley. John E. Byers, Butler, Pa. Application filed April 11, 1902.

Guard wheels are provided at the front and rear of the trolley wheel, and pivoted arms mounted upon opposite sides of the trolley wheel and carrying the guard wheels at their upper ends are adapted to be simultaneously moved toward and from each other.

721,156. Fan. Walter E. Coleman, Newdorp, N. Y. Application filed May 15, 1902.

Combined with a stationary base and a rotatable spindle supported therein are an electric motor and fan mounted upon the spindle, a rotatable friction wheel for engaging the base for automatically rotating the motor and fan around the base of the spindle by the direct action of the motor, and an independent shaft for the friction wheel.

721,157. Fan. Walter E. Coleman, Newdorp, N. Y. Application filed August 16, 1902.

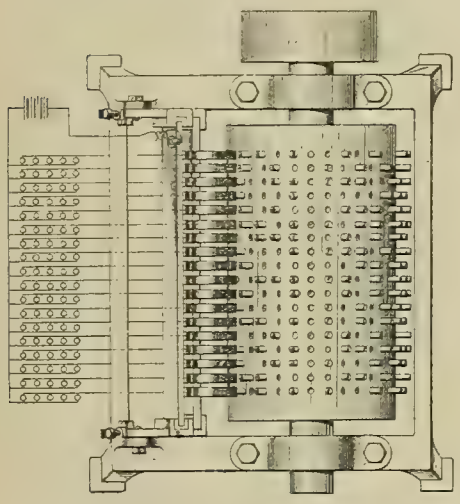
One or more deflectors are mounted pivotally upon the fan-guard. A counter shaft carrying a pulley is connected by an endless band with the power pulley upon the motor shaft. Mechanism is interposed between the counter shaft and the deflectors for vibrating the latter.

721,161. Electric Signal for Railways. Elisha B. Cutten, New York, and Arthur C. Fraser, Brooklyn, N. Y., assignors to Arthur C. Fraser and George H. Fraser, Brooklyn, N. Y. Application filed February 6, 1891.

In the system are a normally closed circuit carried by the locomotive and fed by a generator, with a predetermined normal current, combined with a danger magnet in connection with the circuit, uninfluenced by the normal current therein but responding to a certain increase of current to give the danger signal.

721,194. Electric Switch. Alfred W. Horn, Buffalo, N. Y., assignor of one-half to Albert Horn, Buffalo, N. Y. Application filed April 7, 1902.

The switch has a number of movable contacts, a carrier movable past the contacts and provided with a number of longitudinal rows of seats, each row having a seat in line with each contact, and pins for shifting the contacts removably secured to the seats. (See cut.)



NO. 721,194.—ELECTRIC SWITCH.

721,202. Facsimile Telegraph. Edward E. Kleinschmidt, New York, N. Y., assignor to Frederick Kleinschmidt, New York, N. Y. Application filed February 7, 1900.

721,205. Electric Time Switch. Albert W. Lauter, Sr. Chattanooga, Tenn. Application filed May 26, 1902.

A clock having an alarm mechanism is provided with a segment and gear wheel so related that the revoluble movement of the gear wheel will force the segment out of mesh with the wheel and thus maintain the switch in closed position.

721,229. Motor. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed September 20, 1901.

A motor for alternating currents has field windings, armature coils, commutator and commutator brushes, connected in series as customary in constant-current motors, and an inductive winding forming a shunt around the commutator brushes. (See cut.)

721,270. Electric Hand or Foot Heater. Alois Zeckendorf, Cincinnati, Ohio. Application filed December 22, 1902.

A heating-pad adapted to be inserted in a shoe or mitten consists of a flexible, non-conducting material, having binding posts at one end, wires extending in U-shaped undulations from one binding post to the other, in parallel laps through the length of the pad and ventilating orifices inserted in the pad between the laps of the wire.

721,273. Circuit-breaker. Henry P. Ball, New York, N. Y., assignor to the General Incandescent Arc Light Company, New York, N. Y. Application filed January 29, 1902.

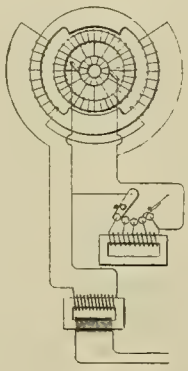
Combined with a circuit-breaker are means energized by a current independent of that traversing the circuit within which the circuit-breaker is included for actuating the circuit-breaker from a distance, and means for temporarily altering the sensitiveness of the circuit-breaker without changing its normal calibration.

721,285. Igniter for Gas Engines. Joseph Cereghino, San Francisco, Cal. Application filed July 8, 1902.

An electric igniter is described.

721,289. Transformer. Otis J. Depp and James P. Hunter, Dallas, Texas. Application filed June 30, 1902.

In the transformer are a core, a split tube about the core and means for spacing the walls of the split portion of the tube.



NO. 721,229.—MOTOR.

721,337. Carriage Call Box. Irving T. Smith, Brooklyn, N. Y. Application filed January 10, 1902.

Numbered slides mounted in racks are moved by electromagnets controlled from a keyboard.

721,348. Weather Vane. Robert Wilson, Newark, N. J., assignor to Benjamin Plant and Alice J. Plant, Newark, N. J. Application filed October 14, 1902.

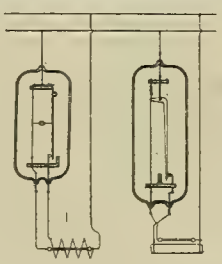
See page 184.

721,372. Electric Controller. John H. Holland, Columbus, Ohio, assignor to the Case Manufacturing Company, Columbus, Ohio. Application filed June 23, 1902.

Combined with a controller and its lever are a reversing switch, a reversing switch lever, and means carried by one of the levers automatically engaging the other to compel them to move simultaneously for a limited distance, and released manually.

721,387. Heater Cut-out for Electric Lamps. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed September 2, 1899.

The lamp has a heater, a glower and a steadying resistance for the glower, and is provided with a controller for the heater circuit having separable contacts, the relative positions of which are controlled by energy derived from the steadying resistance, and a sealed chamber in which the contacts are located. (See cut.)



NO. 721,387.—HEATER CUT-OUT FOR NERNST LAMP.

721,410. Switch for Electric Circuits. James J. Wood, Fort Wayne, Ind. Application filed June 28, 1901.

A bridge-piece pivoted between fixed terminals is movable around its pivot to bring its end portions into or out of contact with the terminals. Oppositely acting motor devices have means for actuating them from a distant point, and a movable connection between the motor devices and bridge-piece is adapted upon the actuating of one of the devices to move the bridge-piece to open the circuit, and upon the actuating of the other device to move it in the opposite direction to close the circuit.

721,435. Incandescent-lamp Socket and Fixtures. Philip H. Fielding, New York, N. Y. Application filed April 14, 1902.

The contacts, terminals and lamp-holding devices of an incandescent-lamp socket are combined with a lamp-shade detachably connected with the parts and provided with an enclosing casing therefor and having integral extending portions forming the shade or reflector.

721,451. Thermostat. John M. Latimer, Philadelphia, Pa., assignor to the United Pneumatic Fire Alarm Telegraph Company, New York, N. Y. Application filed July 27, 1901.

In the thermostat are a fixed contact, a movable contact of volute form, the fixed contact being located in the plane of the volute, and a fuse hung within the movable contact between its ends for placing the movable contact under tension.

721,481. Safety Device for Hoists. Samuel S. Wales, Munhall, Pa. Application filed October 9, 1902.

In the device are a pendulum case mounted on a stub-shaft arranged to be connected to the end of a driven shaft on a hoist, and a slow-motion gearing and circuit-completer supported in the case.

721,490. Electromagnet for Separating Metals. George H. Young, Elmira, N. Y. Application filed February 12, 1902.

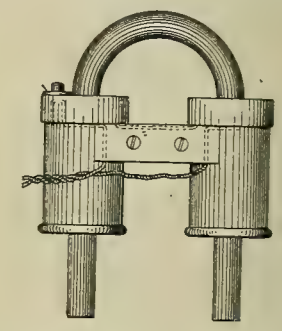
An electromagnetic separator for hand manipulation comprises a steel or iron core of U-shape having a spool of wire wound upon each leg thereof, the wire in the spools running from one spool to the other and the ends being carried through suitable cable to a source of current supply, the bend of the core-piece forming a handle, and a button or other switch located in proximity to the handle, whereby the current may be switched on or off by the hand which grasps the instrument. (See cut.)

721,520. Fire-alarm System. Benjamin P. Ketcham, Carthage, N. Y. Application filed March 13, 1902.

In the system combined with an annunciator circuit are an alarm-circuit closed by the closing of the annunciator circuit and having an electromagnet installed therein, and an alarm mechanism, a power-shaft for actuating the alarm mechanism, and means for holding the power-shaft against rotation and releasing the same.

721,529. Trolley-pole Reverser for Electric Tramways. Francis E. Ward, Cheltenham, England. Application filed December 22, 1902.

An automatic reverser for a trolley or similar current-conducting pole consists of an apparatus or appliance in the form of a current-carrying guide-wire applied to the main current-carrying wire, so that it branches off from the main wire at an angle for a distance and then proceeds onto the main wire again or onto another main wire, the guide-wire being always in electrical communication with the main wire and being traversed by the trolley-pole at the time the car is traveling in a reverse direction.



NO. 721,490.—ELECTROMAGNET FOR SEPARATING METALS.

721,559. Binding Screw for Electrical Connections. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed December 2, 1902.

The screw has a washer under its head, mounted, but free to turn on the neck of the screw.

721,561. Motor. John H. Green, Chicago, Ill., assignor to Hermann Meyercord, Chicago, Ill. Application filed July 29, 1901.

One claim reads: In a motor, the combination of a rotary motor element provided with a pocket adapted to discharge automatically upon a rotating movement of the element, a magnet element operatively connected and moving with the motor element, a second magnet element located adjacent to the path of movement of the first-mentioned magnet element and means for gradually charging the pocket to overcome the mutual attraction of the magnet elements and rotate the motor element.

721,602. Heater Cut-out for Electric Lamps. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 9, 1899. Renewed April 30, 1901.

Combined with an electric-lamp glower which is a non-conductor when cold and a conductor when heated are an electric heater therefor, a balancing device included in series with the glower, a cut-out for the heater consisting of two contact points normally in contact with each other, means tending to separate such points and a mechanical connection with one of the points for separating the points upon the expansion of the balancing device.

721,646. Electric Headlight. John Kirby, Jr., Dayton, Ohio, assignor to the United States Headlight Company, Buffalo, N. Y. Application filed December 26, 1901.

In an electric-arc headlight are combined a case having an open front and an opening in the back of the case provided with a door for closing the opening, a hollow sleeve formed in the wall of the case, a carbon-holder supported in the sleeve, a reflector whose normal position is behind the carbon-holder, and means whereby the reflector can be shifted to permit of access to the carbon-holder from the back of the case.

721,647. Headlight. John Kirby, Jr., Dayton, Ohio, assignor to the United States Headlight Company, Buffalo, N. Y. Original application filed December 26, 1901. Divided and this application filed May 5, 1902.

Combined with a dashboard of a railway car having an opening therein are a dash-ring secured to the dashboard around the opening provided with a rearwardly extending horizontally disposed rim, a headlight case having a front projecting ring adapted to engage the rim from the rear of the dashboard, and means whereby the case is secured therein.

WESTERN ELECTRICIAN

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Electric Power at the Inland Steel Works.

Electric power has a wider range of application in modern steel works, perhaps, than in any other industry. It is due in large measure to the adoption of the electric motor for the variety of uses to which it can be applied that the steel mills of to-day are operated so economically and with comparatively so few employes. To be sure, the electric motor has not entirely supplanted the steam engine, as the latter is still used in large units to operate the heavy rolls, but it has nevertheless demonstrated its field of usefulness, and hardly any modern steel works is without its electric-motor equipment.

A steel plant which is typical of the most modern application of electric motors is that of the Inland Steel Company of Chicago, whose works are located at Indiana Harbor, Ind. A little over two years ago there was nothing at Indiana Harbor except the usual sandy shore to be found at the southern end of Lake Michigan. To-day there is a large, well-equipped and growing steel mill and a city of several hundred inhabitants, which is expanding rapidly. The steel plant has a tract of 50 acres, and the portion on which the buildings have been erected has been filled in 11 feet, making a dry, serviceable site. The buildings, including a plate mill, open-hearth furnace and blooming mill, rolling mill, gas house, machine shops, boiler plant, etc., have all been laid out so as to permit the least handling of material and provide for the most economical distribution of steam and electric power. The company manufactures billets, structural steel and various grades of both hard and soft steel for different uses. One of its chief products is planished electric steel, which is used as a substitute for the well-known Russia iron. This steel is turned out in sheets and is sold to be used by electric manufacturers for transformers, generators and other work in which iron stampings are employed.

The open-hearth mill has a total length of about 500 feet, and in the north end are located four 50-ton open-hearth furnaces. The charging floor for these furnaces is located on the east side of the main mill at an elevation of about 20 feet. A view of the floor is given in Fig. 1. Running the entire length of the charging floor is the Eck 10-ton charging machine illustrated in the picture. This machine is probably the most interesting piece of apparatus from an electrical point of view in the entire mill. It combines a charging machine for the furnaces and also an overhead traveling crane with separate trolley for hoisting. Used as a crane the pans containing the chargings can be picked up and carried to any point on the track in front of the furnaces, from which the machine can pick up the pans and carry them into the furnaces.

There are six motors on the charging machine, each fulfilling a separate and distinct function. A 30-horsepower motor propels the crane for its longitudinal travel, while the trolley travels back and forth on the crane by means of a three-horsepower motor, and a 30-horsepower motor is used for the trolley hoist. When the machine is used in its charging capacity it is operated longitudinally by the same 30-horsepower motor that moves it as a crane. The motors for the charging operations are distinct, however. A 30-horsepower motor operates the hoist, another of the same capacity drives the trolley, giving the charging machine its transverse motion, while a five-horsepower motor is used to dump the chargings.

In its action the charging machine is very flexible and rapid. The operator stands on a platform which is about three feet above the floor, as shown in the illustration. The chargings, which are mostly of scrap iron, are placed in steel pans on flatcars in front of the furnaces. The charging machine moves along the floor until it is opposite the pan desired, when the charging beam is lowered and connected to one end of the pan. The pan is then raised to the position seen in the picture and the crane moved until opposite the desired door of the furnace to be charged. The door is then raised by hydraulic power by another operator, while the crane operator lowers the pan and carries it into the furnace, changing its position until he has it in the desired place. Then he operates the dump motor which revolves the entire charging beam and pan, dumping the contents of the latter into the furnace. The empty pan is then withdrawn, a full one taken up and the process repeated.

All these movements are made through the agency of four controllers, which are clearly shown in front of the operator. Two of the controllers are provided with throw-over switches, so that they can operate the hoist on the charger and the dump motor or the hoist on the crane trolley and the trolley transverse-motion motor, respectively, it not being necessary to use the machine as a crane and a charging machine simultaneously. The apparatus was built by the Morgan Engineering Company, and Westinghouse motors are used. When the operator is picking up a pan the brilliant light from the furnace doors is apt to make the hole in the pan indistinguishable, so an arc headlight has been arranged which throws its light directly on that point, thus counteracting the other light and facilitating the connection.

The open-hearth furnaces of this mill face the main open space of the building, as shown in Fig. 2, in which the furnaces are seen at the right with their spouts extending over the wide track upon which the ladles are carried. The ladles are moved along this track by means of heavy cars operated by 30-horsepower motors and governed by Dinky controllers. One of the cars carrying a ladle is seen in the center of the picture and another may be distinguished beyond at the farther end of the mill. In the foreground are shown two ladles dismounted, while back of them and in front of the first ladle car are seen the molds in which the steel ingots or blooms are cast. These ingots are raised from the molds by electric overhead traveling cranes, of which one is seen at the extreme end of the shop. Several of the ingots may be noticed at the left of the picture and also a track upon which travels an ingot electric locomotive used in carrying the ingots on small cars from this portion of the mill to the soaking pits toward the opposite end. The locomotive is operated by a 25-horsepower motor fed through a single-wire trolley. There are five overhead traveling cranes in this mill, consisting of a 40-ton crane with 10-ton auxiliary hoist, a 15-ton, a 10-ton, a five-ton and a three-ton crane, all operating practically on one runway. The first three cranes mentioned are of the Morgan type and the other two are Whiting cranes. All the cranes, of which there are 10 in the entire plant, as well as the electric locomotives, are operated on a ground-return system.

Other electric equipment in the blooming mill comprises a 50-horsepower motor operating table rolls, a 30-horsepower driving shear-table rolls, 30-horsepower for transfer to furnaces, 50-horsepower on bar-mill roll, 50-horsepower on saw table, 75-horsepower on bar-mill shear, 100-horsepower on hot saw, 30-horsepower for several tables and transfers, 10-horsepower for sheet-bar conveyor, 25-horsepower for an angle straightener, a five-horsepower for a bulldozer, besides other miscellaneous apparatus. Practically all of these motors are of the Northern or

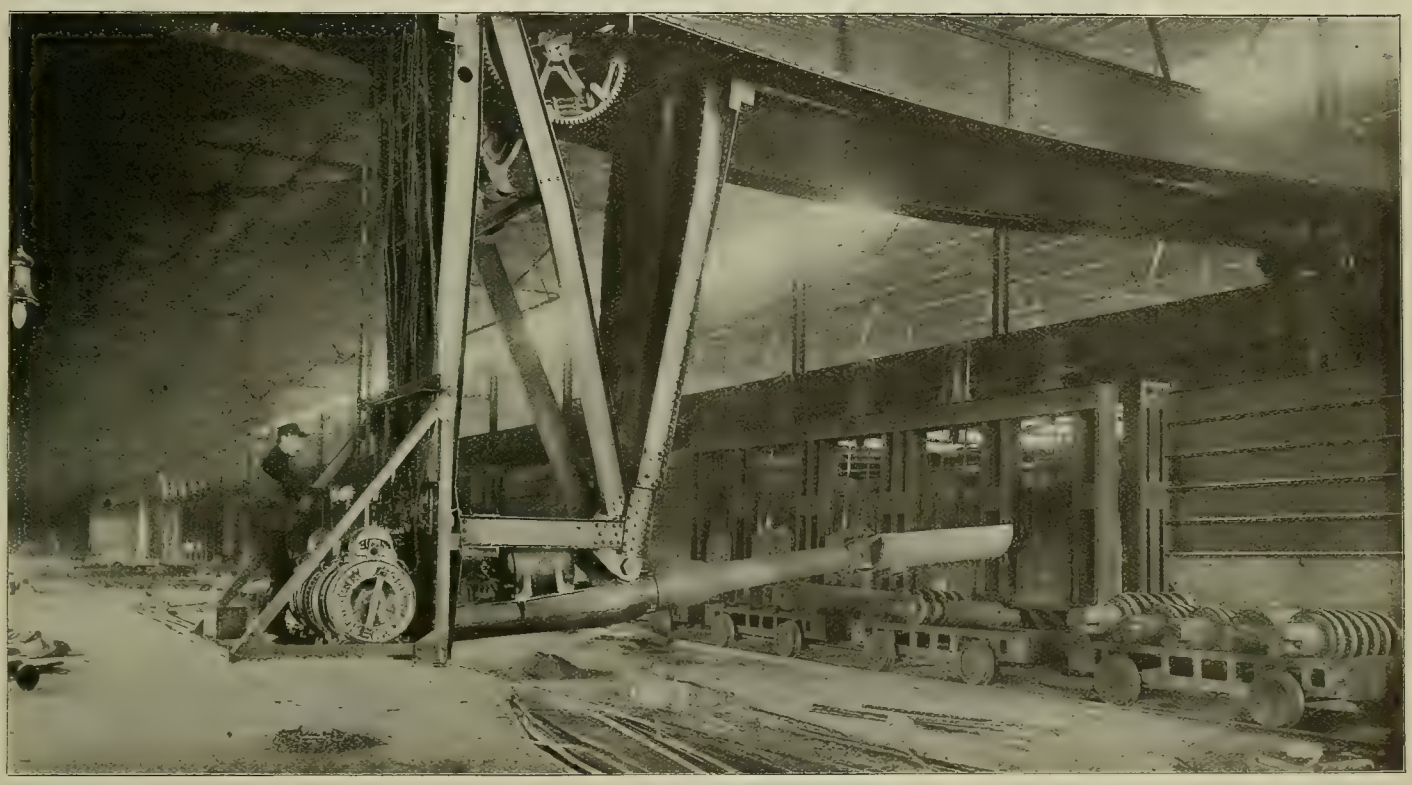


FIG. 1. ELECTRIC POWER AT THE INLAND STEEL WORKS.—TEN-TON CHARGING CRANE.

Westinghouse types and operate on 230-volt two-wire circuits.

In the sheet mill, where ingots are rolled into sheet steel for the planished-steel product, the large sets of rolls are driven by a cross-compound 3,500-horsepower steam engine. The sheet shears and roll-turning lathes are electrically driven. Fig. 3 illustrates four of the sheet shears driven by five-horsepower geared motors and one plate-mill shear geared to a 10-horsepower motor. An electric locomotive is used to transport the plates from the blooming mill to this sheet mill, the track being all outdoors. The locomotive, which is shown in Fig. 4, is known as an industrial car and was built by the General Electric Company. It is operated by two 30-horsepower motors and has a speed of eight miles an hour, a drawbar pull of 4,400 pounds and a capacity of 13 tons.

FIG. 2. ELECTRIC POWER AT THE INLAND STEEL WORKS.—LADLE TRAMWAY FOR OPEN-HEARTH FURNACES.

An interesting and exceptional use of electricity is made in the chemical laboratory of the plant where the current is used to heat the hot plates and immersion coils. A half-horsepower motor drives a drill press in this laboratory. In the machine shop two lathes are operated by five-horsepower and three-horsepower motors, a radial drill is driven by a three-horsepower vertical motor, a planer by a 15-horsepower, and a 30-horsepower motor drives drill presses and emery wheels. The carpenter shop has a 15-horsepower motor driving band saws, lathes and other woodworking machinery. The total installation of motors includes about 65 motors, ranging in size from one-half to 100 horsepower, this number being exclusive of the motor equipment of the 10 cranes, the electric locomotives and ladle cars.

The boiler plant for the mill is installed in a separate building and comprises eight 500-horsepower Stirling and two 250-horsepower Van Dyke water-tube boilers. The boilers furnish steam at 125 pounds pressure for the rolling and auxiliary engines and for the electric generating units. A unique method is used to supply the boilers with coal. An elevated side track extends along one side of the building and from this track the coal is dumped into bins which have openings into a deep passageway in front of the boilers. Traveling on a single rail in this passageway is a traveling stoker or coal elevator of the Heyl & Patterson type. This machine takes the coal from any of the bins, and elevates it to a hopper on the top of the machine, from which it is fed by gravity through a pendulum shute to the hoppers of the Jones underfeed stokers with which the boilers are equipped. The hopper on the stoker holds a ton of coal and the coal is elevated about 28 feet. A five-horsepower Lundell motor, controlled by a Cutter-Hammer controller is used for the longitudinal travel of the stoker, and a 7½-horsepower Westinghouse motor operates the elevating machinery. A similar traveling coal stoker is erected in the gas house.

The electric generating plant of the works is located in the machine-shop building and comprises three direct-connected units, with Ames simple non-condensing engines and Northern generators. Two of the engines are 18 by 18 inches in cylinder dimensions and drive 200-kilowatt, 250-volt generators at 200 revolutions a minute. The other unit consists of a 14 by 14-inch engine and a 100-kilowatt, 125-volt dynamo. The two 250-volt generators supply the 230-volt motor circuits, and the 125-volt machine furnishes current to 135 Adams-Bagnall enclosed-arc lamps and about 800 incandescents. A four-panel black-slate switchboard distributes the current to the six power feeders and the six light circuits. This board was designed by Charles McCullough, chief electrician for the Inland Steel Company, who also supervised the installation of all the electric machinery on the grounds.

Municipal Trading in Great Britain.

[From a special correspondent of the Western Electrician.]

For some years now in Great Britain, in all matters appertaining to electricity, the great tendency has been toward municipal ownership, or, as it is better known here, municipal trading. Electric lighting, electric railways, the "bulk" supply of electricity for power purposes and telephony are all at the present day worked by municipalities. Parliamentary powers have in a few instances been obtained for the supply of electrical fittings and the hiring out of motors, and the latest phase of the crisis—and it is a crisis from the contractors' point of view—is the endeavor which is being made by the London County Council in the next session of Parliament to legalize the wiring of premises for the electric light. Against the latter emphatic protest has been made by the London Electrical Contractors' Association, but, it is to be feared, with but little hope of success. At one time this very practice of undertaking the wiring of consumers' premises was actually being carried on without consent, but some sharp-witted lawyers discovered the fact that the loans granted by the Local Government Board for electric-lighting purposes did not cover such powers, and a ratepayer's complaint quickly ended in parliamentary sanction being sought.

The proposal of the London County Council is to make it legal for the numerous borough councils to do such work as wiring, but the direct effect upon small local wiring contractors is easily seen. As ratepayers, these people will be called upon to provide the wherewithal for their local governing bodies to embark upon a competitive business, and impartially minded people here are agreed that it is one of those instances in which municipal trading overreaches itself.

Services which render benefits more or less directly for the general public, such as electric lighting, tramways and telephones, are recognized in this country as the legitimate functions of local governing authorities, but even in these cases instances of financial loss at the end of the year are by no means unknown. The great pity of it all is that the local dignitaries of very small towns, with examples before them of successful municipal enterprise, such as Glasgow, Manchester, Liverpool, Sheffield, and many others, who have enormous outputs, fondly imagine that, in a considerably much more restricted area and very considerably less population, equally satisfactory results are to be achieved. It is the very "business" nature of the larger cities which achieves their success. In a similar measure, it is the large number of "business" houses, theaters, etc., which are supplied throughout the city of London, which insures the financial safety of the many stock companies upon which that portion of London depends for its supply of electrical energy.

A great fight against municipal electric-traction enterprises is being waged by the British Electric Traction Company, whose influence is very often too powerful for any smaller municipality which may attract its attention. A case in point occurred at Hove, a fashionable place near Brighton, on the south coast, where, after the townspeople voted in favor of the municipal tramway bill, the necessary majority of the Town Council could not be obtained, and so the company's bill will come before Parliament unopposed by any competitive bill, although, no doubt, the Hove local authority will put in an appearance against the measure when it comes before the parliamentary committee. At Birmingham the company has had a much harder struggle, but there is a possibility of a compromise being arrived at, owing to the company owning a large percentage of the tramway lines outside the city boundaries.

One of the outstanding complaints of the champions of private enterprise has hitherto been that in granting provisional orders for electric lighting, the Board of Trade has always given preference to an application by the local authority, if both the municipality and a company applied for powers, irrespective of which was prepared to commence operations the earlier. This attitude, however, is now being considerably modified, and in the case of the North Metropolitan Electrical Power Distribution Company, which has powers to supply in "bulk" over a large portion of Middlesex, a certain local authority was granted an electric-lighting provisional order on the understanding that if a supply was not given within three years, the company would be allowed to step in and supply the neighborhood.

The true fact of the matter of municipal trading is—and this applies to everything, whether electrical or not—that practically no two cities are comparable with each other, and that the conditions prevailing throughout the kingdom vary so enormously that it is impossible to anticipate results in one place judged upon what has happened in another. Generally speaking, however, municipal enterprise applied to the electrical industry in Great Britain has not proved by any means a failure, but in the smaller towns little doubt can exist that with the advent of the wholesale "power" schemes, the smaller places will best serve the interests of the taxpayers by taking a supply in "bulk." Absolute success can rarely be relied upon, unless a big demand is at hand, and the large number of small towns which are waiting for the power companies to commence supply testifies to the fact that this policy is being carried out.

Electric tramways, whether under municipal or company management, are invariably financially successful; municipal telephony has still to assert itself, and although electric supply entails some risk, it is in the smaller details, mentioned earlier in this article, that the ratepayers and local tradesmen are unjustly treated.

FIG. 3. ELECTRIC POWER AT THE INLAND STEEL WORKS.—MOTOR-DRIVEN SHEARS.

Proposed Western Telegraph System.

At a meeting of those most interested in the proposed new telegraph system between Kansas City, St. Louis, Chicago, Milwaukee, St. Paul and Minneapolis, held in Chicago on March 7th, plans were consummated to such an extent as apparently to assure the establishment of the new system. It is understood that there will be a consolidation of several companies to form the new and larger one, the name of which has not yet been decided upon. In speaking of the meeting on Saturday, C. F. Crawford of the Chicago and Milwaukee Telegraph Company said: "Our plans of consolidation and reorganization have not yet sufficiently developed to give out the details of the new company. That the new line will be built is an established fact. Contracts for material for some of the construction have already been let."

It was learned from W. R. Stewart that entrance into Chicago from the south would probably be made by attaching the cables to the South Side Elevated structure from Sixty-third Street. Cable connections in the various other cities, it is said, will in most instances be gained over the lines of the companies interested in the venture. The general offices will, it is thought, be located in St. Louis, the Orthweins of that city being the principal figures in the deal.

In speaking of the new company and the probable effect it would have upon the existing telegraph companies, William J. Lloyd, assistant superintendent of the Western Union Telegraph Company in Chicago, made the following interesting observations:

"The best answer I can make regarding this proposal for a telegraph company between Chicago and St. Louis is that we are advising our friends not to put any money into the enterprise. In my opinion the scheme will prove a bad investment. The promoters, I'm afraid, haven't a clear conception of the telegraph business of to-day. There has been a complete revolution in many important respects, especially in the ways of expenditures and the system of economy. Rates in the last decade have gradually fallen, while the cost of operation has increased. Salaries, while they are not higher, are no less. The price of material has risen in every manufactured commodity used by a telegraph company. All grades of wire—notably copper—have advanced heavily in the last 10 years, and not the least significant point is the competition of the long-distance telephone company. Time was when offices 100, 200, 300 and even 400 miles distant were the most profitable in the business. Now it requires the utmost vigilance on our part to keep them remunerative. The telephone is used all around us—in this and to nearby states.

"In instance, Decatur, Ill. Not long ago the receipts of that office were $400 a month. To-day the earnings have dwindled to $200 because of the telephone service. As for the points the new company is to cover—Kansas City, St. Louis, Milwaukee—the officers will find their ingenuity taxed to make both ends meet. There are two companies installed in Kansas City and St. Louis, and in Milwaukee there are three, and this does not include the telephone. Moreover, the cream of the business is limited to the session hours of the exchange; after 'change the traffic decreases heavily.

"Besides, there is always danger of a rate war when a new competitor comes in the field. Should rate cutting ensue a serious treasury deficit were inevitable. As it is, the enhancement in the cost of labor and material makes favorable returns to stockholders a difficult problem. Finally, I wonder how the promoters will make their cable connections in the different cities they want to reach? It is not an easy matter to obtain these privileges."

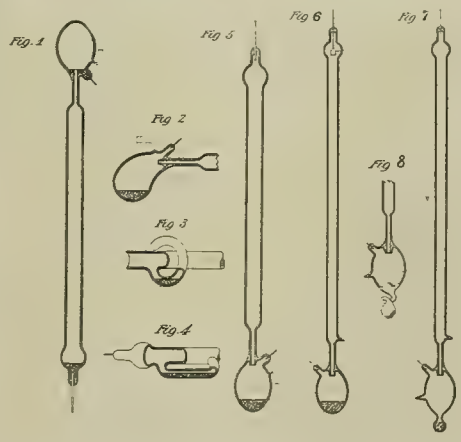
T. P. Cook, general superintendent of the western division of the Western Union Telegraph Company, was not much concerned about the probable new competitor. He said that the Western Union covered such a broad field and did so extensive a business, having 23,000 offices, that the loss of some of the business in a few cities would hardly make an impression on the earnings of the company. He did not think the new company would prove a profitable investment.

FIG. 4. ELECTRIC POWER AT THE INLAND STEEL WORKS. OUTDOOR TRAMWAY FOR PLATE MILL.

Construction of Cooper Hewitt Mercury-vapor Lamps.

In the Cooper Hewitt vapor electric lamps one or both of the electrodes is generally of mercury, and owing to the great weight of this substance there is more or less danger of the lamps being broken or injured in being carried from place to place or in being handled without special care at any place. An invention of Max von Recklinghausen of New York city is designed to provide against these dangers by so constructing these lamps as to provide special pockets for the mercury during travel, whereby the strain of the considerable weight of the mercury is to some extent relieved and in any case is brought to bear upon other parts than those most likely to yield to such strain. The usual condensing chamber of a Cooper Hewitt lamp may be developed into such a pocket, or a special pocket may be made on any part of the lamp tube.

In the drawings, Figs. 1 and 5 are sectional views of the same lamp in reversed positions, showing the condensing chamber developed into a pocket; and Figs. 2, 3 and 4 illustrate different arrangements of pockets or their equivalent. In every instance except in Fig. 1 the lamps are shown in the position which they should occupy when ready for shipment.



VARIOUS FORMS OF COOPER HEWITT LAMPS.

In Fig. 1 the condensing chamber of a Cooper Hewitt lamp is developed into a pocket, at the bottom of which, when the lamp is prepared for shipment, the mercury is located. This particular lamp is designed to have two mercury electrodes—connected with each of the leading-in wires. When operated, the lamp will be in the position shown in Fig. 1, the mercury finding its way first into the pocket which the upper leading-in wire enters, and the overflow passing then to the pocket at the opposite end of the lamp and there forming the second or negative electrode. Fig. 2 again shows the chamber developed into a pocket for holding the mercury, the shipping position of the lamp being such that the main tube of the lamp lies horizontal.

In Figs. 3 and 4 are shown special pockets, blown on different parts of the lamp body and adapted to contain the mercury, which can at will be distributed from the pockets to the proper parts of the lamp to form the electrodes. The condensing chambers of the Cooper Hewitt lamps have generally been constructed with the leading-in wire entering at the extremity thereof. This has caused a contraction of the chamber at that point, and it is these contracted portions that are particularly weak and unable to resist the weight or shock of the mercury. The chamber illustrated in Fig. 5 is rounded out at the end to obviate this weakness.

Stanwood E. Flichtner of Englewood, N. J., has designed some further improvements in the Cooper Hewitt lamps, so as to prevent fracture at any point with special reference to the point of sealing off the lamp. Fig. 6 illustrates a device of this kind, while Fig. 7 represents the improved arrangement forming the subject-matter of Mr. Flichtner's patent, and Fig. 8 illustrates a modification. All the figures illustrate the lamps in the positions which they may well occupy when shipped, the operating positions being the reverse of those shown. Ordinarily the seal-off has been located at the end of the bulb or condensing chamber usually forming part of the Cooper Hewitt lamp, in which location it is especially exposed to shock from the shifting mercury when the lamps are in transportation. Accordingly it has been proposed to place the seal-off at one side of the bulb, or at one side of the main body of the lamp as illustrated in Fig. 6. In Fig. 7 is provided an additional chamber, connected with the bulb by a narrow neck. With the construction illustrated the lamp may be tipped or tilted to a considerable angle without excessive flow of mercury taking place and without any shock being likely to effect any part of the lamp. The chamber may be connected with any part of the bulb, and the neck may be formed into a spiral, as shown in Fig. 8, in which case the lamp might be transported lying on its side. The seal-off may be located in any convenient position without being exposed to danger of fracture when the special pocket is provided.

At the opposite end of the lamp shown in Fig. 6 is shown a wire, leading to an electrode. The latter may be of pure iron or of any other suitable substance, serving as the positive electrode of the lamp. The inventor prefers, however, to make both electrodes of mercury, in which case it is convenient to arrange the positive electrode at the upper end of the lamp during operation, the overflow of mercury finding its way into contact with the leading-in wire at the bottom of the lamp and serving as the negative electrode.

An additional advantage appertaining to the form of protecting device described is that by reason of the presence of the neck connecting the auxiliary chamber with the bulb the protecting device can be readily sealed off after reaching its destination, and the lamp can then be operated in the usual way without presenting any unusual appearance. Both inventions are assigned to the Cooper Hewitt Electric Company.

Electric Power in Montreal.

The annual report of the Lachine Rapids Hydraulic and Land Company of Montreal for the year 1902 shows a net profit of $220,952. On June 30, 1902, a dividend of 3½ per cent. was paid for the six months, and on December 31, 1902, another of four per cent. for the second six months. The connected load now shows 105,348 incandescent lamps, 392 alternating arcs and 3,699¼ horsepower in motors, a satisfactory increase being indicated. On May 8, 1902, an agreement was entered into between the Shawinigan Water and Power Company and the Lachine company, whereby the latter obtained exclusive control of power transmitted from Shawinigan Falls to the Island of Montreal, the agreement being for 25 years, with the right of renewal for a further period of 25 years. Up to the present, the company has been devoting itself largely to small units of power and lighting, but with the acquisition of the Shawinigan power, it is now in a position to supply the power market on the Island of Montreal in either large or small units. The general manager of the Lachine Rapids company is W. McLea Walbank, well known in the United States.

Kleinschmidt Facsimile Telegraph.

An invention which relates to that class of telegraphic mechanism or apparatus which is generally known by the term "facsimile-telegraph" and which is designed for the transmission in facsimile of manuscript messages or pictures or other matter which is written or drawn upon a sending blank or sheet has recently been patented by Edward E. Kleinschmidt of New York city. The invention has particular relation to facsimile telegraphs which embody in the transmitting machine or apparatus a stylus mechanism which contacts with a metal-foil sheet on which the matter to be transmitted is written or drawn with an insulating ink, the contact of the stylus device with the insulated portions being arranged and adapted to send an impulse over the line and cause a corresponding actuation of an electro-

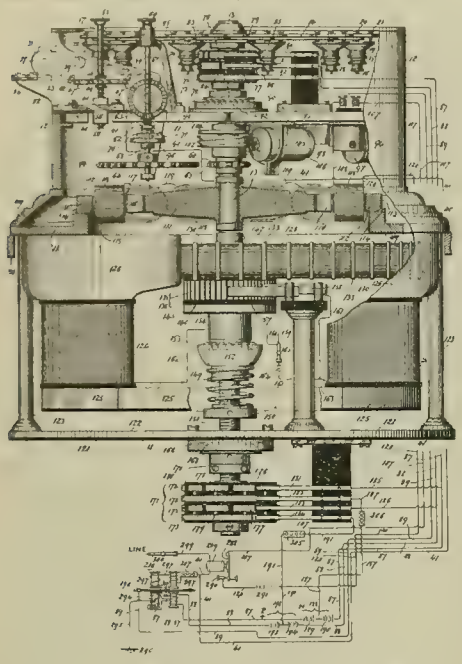


FIG. 1. KLEINSCHMIDT FACSIMILE TELEGRAPH. TRANSMITTING APPARATUS.

magnet stylus device comprised in the receiving machine or apparatus, whereby the recording stylus mechanism will operate to mark or record in facsimile the matter thus transmitted.

The object of the invention is to produce an improved facsimile telegraph in which perfect synchronism between the sending and receiving machines will be continuously maintained, which will operate continuously without occasion for frequent stoppage of the machines for the application or insertion of new matter to be transmitted, which by continuous operation will rapidly transmit a large amount or area of matter, which will be exceedingly simple in construction and mechanism and rapid and effective in operation, and which will attain a maximum degree of economy and convenience in use.

In the accompanying drawings Fig. 1 is a general side elevation, partly in section and with parts of the enclosing casing broken away, illustrating the transmitting machine or apparatus. Fig. 2 is a general diagrammatic plan view illustrating the complete circuits of the receiving machine and the connection thereof with the single line wire.

In the transmitting machine the stylus carrier (14) carries a series of transmitting stylus devices (15), which depend or project downwardly from the carrier and are arranged in a circular series at the peripheral portion of the latter. The relative construction and arrangement of the 10 stylus devices is such that two or a pair will be simultaneously in operative position upon the metal-foil-paper sheet or blank at all times during the transmission of the matter upon the blank. The arrangement of a number of styluses in a circular series upon a revolving plate or series carrier and the operative arrangement and connection whereby a number of such styluses are simultaneously in operative position enables a materially greater speed in the transmitting operation of the apparatus.

The feed mechanism for effecting the carriage and continuous feed of the foil-paper message sheet or blank is arranged at the front and top portion of the framework and casing with relation to the line of travel of the transmitting stylus devices (15) and beneath the latter, so that the stylus points (16) will describe an arc or segmental line of travel over the surface of the foil paper and in contact with the same.

A brush contact device which is adapted to contact with or bear upon the foil surface of the message paper (25) comprises a flexible metallic brush (36), extending transversely across and over the platen (26) and having its lower contact edge curved and provided with a series of parallel slits, as at (37), for the purpose of increasing its flexibility.

The circuit connections for the respective stylus devices (15) are made through the medium of a "stylus commutator" (72), which is mounted upon the main shaft (13), preferably at the top portion thereof and adjacent to the plane of projection of the styluses. This commutator carries a continuous ring (73) and two separate ring sets of segments (74) and (75), respectively. In the practical arrangement of the commutator and styluses the inventor employs a commutator segment for each stylus device, there being 10 stylus devices shown in the drawings and there being consequently 10 segments, and the segments are divided into two separate sets of five each, so that the stylus devices are correspondingly divided into two separate sets of five each, the stylus devices of one set being respectively connected to the segments (76) of one segmental set (74), and the stylus devices of the other set being respectively connected to the segments (77) of the other set (75). The stylus devices are alternately arranged with respect to their separate sets.

In the operation of the machine the main shaft (13) is adapted to be locked against the action of the continuously-operating motor mechanism by which it is revolved, this locking being automatically and electrically accomplished by impulses over the line and serving to insure the simultaneous starting of the transmitting and receiving machines comprised in the same line circuit by means of the automatic simultaneous release of the stop mechanism. By reason of the arrangement just stated the motor mechanism which operates the machines may be run continuously, yet the machines may be independently stopped in unison and independently started in unison. The devices included in this stop mechanism comprise a unison magnet (97), the armature (98) of which carries at its outer end a supplementary arm (99), which is pivotally connected to the armature, as at (100), so that it can turn or operate in a plane at right angles to the plane of movement of the armature.

A "synchronizer" in direct connection with the main shaft (13) is preferably arranged within the base portion of the machine casing (94) and embodies the general structural features of an electric motor, comprising a central armature (111), which is mounted upon the main shaft (13) preferably at a point just beneath the gear connection between the shaft and the paper-feed mechanism. This armature revolves within a circular field (112), comprised in the synchronizer. Both the armature (111) and field (113) are provided with a corresponding number of poles (116) and (117), respectively, the number of the poles upon each member of the synchronizer preferably corresponding to the number of stylus devices, and therefore being in the present illustration 10 in number. By this relative arrangement the synchronizer is best adapted for the sending of impulses at every tenth period in one complete revolution of the stylus carrier, thus enabling the sending of a synchronizing impulse for each stylus device and when the synchronizer poles are opposite each other. The arrangement is preferably such that these synchronizing impulses are always sent when the respective stylus devices are at the center of the foil-paper sheet or blank (25).

The main shaft (13) is revolved by means of a direct-current motor. The motor is, in the main, of the ordinary type, but is specially adapted to its position and arrangement relative to the machine parts. The motor, as shown, comprises field magnets (124), arranged in a circular series and connected by bottom bars, as at (125), the field magnets having at their top a concave pole piece (126), which may be connected to the under side of the base plate (109) by means of screws, as at (127), by which arrangement the field of the motor is suspended from the base plate (109). The motor armature has a slidable frictional connection with the main shaft (13) and is sustained in its movement by a slidable ball-bearing, the construction and arrangement being such that the shaft (13) will normally revolve with motor armature when the shaft is not locked against the revolution, and the motor armature will continue to revolve, and the shaft will remain stationary when the latter is locked against revolution by action of the automatic stop mechanism.

Upon the main shaft (13) is mounted the "synchronizer commutator" (171), the office of which is to govern the sending of the synchronizing impulses. This commutator is preferably secured upon the lower or bottom end of the shaft beneath the lower ball-bearing devices. The specific function of this synchronizing commutator is to short-circuit a part or one-half of the line battery during the sending of writing or transmitting impulses and to open the short-circuit to permit the full force of the line battery to pass over the line for the sending of a synchronizing impulse.

The transmitting and receiving machines embody their own circuit connections, whereby they perform their respective operative functions in the complete operation of the facsimile telegraphic apparatus; but the transmitting and receiving machines are connected over the line by a single line wire, over which both the transmitting and synchronizing impulses are sent, and any practical number of transmittnig and receiving machines may be arranged in the same line circuit to provide the desired number of stations, and inasmuch as the current transmitted over the line in the operation of the apparatus is similar to any ordinary telegraphic current it is apparent that any ordinary relay and duplexing arrangements or methods may be employed.

The transmitting and receiving machines are twins in their general characteristics and operation except in the specific details concerned in the respective functions of sending and receiving the impulses and transmitting and recording the matter upon the foil-paper message sheet or blank.

The set of recording styluses corresponds in number and in relative arrangement to the set of transmitting styluses, and they are correspondingly arranged in a circular series upon the stylus carrier. The relative arrangement of the set of recording styluses with respect to the set of transmitting styluses is such that each individual stylus of the recording set and its fellow stylus of the transmitting set are in identically the same position with relation to their disposition upon the stylus carrier, so that when a transmitting stylus is, for instance, in exactly the center of the foil-paper message sheet or blank its fellow stylus of the recording set will be in identically the same position with relation to the recording mechanism of the receiving machine. When one of the transmitting styluses contacts with insulating ink upon the foil-paper sheet the impulse which is then sent over the line will actuate the corresponding fellow stylus of the recording set to cause it to produce a mark upon the recording paper identical in length or duration to the length or duration of the insulating contact.

The writing impulses are weak currents, and the synchronism impulses are heavy currents. The writing currents of the two styluses, which are simultaneously in operative position and in contact with the foil-paper message sheet or blank are kept separate by causing one stylus to transmit only negative currents, while the other stylus will transmit only positive currents. The heavy currents for the synchronizing impulses are permitted to pass over the line by the action of the synchronizing commutator, which operates to short-circuit automatically a portion (illustrated as one-half) of the line batteries during the sending of writing impulses and which automatically at determined intervals (illustrated as at every tenth period, in one complete revolution of the complete set of transmitting styluses) opens the short-circuit, and thus permits a heavy impulse to pass over the line, which later action always occurs when either one of the brushes of the

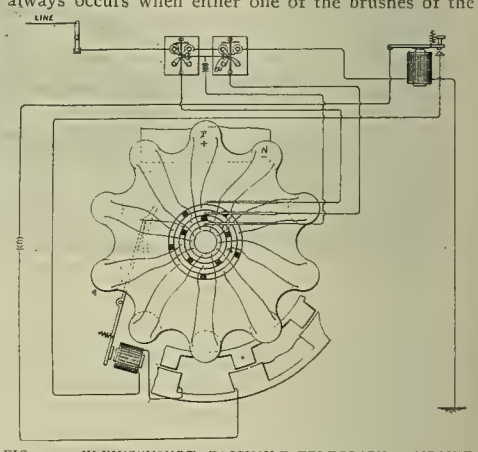


FIG 2.—KLEINSCHMIDT FACSIMILE TELEGRAPH. CIRCUIT DIAGRAM OF RECEIVING APPARATUS.

stylus commutator segmental ring sets is on one of the short intermediate segments.

The starting of the machines in unison is automatically accomplished by merely closing the line circuit when the frictionally-connected direct-current motors are in operation and the instant the line circuit is closed (with the machines in their determined initial position) a heavy current will be transmitted, which will release the stop mechanisms of the various machines and enable them instantly to start in unison.

Edison Phenomenon.

According to M. Allegretti in the Physikalische Zeitschrift, as translated for the London Electrician, the Edison phenomenon, consisting of the passage of electricity from the extreme negative end of the filament of an incandescent lamp to a metallic plate introduced into the bulb, has not yet been fully explained, although much work has been done upon it by Preece, Fleming and others. The main question is as to whether we have here a phenomenon of ionization or a true projection of negative particles. The author prepared a special vacuum tube having three openings, by means of which the two electrodes and the metallic plate could be easily replaced. He found that the current between electrode and metallic plate decreases rapidly as the distance increases, and less rapidly as the area of the plate diminishes. The phenomenon produces no effect upon a sensitive plate wrapped up in black paper. A magnetic field weakens the current perceptibly, especially at the lower pressures. The author believes that the phenomenon is primarily due to ionization, but that at the higher vacua it is enhanced by the production of cathode rays, which may be deflected in the same way as the ordinary cathode rays by a magnet.

The Bureau of Standards and the Coast and Geodetic Survey will be detached from the Treasury Department and placed under the new Department of Commerce.

New Works of the General Electric Company, England.

During the last 18 months or two years the Midland district of England has received favorable attention from more than one large electrical engineering concern, notably the British Westinghouse Company and the British Thomson-Houston Company. Willans & Robinson, the well-known engine makers, have been located at Rugby for several years now, while the General Electric Company (1900) Limited, to give the firm its registered title, has also had its works at Manchester. By this last-named company, finding its increasing business outgrowing its existing accommodations, has had to build a supplementary works, and the site selected was about three miles outside Birmingham, at a place called Witton. The individual departments of the new establishment comprise the engineering works, conduit factory, carbon factory, foundry and test room.

PART OF MACHINE SHOP IN ENGLISH GENERAL ELECTRIC WORKS.

The chief use to which the works will be put, however, is the manufacture of dynamos and motors, but the addition of the firm's own carbon factory is not without interest. This carbon factory, which has been designed as the result of considerable European experience, comprises two main buildings, the total area covered being about four acres. The raw material is first dealt with in the crushing department, whence it is conveyed by elevators to the mixing department. After being converted into the huge blocks ready to feed the presses, it is passed out in its final shape, but in a soft condition, to await hardening and packing ready for transport to the ovens, where it is baked for 12 days, the capacity of the ovens being 200 tons. These baking ovens are divided into 36 sections. From the ovens, the manufactured material is conveyed, by means of a mono-rail traveler, to the second building for the purposes of cutting, sorting, finishing, etc.

Several qualities of carbon are turned out, one of which is a special commercial material for competition with the Continent, giving an average of 10 per cent. longer burning hours than equivalent makes. Special apparatus has been erected for arc-lamp carbons, carbon-battery plates and manganese agglomerate blocks, as well as for carbons for all purposes. Provision is made for turning out 13,000,000 feet of carbon rods per annum, and facilities are being made for an extension to three times this quantity. The number of work people engaged in these carbon works is over 200, all of whom have had to be specially trained, as the industry is a comparatively new one in that country.

The General Electric Company has at its disposal 100 acres of land, but only 40 acres has as yet been occupied. The power house is of ample capacity, account having been taken of future extensions. There are at present three Galloway boilers and three generating sets. The station runs condensing, and power is supplied at 240 volts on a three-wire direct-current system.

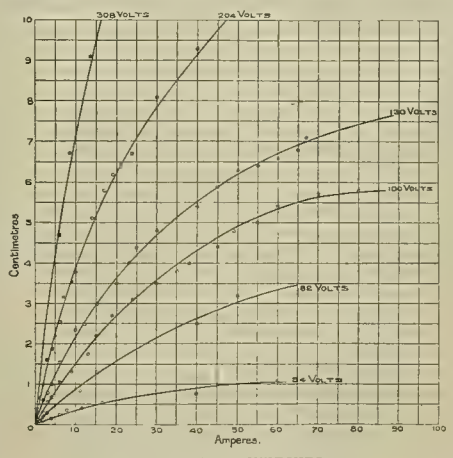
The main object of the works is, as has already been mentioned, the manufacture of dynamos and motors, hence a large amount of space has been given over to this department. There are two bays (one of which is seen in the illustration) 340 feet long, 60 feet wide and 55 feet high to the crane. The commercial, technical and drawing offices are situated in this building. In the machine shops the system adopted has been to group the various classes of machine tools, each of which is supervised by a foreman, who is a specialist in the particular class of work. The size of the machinery, capable of dealing with the heaviest electrical machines, is exemplified by the statement that one boring mill can deal with a magnet wheel or armature frame up to 25 feet in diameter. The driving motor for this machine is of 15 horsepower. The whole of the large machines are portable and driven by a separate electric motor. The galleries in the machine shops are given over to brasswork, and to the production of former-wound armature coils. The winding and taping of these are done by female labor.

The foundry has a length of 200 feet and a width of 50 feet. One cupola is now erected, and a second will soon be added. A three-motor crane serves this department and will lift up to five tons. The test room is built in the same building as the power house. The works for the production of interior conduits have only just been completed, and include three bays.

The card system of checking the workmen's time, etc., is employed, together with electric clocks, which print the time of entry and departure each day. So with the various jobs, every man is given a card with each new piece of work, stamped with the time of commencement, and signed by the foreman when finished. In this way the company satisfies itself that all time paid for according to the clock register is accounted for by the job cards.

Sparking at Switches.

In a recent paper read before the British Institution of Electrical Engineers A. Russell and C. Paterson discuss the subject of sparking at switches. When a direct-current circuit is quickly broken a spark ensues. In the diagram are given lengths of sparks at various constant voltages. The following are the conclusions arrived at: (1) The spark at break ought to be taken as a guide to the rating of a switch for use on direct-current circuits. (2) The shape of the terminals does not make much difference to the length of the spark. (3) The effect of increasing the speed of break above that ordinarily employed is small. (4) The effect of a double break is to make the lengths of the spark the same as the length of a spark with the same current at half the voltage. (5) The difference in the length of the spark when copper, steel, or zinc is used is not great.



SPARKING AT SWITCHES.

(6) For small double-break switches for use on circuits of 200 volts and upwards, when the trailing spark just fails to bridge the air-gap, the air-gap should be double the distance at which a permanent arc can be obtained. (7) For double-break switches for large currents under the same circumstances the air-gap should be more than double the arcing distance.

The Legislature of Arkansas has passed a bill requiring street-car companies in cities of the first class to operate separate cars for white and colored people or to separate such passengers in cars operated for both.

Edison Storage-battery Improvements.

Thomas A. Edison has been granted a patent (dated March 3, 1903, and applied for November 28, 1892) for an improvement to his reversible galvanic battery of the type employing an alkaline electrolyte and insoluble electrolytically-active materials. The invention relates particularly to the oxidizable element, and consists in the use of cobalt oxide, preferably mixed with metallic mercury or with metallic mercury and copper or silver, whereby a great proportion of the cobalt oxide is kept in electrical contact with the electrode and made electrolytically active in an alkaline solution to form the oxidizable element on discharge. The invention also consists in the combination of such an element with a suitable depolarizer furnishing oxygen on discharge in an alkaline electrolyte to form a complete reversible galvanic battery.

In order to produce the new element, Mr. Edison says he prefers to proceed substantially as follows: "Dried oxalate of cobalt is first produced in any suitable way and is ignited and kept at a low temperature in the air until it has been wholly decomposed to form the anhydrous oxide of cobalt. This oxide is then mixed with preferably about 15 per cent. of precipitated oxide of mercury if an electrode is to be obtained composed of cobalt and mercury, or, if desired, it may be mixed, preferably, with about 25 per cent. of finely-divided metallic copper and six per cent. of precipitated oxide of mercury if the resulting electrode is to be formed of cobalt and a combination of copper and mercury. These proportions, of course, may be varied; but those indicated give good results. I find, in fact, that by increasing the proportion of mercury, or of mercury and copper, a larger proportion of the cobalt is rendered active; but the increase in efficiency is secured at a sacrifice of lightness and economy. Silver may also be employed in place of the copper; but it possesses the objection of being too expensive at the present time for economical use. The mixture of oxide of cobalt and oxide of mercury or of oxide of cobalt, metallic copper, and oxide of mercury is then mixed thoroughly, formed into briquettes, and utilized in any desired manner, preferably by being supported in perforated nickel-plated pockets or receptacles, which in turn are crimped in position within plates or grids, as I have described in patents already granted to me.

"An electrode containing a mixture of cobalt and mercury or of cobalt, mercury, and copper or silver is preferably employed in an alkaline solution of, say, 20 per cent. of potassic hydroxide in water opposed to a depolarizing element containing nickel hydroxide as the active material mixed with foliated or flake graphite. When such a combination has been charged and recharged several times, its average voltage is about 1.10 volts. When such a combination is in a fully-charged condition, the nickel hydroxide is raised to a very high state of oxidation, and the cobalt is reduced so far as its active particles are concerned to the metallic state. On discharging the nickel hydroxide reverts to a lower condition of oxidation, while the metallic cobalt is oxidized. Owing to the relative ease, as compared to cobalt, with which mercury and copper reduce, the added mercury or copper, or silver, if used, will be reduced to the metallic state when the battery is first charged, so as to procure good electrical contact between the active cobalt particles. Since the cobalt on discharge oxidizes much more readily than either mercury, copper, or silver, the latter materials remain in metallic form, and their presence serves wholly to assist electrical conduction between the particles of the active material.

"Although I prefer to add a readily-reducible metal, like mercury, copper, or silver, or a combination thereof, to the cobalt for the purpose of maintaining electrical contact between the active materials, it will be of course understood that any insoluble conducting material, preferably in flake form, such as flake graphite, can be used for maintaining the cobalt particles in electrical contact."

In another recent patent Mr. Edison describes a funnel for use in filling storage-battery cans or analogous purposes. The funnel has a discharge through the wall of its neck. A plug closing the lower end of the neck carries a tube which extends up through the neck and body of the funnel. A float is carried by the lower end of the tube and is protected by the plug.

Manila Electrical Franchise.

A syndicate headed by Charles Swift of Detroit and including the Westinghouse company and White & Co., was the only bidder for the Manila street-railway and lighting franchise, referred to at length in the Western Electrician of January 3d last. The interests represented in the syndicate combined and purchased the franchise and property of the old Spanish company. The German bidders withdrew. The Swift syndicate offers the government a fortieth part of the gross earnings, which has been accepted.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

National Electric Light Association, Auditorium Hotel, Chicago May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Detroit, Mich., July 15th to 17th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

BEARING on the question of improving the personnel of railroad telegraph operators, with the idea of insuring greater safety in train dispatching, as referred to editorially by the Western Electrician recently, it is interesting to note that the subject is under consideration by at least one of the state legislatures. Senator Walker has introduced a bill into the Missouri Legislature creating a board of telegraph operators, who shall examine all telegraphers before they accept a position on any railroad. This seems to be a step in the right direction, and although, on general principles, the number of state "bureaus" and "departments" and "commissions" should be reduced rather than increased, any honest effort to increase the efficiency and raise the standard of employment of railroad telegraphers should be welcomed.

A SIGNIFICANT admission of the inroads of the telephone into the telegraph business is made by Mr. William J. Lloyd, assistant district superintendent of the Western Union company at Chicago, in an interview on the prospects of the proposed new telegraph system to connect Chicago, St. Louis and other western cities. "Not the least significant point," said Mr. Lloyd, "is the competition of the long-distance telephone company. Time was when offices 100, 200, 300, and even 400 miles distant were the most profitable in the business. Now it requires the utmost vigilance on our part to keep them remunerative. The telephone is used all around us—in this and to nearby states. For instance, take Decatur, Ill. Not long ago the receipts of that office were $400 a month. To-day the earnings have dwindled to $200 because of the telephone service." The ever-growing competition of the telephone with the telegraph has been recognized for a number of years, of course; but it is seldom that such a direct and particularized admission of it has been made by an officer of either of the two great telegraph companies.

ON December 14, 1902, the German tariff act, which has attracted so much attention in all commercial countries, was passed by the Reichstag and was immediately thereafter confirmed by the Bundesrath and became a law of the German Empire. The imperial decree followed, announcing its enactment, defining the classes of articles that are to be duty free, and declaring that the date at which the new tariff law would become operative would be announced hereafter. When this will be will depend mainly upon the time that will be necessarily occupied in negotiating new commercial treaties with the several nations (including the United States) with which Germany has had such treaties during the last 10 years, which treaties must now be revised and agreed to on the basis which will be established by the new tariff. How long this will require is a matter of conjecture, but it is generally thought that the treaty negotiations will occupy from 12 to 18 months, which would bring the new tariff law into force somewhere between January and July, 1904.

In common with other American products electrical machinery and appliances and, in general, machinery of all kinds, are affected adversely by the new law. Thus electrical machinery, such as dynamos, motors, transformers, etc., are now to pay a duty of $2.14 on each 100 kilograms (220½ pounds nearly) for machines under 500 kilograms in weight, $1.66 per 100 kilograms for machines of 500 to 3,000 kilograms, and $1.42 per 100 kilograms for machines weighing more than 3,000 kilograms. Machine tools, hydraulic presses, welding machines and mechanical hammers are classed together and are listed at rates of duty varying from $4.76 per 100 kilograms for machines of 250 kilograms or less to 97 cents per 100 kilograms for machines weighing over 10,000 kilograms. Steam engines, turbines, gas and caloric engines, blowing machinery, pumps, portable cranes, pile drivers and power hammers, ice machinery, etc., range from a rate of $23.80 per 100 kilograms for machines weighing less than 40 kilograms each to $4.28 for machines between one and two tons in weight, and so on down to 83 cents per 100 kilograms for machinery weighing more than 100 tons each. Telegraph instruments, telephones, electrical power transmitting apparatus, electrical measuring instruments, etc., are listed at $14.28 per 100 kilograms. Automobiles, railroad and street cars are down at $2.38 per 100 kilograms.

With scrupulous care the new tariff act, from first to last, favors and supports the interests of the agricultural as against the industrial and mercantile classes. It remains to be seen to what extent it may be modified by a new commercial treaty between the United States and Germany.

THE attitude of the Canadian authorities toward the various projects for utilizing the power of Niagara Falls in the Dominion is, of course, of much importance to the several companies that are either actually engaged in the work of construction or seeking the necessary powers. It is, therefore, of interest to observe that Premier Ross of the government of Ontario has declared his government's policy regarding the development and transmission of electric energy at Niagara Falls. In reply to the deputation from municipalities, the premier stated that, at the approaching session of the Legislature, he will introduce a bill to appoint a commission to be practically nominated by the various municipalities interested. It will be empowered to develop, buy or transmit, etc., electricity produced at Niagara Falls. The government will not undertake the work because, in the present state of the art, it is only possible to serve a portion of the province, and Mr. Ross holds that the provincial finances should not be risked in an undertaking not of equal advantage to all. A definite investigation will be made into the present situation as to the amount of power that may still be conveniently developed.

ON one of the business streets of Chicago there is a projecting sign in polished brass in relatively close proximity to another sign projecting over the sidewalk and lettered with incandescent lamps. At night when the electric sign is flashed by an automatic device the advantage to the neighboring brass sign —which belongs to another owner, by the way—is very obvious. When the observer is on the electric-sign side of the brass sign the lettering of the latter is seen to stand out from the darkness at regular intervals by reason of the light from the lamp-studded sign. The effect is enhanced by the fact that one side of the electric sign is dark while the other is flashed. Thus to the spectator approaching from the proper direction the electric sign is, at intervals, only imperfectly visible, while the brass sign, farther on, is in full flood of light from the adjacent side of the electric sign. The owner of the brass sign thus obtains the benefit of much valuable illumination, for which, presumably, he does not pay. Is there not a lesson in this probably accidental arrangement bearing on electric-sign work? Would it not be possible to make effective use of the reflected light by design? The possibilities of the use of reflected light in sign work at night deserve study and experiment. It is probable that by judicious reflection central-station men will be able to present more striking sign effects than the staring lamp designs now employed, with the expenditure of less current.

TELEPHONE companies will be somewhat interested in a recent decision of the Kentucky Court of Appeals, in which the liability of the exchange company to the subscriber under the ordinary form of contract is defined. It appears that by mistake a physician's telephone was disconnected for non-payment of rent when the rent was in fact paid. During the 18 hours that the telephone was disconnected persons endeavoring to reach the physician by telephone were informed that the telephone had been disconnected for non-payment of rent. The physician suffered no pecuniary injury. The court held, in an action by the physician against the company, that he could not recover punitive damages. The measure of damages, the court held, was the amount paid for the service for the time the telephone was disconnected, taking as a basis the amount paid per month. The Court of Appeals said in part: "There was nothing in the case to warrant an instruction on punitive damages, and the court properly refused to instruct the jury on this subject. The plaintiff had by contract acquired the right to a certain service, and, this contract being broken, the measure of damages is compensation for the breach, as in other cases of broken obligations. The case is entirely different from those where there is a physical trespass, as in the case of the expulsion of a passenger from a train, where there is not only a breach of contract, but an actual tort." This is a position that seems to be justified by common sense, and telephone companies will be gratified to know that it is the law as well.

Chicago Electrical Association.

An innovation in the way of meetings was instituted by the Chicago Electrical Association on March 6th, when about 50 members and friends met for a semi-social evening at the Albion Cafe in the Pullman Building. Dinner was served at six o'clock in a private dining room, after which the meeting resolved itself into an informal and social gathering. President P. B. Woodworth presided in his usual happy manner and introduced S. G. McMeen of the engineering department of the Western Electric Company, who made the principal address of the evening. Mr. McMeen chose for his subject "Middle-west Engineering—An Optimist's View," and contrasted the engineer of to-day and the engineer of 10 years from now. At the present time the engineer acts largely in a commercial capacity, his duties being principally to see that his employer's money is spent wisely and is productive of the best results, while a decade hence, the speaker predicted, the engineer will act as the executive officer, or, in other words, will step to the front and handle his work with his own authority and responsibility. Mr. McMeen believed that the future of the engineer is a very bright one, and in general he took a very broad, optimistic view of the coming years' development in engineering lines. Among other points touched upon was that while practically no improvement had been made during the past centuries in the arts, such as painting and sculpture, yet in science the advance had been steady and was not to be compared with the work of a few hundred years ago. Mr. McMeen's reputation as an entertaining and instructive lecturer is well known, and his address was very well received.

Harold Almert of Oak Park then addressed the association on standardization of advertising literature, reading the report that was made on this subject at the recent Milwaukee convention of the Northwestern Electrical Association and printed in full in the Western Electrician of January 24th. Mr. Almert highly indorsed an investigation of this subject and moved that a committee of three be appointed so that the Chicago Electrical Association could cooperate with the Northwestern and other associations which were taking the matter up, so that they might all work toward the same end. The motion was unanimously carried and the following-named members were afterward appointed: Harold Almert, R. F. Schuchardt and C. W. Whitney.

The rest of the evening was spent in informal talks by D. W. C. Tanner, J. L. McQuarrie, R. F. Schuchardt and others on association matters and other matters of interest. The meeting adjourned at 9:30 p. m., the unanimous sentiment being that it had been an unqualified success. The next regular meeting of the association will be held in the association's room at 1741 Monadnock Block, on March 20th, when S. J. Larned, general superintendent of the Chicago Telephone Company, will read a paper on "Telephone Service."

Space-telegraph System to Be Installed in Chicago.

Within a few days an attempt is to be made to operate a space-telegraph system over some of the most congested portions of Chicago. The test will be made between the city offices of Armour & Co. in the Home Insurance Building, at the corner of Adams and La Salle Streets and the Armour packing plant in the Union Stock Yards. Poles are to be erected on these buildings so as to avoid interference with any intervening steel buildings or structures. The distance between the two points in an air line is between 4½ and five miles. The test will be conducted by Mr. White, C. C. Galbraith and Lee DeForest, officers of the American DeForest Wireless Telegraph Company of New York city. It has been stated that if the experiments result successfully, and if it is demonstrated that attuned messages can be transmitted, Armour & Co. may establish the system permanently and also connect its other local offices, thus doing away with many miles of telegraph wires at present employed.

Another proposed wireless-telegraph station is to be erected at Euclid Beach Park, near Cleveland, where messages will be received and sent to other lake ports. The station will require two 200-foot masts connected by a cross wire, from which will be strung vertical wires to the ground for receiving purposes. An alternating current will be used and, it is stated, no coherer will be needed in receiving the messages, the DeForest system being employed. It is hoped to have the station completed by May 1st, and all the boat lines stopping at that port will be solicited to equip themselves to use the system. Stations will also be established at all the other large lake ports, it is said.

Canadian Electrical Association.

The annual convention of the Canadian Electrical Association will be held in Toronto on June 10th, 11th and 12th. The local committee consists of all members of the association residing in Toronto, with J. J. Wright as chairman. P. G. Gossler of Montreal, A. A. Dion of Ottawa, and J. J. Wright, Toronto, form the committee to award prizes for papers of superior merit. It is expected that the coming convention will be largely attended, especially by the western members, and that the programme will combine in a profitable degree instruction and pleasure.

The Electron Theory.

H. A. Lorentz has made an important theoretical advance in the electron theory. In a paper on "The Fundamental Equations for Electromagnetic Phenomena in Ponderable Bodies, Deduced from the Theory of Electrons," read before the Royal Academy of Amsterdam, the author passes from the case of the propagation of light in transparent substances moving with a constant velocity to a more general case. He transforms the original equations into a set of formulæ, which, instead of quantities having reference to individual electrons, contain only such as relate to the state of visible parts of the body, and are, therefore, accessible to observation. These formulæ hold for bodies of very different kinds, moving in any way we like. The results are mainly those arrived at by Poincaré, although the treatment is different. The ether is, as before, supposed to remain at rest and to penetrate the charged particles. The equations of the electromagnetic field are, therefore, to be applied to the interior of the electrons, as well as to the spaces between them. The two final equations deduced may be used without applying them to individual electrons, but they are intimately connected with the distribution and motion of elementary electric charges.

If the electron has an invariable charge, and a positive ion is always a single atom from which an electron has been split off, it is reasonable to suppose that the positive electron will also have an invariable charge. It should, therefore, show a ratio e/m varying only with the atomic weight, and the ratio should change from one substance to another in a manner solely depending upon the known atomic weight of the substance. W. Wien has for some time been endeavoring to discover such a regular variation in the canal rays. But all the experiments hitherto made result in showing that there is no abrupt transition from one value to another. The "specific charge," as Mr. Wien calls the ratio e/m, in a foreign contemporary, may be anything from 750 to 10 millions. For both hydrogen and oxygen it figures at about 10,000. This would be the correct figure for hydrogen in the ordinary electron theory, and the author thought that the same value obtained in oxygen might be due to impurities of hydrogen. But the purification of the oxygen led to no more decisive results. It must, therefore, be assumed either that the positive electron can be bound to a number of material molecules, or that it can be subdivided.

In a German scientific journal W. Kaufmann proves, with the aid of a theory furnished by Abraham, that the mass of the electron is "apparent"—i. e., due to its electromagnetic inertia. An attempt was made some time ago, with imperfect material, to verify Abraham's theoretical demonstration, but the "material" mass of the electron then came out negatively. With better material, there is now found to be a complete agreement between theory and experiment. The experimental method was essentially that of "crossed spectra," the magnetic spectrum of a sheaf of Becquerel rays being superimposed at right angles on the electrostatic spectrum. The results obtained show that the equations are accurately fulfilled, and as they are based upon a purely electromagnetic mass, the apparent mass of the electron must be purely electromagnetic.

Popoff Self-decohering Coherer System.

Alexandre Popoff of Cronstadt, Russia, the well-known space-telegraph inventor, has been granted a United States patent for an invention of a self-decohering coherer system. The coherer or radio-conductor, as it is called, comprises a tube filled with a granular metallic resistance chain and in its circuit, connected up without relay or tapper, are one or more telephones connected in such manner through an induction coil as to be operated thereby. The metallic electrodes of the coherer extend into the tube and lap past each other. The granular filling consists of crushed steel beads, the individual grains of which retain the rounded polished surface, as well as the acquired angular fractured surfaces, thus giving various degrees of oxidation.

Electric Railways in Canada.

The annual report of the Canadian Department of Railways and Canals has been issued, and in respect to electric railways in the Dominion it shows that there were on June 30, 1902, 558 miles of electric railway completed, of which 553 miles were laid with steel rails, 169 miles being double-track. The paid-up capital amounted to $41,593,063, of which the municipal aid amounted to $173,000. The gross earnings aggregated $6,486,438, an increase of $718,155, and the working expenses, $3,802,855, leaving net earnings of $2,683,583. The number of passengers carried was 137,681,402, an increase of 16,744,746, and the freight carried amounted to 266,182 tons, a decrease of 21,744 tons. The car mileage was 35,833,841. Eight persons were killed on these railways. Electric power was supplied in 13 cases by water and in 27 cases by steam. Ontario has 334 miles of electric railway; Quebec, 140; New Brunswick, 12; Manitoba, 13, and British Columbia, 45 miles. One company has ceased operation.

Death of E. B. Arnold.

Everton Burritt Arnold died in Lock Haven, Pa., on March 9th, after an illness of 10 days, from typhoid pneumonia, aged 31 years. For a number of years Mr. Arnold had been engaged in a confidential capacity in charge of material and finances on construction work for the Arnold Electric Power Station Company of Chicago. He was a brother of B. J. Arnold and of other members of the well-known Arnold family, and was highly esteemed by many friends and acquaintances in the electrical field who admired his ability and character and will lament his untimely death.

E. B. ARNOLD.

Mr. Arnold was born in Ashland, Neb., and received his education in the public schools of that place and Hillsdale College at Hillsdale, Mich. From 1893 to 1895 he had charge of the factory of the Pumpelly-Sorley Storage Battery Company in Chicago. Since 1895 he had been connected with the Arnold company in the capacity mentioned. His duties kept him out of town most of the time, and he supervised the business end of the construction of many important installations carried out by the Arnold company, such as the Chicago and Englewood storage-battery road, the Chicago and Milwaukee electric railway, the Baring Cross shops of the St. Louis, Iron Mountain and Southern Railroad at Little Rock, Ark., the Lansing (Mich.), St. Johns and St. Louis electric railway and the Oak Grove shops of the New York Central Railroad at Oak Grove, Pa. He was just finishing up his work in Oak Grove when he was taken ill. He was removed to Lock Haven and received the best of care, but his disease took an unexpected turn for the worse and in the last two or three days of his sickness he sank rapidly to the end. Mrs. Geraldine Arnold, mother of the deceased, was hastily summoned from Chicago and arrived in time to see her son breathe his last.

In addition to his mother, Mr. Arnold is survived by five adult brothers—Bion J., Wayland L. and Ralph G. of the Arnold Electric Power Station Company of Chicago, Ward S. of the Chicago office of the Stanley Electric Manufacturing Company and Harold W. of the Western Electric Company—and one sister, Mrs. Gould, wife of D. C. Gould of the Stromberg-Carlson Telephone Manufacturing Company. The remains were brought to Chicago, the funeral being from the residence of B. J. Arnold. Burial was at Ashland, Neb.

Mr. Arnold was a young man of high principle and excellent capacity. He was noted for an extraordinary aptitude in mental numerical calculation, and his grasp of all business details was precise and accurate. He possessed the fullest confidence of his friends and associates, and his services were of great value to his employer. He was unmarried.

Electrical Exports for January.

The electrical exports from the United States for the month of January, 1903, amounted to a total value of $795,549, as compared with $828,574, for the corresponding month in 1902. The exports for January of the present year thus show a decrease from those of the corresponding month of last year amounting to $33,025. A comparison of the exports of electrical machinery, however, shows an increase from $409,470 for January, 1902, to $556,315 for January, 1903. The decrease in the total amount of exports is accounted for in the falling off in electrical appliances, such as telegraph and telephone instruments, the figures being $419,098 for 1902 and $239,234 for 1903.

Classified according to destination, the exports of electrical machinery to some of the principal buyers during January were as follows: United Kingdom, $243,102; British North America, $106,078; Japan, $72,645; Brazil, $34,330; Mexico, $32,992; British Australasia, $20,335; British Africa, $4,774; Cuba, $2,074; France, $2,445; Germany, $3,667; Argentina, $3,001; Philippine Islands, $2,471; Chinese Empire, $250; British East Indies, $946; Central American States and British Honduras, $4,848; Hongkong, $3,568. There has been a decided increase in exports of electrical machinery to all of the above countries except Germany, Cuba and the British East Indies, the last named being the only one to show a marked falling off, the figures being $33,027 in January, 1902, as against $946 in the first month of 1903. The United Kingdom, Mexico, Brazil and Japan show the greatest increase, Japan taking the lead, with an increase from $13,147 in January, 1902, to $72,645 in January, 1903.

DEVELOPMENT OF THE TELEPHONE FIELD.

Recent Telephone Inventions.

Indicative of recent progress in the telephone industry is a set of six patents issued to different inventors last week. Three of these cover telephone transmitters, and are represented in Figs. 1, 2 and 3. The transmitter shown in section in Fig. 1 is the invention of Lemuel Mellett of Somerville, Mass., the patent being assigned to the Microphone Transmitter Company of Boston. The object of the invention is to obtain greater delicacy or receptiveness

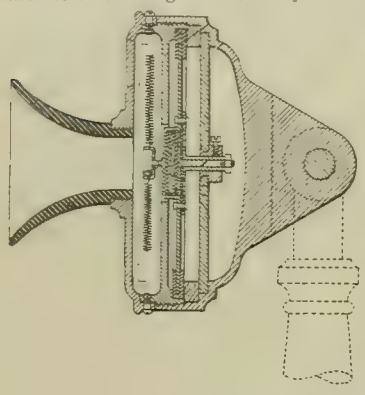


Fig. 1. Mellett Transmitter.

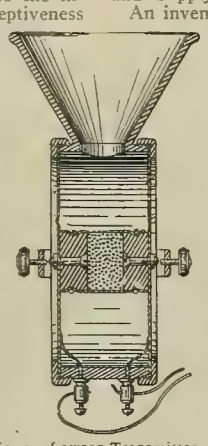


Fig. 2. Lawson Transmitter

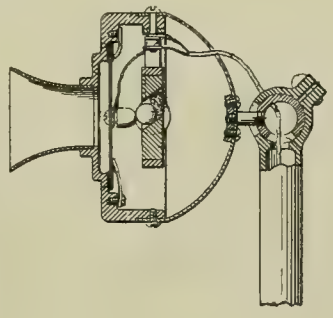


Fig. 3. Holmck Transmitter.

RECENT TELEPHONE INVENTIONS.

in the instrument with a consequent increase in the loudness and distinctness of the sounds given out at the receiving end of the line. This object is attained by dispensing with the ordinary diaphragm as the primary sound-receiving element of the transmitter and employing in its place a primary sound receiver, consisting of a number of mechanical vibrators, preferably attuned to the notes of the scale and provided in sufficient number to take up all or the principal tones of the speaking voice, such vibrators controlling the resistance-varying means, preferably by direct attachment to the movable electrode.

Albert F. Lawson of Buffalo, N. Y., is the inventor of the transmitter shown in longitudinal section in Fig. 2, the object of which is to increase materially the resonance and sensibility of the operative parts. To that end the invention consists of an arrangement by means of which the effect of the human voice in the form of sound waves is exerted against the back or inside face instead of the front or outside face of the diaphragm or diaphragms, forming a part of the walls of the vocalizing chamber of the transmitter.

The transmitter shown in vertical section in Fig.

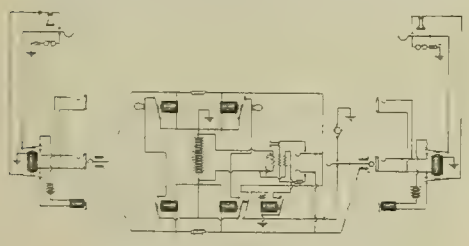


FIG. 4. DEAN TELEPHONE TESTING SYSTEM.

1 is the invention of Charles Holmok of Cleveland, Ohio, whose object is to produce an instrument which shall be extremely sensitive to sound, while it is at the same time simple and inexpensive. A further object is to provide means for readily adjusting the parts, so that the same instrument can be adapted to various conditions and to the different requirements of local and long-distance service. The transmitter has a front case carrying a diaphragm and a bracket having arms with axially aligning screws mounted in the arms. A metallic ring is supported between the points of the screws and a carbon disk mounted in the ring has an inclined bore, and a carbon ball carried within the bore is adapted to rest against the diaphragm.

William W. Dean, a well-known Chicago telephone man, has invented the testing system for telephone lines shown in Fig. 4, the diagram illustrating two telephone lines and the necessary central-station apparatus. The object of the invention is to provide a testing system particularly adapted to that class of telephone lines wherein no special testing terminal is provided upon the switchboard, one of the main line terminals of the switch socket or a terminal connected with one side of the talking circuit during a connection being relied upon for testing purposes. Each operator is provided with a testing circuit having a high resistance and preferably also a high impedance, and which preferably takes the form of a relay which is adapted to be connected with all of the cords controlled by the operator, the relay or test-resistance device being normally in circuit with the tips of all of the calling or testing plugs. When, therefore, the tip of any one of the plugs is touched to the testing terminal upon the switchboard, a current will traverse the relay or test device if the line is busy. The relay or device thereupon acts to control a local circuit containing a suitable source of electricity and the operator's telephone or other responsive device. The strength of the current flowing in the local circuit may be readily adjusted as desired, and in this manner the strength of the click in the operator's telephone may be suitably adjusted. The patent is assigned to the Kellogg Switchboard and Supply Company.

An invention relating to common-battery telephone systems or systems in which the battery or other source of electrical energy is centralized at one point and in which local batteries at the subscribers' stations are or may be dispensed with, is shown in Fig. 5 and is patented by Samuel B. Fowler of Morristown, N. J. The invention is particularly concerned with that part of such a system which is

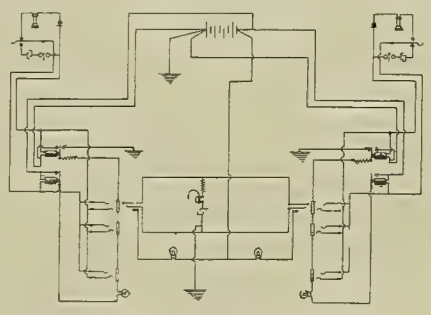


FIG. 5. FOWLER CENTRAL-ENERGY SYSTEM.

comprised in the circuits of the switchboards in the central office or exchange. The objects attained by the invention are the simplification of the signaling circuits, particularly the cord circuit, the provision of a positive busy test, and the doing away with the need of cutting off the signaling battery current and the substitution of another current for talking. In the system are combined a subscriber's line, open when not in use, a common battery connected to ground, a relay bridged on the line in series with the common battery, a circuit including the sockets

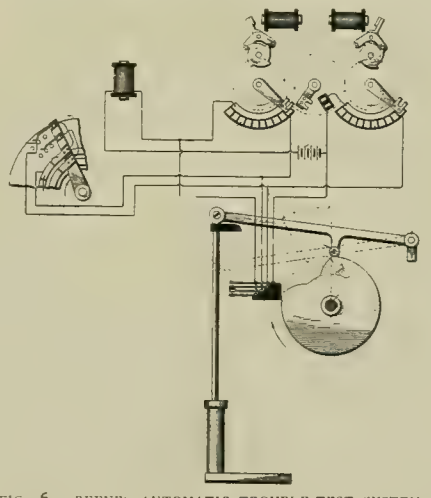


FIG. 6 REEVES AUTOMATIC TROUBLE-TEST SYSTEM.

of the jacks and a resistance between the sockets and one terminal and adapted to be connected by the action of the relay to the common battery. A back contact for the terminal is connected to the ground, and a conductor is adapted to be connected to any of the sockets and includes two lamps.

An invention which is especially applicable to the Faller automatic telephone system is covered by a patent issued to Frank Norris Reeves of New York, N. Y., assigned to the Electromechanical Improvement Company of Charleston, W. Va., and entitled "Trouble Test for Automatic Telephone Systems." The invention relates to improvements in automatic means for indicating the occurrence of electrical or other trouble in the operation of automatic telephone systems, and has for its primary object the prevention of delay or interruptions in such systems by the immediate notification of the switchboard attendant of the presence of such trouble either in the exchange or on the line.

In the Faller system each successive switch is accompanied by or depends upon one complete revolution of a so-called "master shaft." When the system is in order, each revolution of this master shaft is completed in a predetermined length of time and no longer. This revolution of the shaft, however, is not continuous, but its motion is interrupted once and resumed again. The whole cycle, though, occupies a predetermined period. Should any trouble occur to prevent a complete switch from being effected or should anything happen to prevent this master shaft from making its revolution in the prescribed time, including its failure to start again after its usual momentary stop, the delay will cause the operation of a signal which will notify the attendant of the occurrence of trouble. To this end Mr. Reeves' invention comprises the combination and arrangement of parts shown in Fig. 6.

Affairs of the Strowger Automatic Telephone Company.

Differences arising at the annual meeting of the Strowger Automatic Telephone Company of Chicago, have been brought to a climax by an application for an injunction restraining Jacob L. Kessner, Adolph Nathan, Louis Stumer, Max Sello and Joseph Siegel from "asserting that they were directors of the Strowger Automatic Telephone Company or asserting that A. E. Wilson, Joseph E. Harris, Edwin W. Gearhart, Sanford F. Harris and Albert G. Wheeler, Jr., were not elected directors of the said company." The faction represented by Albert G Wheeler asserts that its rights were ignored at the recent meeting of stockholders. By using unusual methods and throwing out about 4,000 votes, it is said, Mr. Kessner and his followers elected themselves. The defeated faction say that the election was a farce, and that as they were unable to secure any judicial rights at the meeting, they will go into court. Jacob L. Kessner and six of his followers were, therefore, served with subpœnas to appear in Judge Dunne's court, where the matter will be taken up. They will be required to produce the proxies of the stockholders voted by them at the annual meeting, and which Albert G. Wheeler and Joseph Harris allege in their petition to have been illegally dated or executed. Mr. Kessner says that there was nothing illegal about the election, and maintains that the 4,000 votes referred to were thrown out because proxies of a later date had been secured.

Bell Telephones in Canada.

At the annual general meeting of the shareholders of the Bell Telephone Company of Canada, held in Montreal, the report of the directors showed that 5,623 new subscribers were added during the year, the total number of sets of instruments now earning rental being 48,481. The company now owns and operates 377 exchanges and 553 agencies. Over 2,655 miles of wire was added to the long-distance system in 1902. The long-distance lines now owned and operated by the company comprise 26,848 miles of wire on 6,991 miles of poles. There were $250,000 worth of five per cent. bonds sold during the past year, the premium on which amounted to $22,809. All the retiring officers were re-elected.

TELEPHONE MEN.

C. B. Dobie died at his home in Sigourney, Iowa, on February 27th. Mr. Dobie was a prominent figure in the Iowa Independent telephone field. He had been president of the Southern Iowa Telephone Association, and at the time of his death was manager of the People's Telephone Company of Sigourney.

At the annual meeting of the directors of the Zanesville (Ohio) Telephone and Telegraph Company, held a few days ago, the following-named officers were chosen: President, F. S. Dickson; vice-president, S. M. Granger; treasurer, R. W. Judd; secretary and general manager, J. B. Rhodes. It was decided to spend $40,000 on improvements and extensions.

A party of officials of the American Telephone and Telegraph Company has recently been on a tour of inspection of their southern properties. In the party were Frederick P. Fish of Boston, president of the American company; Edward J. Hall of New York, vice-president of the American Bell company and president of the Southern Bell company, and a number of other officials. In honor of the removal of the Southern Bell Telephone Company's headquarters from New York to Atlanta, W. T. Gentry, general manager in Atlanta, will give a dinner in honor of Edward J. Hall, president of the Southern Bell company, and other officers.

Ohio Telephone Notes.

The Franklin Union Telephone Company of Apple Creek, Wayne County, has been incorporated, with a capital stock of $7,000, by Frank A. Beazell, H. M. Meier and others.

The North Benton-Deerfield Telephone Company of North Benton has been incorporated, with a capital stock of $1,000, by D. J. Miller, A. R. Cobb, George B. Kinsey and others.

W. H. Fledderjohann and others have purchased the plant of the Citizens' Telephone Company at Logan and the name will be changed to the Home Telephone Company.

The Point Rock and Wilkesville Telephone Company of Wilkesville has been incorporated, with a capital stock of $4,000, to build an Independent line in Meigs County. James Westfall, Gard McLaughlin, George Barnes, A. W. Humphrey and others are interested in the new company.

The Elida Mutual Telephone Company of Elida, Allen County, has been incorporated, with a capital stock of $21,000, by R. E. Jones. S. D. Crites, William S. Peters and others are interested in the company.

The Home Telephone Construction Company of Toledo and Wauseon has organized the Northwestern Toll Company, which will build long-distance lines connecting 16 of the largest northern Ohio towns with the new Independent plant at Toledo. The Barber-Brailey syndicate of Wauseon is at the head of the movement.

The Hoagland Run Telenhone Company of Blissfield, Coshocton County, has been incorporated, with a capital stock of $5,000, to build a local plant with radiating lines. Andrew Reiss, F. M. Curtis and others are the incorporators.

Ezra M. Lawton owns a telephone franchise in Cincinnati, or one was granted to him, and it is believed that an Independent system can be operated under it. Several Cleveland parties have been in Cincinnati lately conferring with the gentlemen in regard to it. An earnest effort is being made by the Independents to get an honorable foothold in the Queen City.

The Home Telephone Company of Dayton will, in a short time, be ready for operation. One of the daily newspapers not long ago contained an article to the effect that the business men would not take hold of the new proposition until actually necessary; or, in other words, until it secures enough patrons to make it useful to them.

The agents of the American Telephone and Telegraph Company met in Columbus two days last week to discuss questions relative to the various matters pertaining to their work. They report heavy competition in the long-distance business.

The Phalanx-Leavittsburg Telephone Company of Phalanx, Trumbull County, has been incorporated with a capital stock of $5,000. C. J. Rood, A. N. Rood and others are interested.

The Harpersfield Telephone Company of Cork will shortly be incorporated. Fifty subscribers have been secured.

It is said that the Sandusky Telephone Company will earn 11 per cent. on the capital stock this year. It paid six last year. It has in operation 1,100 telephones.

The Home Telephone Company of Toledo is already in need of additional switchboard facilities, and the matter will be taken up at the annual meeting to be held in a few days.

The Hannibal and Round Bottom Telephone Company, Hannibal, has been incorporated, with a capital stock of $1,000, by J. A. Fraley and others.

The Monroe Mutual Telephone Company of Greenville, W. Va., has been incorporated, with a capital stock of $8,000, to build lines in Monroe and Somers Counties, that state. J. M. Ballard, C. S. Whitten and other Greenville gentlemen are interested in the company. O. M. C.

Southern Telephone Developments.

J. W. Jarvis has about perfected details for installing a local telephone system in Canton, Ga., to work in conjunction with the Southern Bell.

In connection with the possible removal from New York to Atlanta of the headquarters of the Southern Bell Telephone Company, it is said that the long-distance lines may be considerably improved.

The South Carolina Long-distance Telephone Company of Columbia has completed connections with Rock Hill, 100 miles distant.

The consummation of the big scheme of the Memphis (Tenn.) Long-distance Telephone Company is progressing apparently very satisfactorily. It is said that $200,000 worth of supplies have been purchased. The company is projecting one of the most extensive long-distance systems in the South. Meetings have been held of Independent telephone men in other cities, looking to a consolidation of interests in accordance with the plans of the Memphis company. C. E. Stinson is president of the company. Those interested already own Independent systems in a number of other cities.

The effort to secure a franchise for a new telephone system in Chattanooga has fallen through.

A meeting of representatives of the Independent telephone lines of Greenville, Tenn., will be held to consider consolidating. Unless suitable arrangements are concluded with the Cumberland company, it is proposed to unite and establish a central station in Greenville.

The Gainesville Telephone Company, with headquarters at Sparta, Tenn., will extend its lines to a number of towns, connecting with the Cumberland Telephone Company at Stanford, Ky.

The Piedmont Telephone Company, Gastonia, N. C., now owns the telephones in 23 towns. The recently purchased exchange at Shelby, N. C., will be rebuilt. A long-distance line from Lincolnton to Asheville, N. C., will also be built. L.

Indiana Telephone Items.

The county commissioners of Cass County have granted to the Burrows Telephone Company the right to operate Independent telephone lines in that county. The company was recently incorporated with a capital of $8,000. An exchange will be built at Burrows, but the company's purpose is to serve the farmers.

A meeting of the stockholders of the municipal telephone company promoted by Mayor Covert of Evansville will be held this week. With the exception of a few thousand dollars, all of the stock necessary has been taken. The remainder will be taken by the successful bidder among the five construction companies which are preparing to bid on putting in the plant. Mayor Covert insists that Evansville is the best situated city in the country for the introduction of the Independent telephone. He says the Independent lines extend to within a few miles of the city in all directions and that connecting lines can be put up at small expense.

A representative of the Central Union Telephone Company, from Chicago, was in Muncie last week endeavoring to adjust the differences between the striking linemen and the local management. It is said that other employes of the Central Union may strike in sympathy with the linemen if the trouble is not settled. Several hundred of the company's subscribers will order their telephones out if the differences are not speedily adjusted.

The Bell Telephone Company, which put in its service in Clay City two years ago in opposition to the Home Telephone Company, has cut off its service, having lost over $4,000 in the venture, it is said.

New telephone companies were incorporated last week as follows:

Fisher's Station and Oaklandon Telephone Company; capital, $4,000. The company will install exchanges in both towns and operate a system extending into Marion and Hamilton Counties. The incorporators are Jonathan Conkle, Bert Klepfer, Oaklandon, and John R. Hoss and A. S. Neaver, Fisher's Station.

The St. Joseph Union Telephone Company with a capital stock of $10,000. The company will establish exchanges in Claudville and Wakarusa, construct and operate lines in St. Joseph and contiguous counties. C. B. Nettrow, Claudville, and E. L. Davidhizar and A. F. Gocker, Wakarusa, incorporators.

The Bell Mutual Telephone Company of Marion, Hancock and Hamilton Counties; capital stock, $400,000. H. S. Offenbacker, Robert E. Bell and Asa Hamilton, incorporators. The company will operate in the three counties above named. F.

Telephone News from the Northwest.

A bill is before the Minnesota Legislature to provide a penalty of $100 fine or 90 days in jail for defacing telephone or telegraph poles or injuring the soil supporting the poles.

The Northwestern Telephone Exchange Company has presented a bill to the city of Minneapolis for two years' service, amounting to $590.

The Legislature of South Dakota has a bill in consideration which requires telephone companies to connect at common points.

The Little Wolf River Telephone Company, said to be insolvent, will, it is reported, be sold at auction under order of the court.

The Northwestern Telephone Exchange Company has strung two special wires to the state capitol building in St. Paul, and all legislators have franks.

The West Wisconsin Telephone Company of Glenwood, Wis., has been incorporated with $5,000 capital stock.

The Wisconsin Telephone Company has arranged with the Wausau Telephone Company at Wausau, whereby the home company is to have the local field and the Wisconsin company will connect and give toll and long-distance service.

The Twin City Telephone Company of Minneapolis and St. Paul has issued a new quarterly directory. It contains over 10,000 names and 129 intercommunicating systems, or private switchboards. The company has purchased a site in North Minneapolis for the erection of a North Side exchange. Additional space has been secured on the east side for the East Side Station, and additions are ordered for the boards of both stations. They are now on the way. Two sections have been added to the central exchange board in Minneapolis.

The Iowa Telephone Company will abandon the local field at Centerville, Iowa, and will have only a toll station there. The Centerville Telephone Company has the local field almost entirely.

It has been reported at Duluth that the Twin City Telephone Company has absorbed the Zenith company there, while the Northwestern Telephone Exchange Company has likewise taken over the Duluth Telephone Company. Both companies deny any such absorption. R.

Pupin Telephone Load Coils.

Mention has already been made in these columns of the experiments conducted on telephone circuits near Berlin, Germany, to determine the advantages of applying to the lines the inductance or load coils which have been invented by Professor M. I. Pupin and which are used in this country by the American Telephone and Telegraph Company. The Germany experiments showed that by the application of Pupin's system, an underground cable with a conductor of one millimeter diameter could be rendered equivalent in speaking capacity to an ordinary unequipped overhead wire of two millimeters diameter, or four times the section. The arrangement of the inductance coils was very simple. Each set of 14 coils of annular construction was inserted in

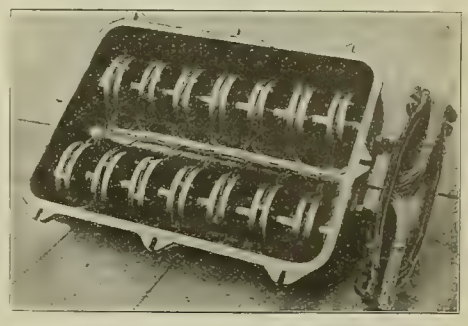


FIG. 1. PUPIN TELEPHONE LOAD COILS. UNDERGROUND CABLE ARRANGEMENT.

an iron box, and the necessary connections to the cable made by means of a special connection box, both being subsequently filled up with compound. Fig. 1 gives a view of such a box with the connections complete.

The coils were inserted in the underground cable at an average distance of about 1,300 meters. Each coil introduced a resistance of about 4.1 ohms in each wire of the circuit, and an inductance of about 0.062 henry. As the resistance of the cable conductor, with coils included, amounted to 23.5 ohms per kilometer, while the wire-to-wire capacity was about 0.037 microfarad per kilometer, the value of the attenuation constant became 0.0106. The self-induction of the simple metallic circuit measured with an alternating current of 900 periods per second gave 0.0003 henry per kilometer. The attenuation constant for the simple circuit was therefore 0.06 (at 900 periods). Consequently, by insertion of the coils, the inductance was increased 200-fold, and the attenuation constant reduced to one-sixth. As a result of this large reduction in the attenuation a considerable improvement in audition was to be expected, and did, in fact, result.

The experiments on overhead circuits were conducted on a line about 150 kilometers long between Berlin and Magdeburg. At every four kilometers distance on a two-millimeter line was inserted a coil of about six ohms' resistance and 0.08-henry inductance. On the completion of the loading the speech over this line was considerably louder than over a three-millimeter line. The installation of the coils was so arranged that at the poles where

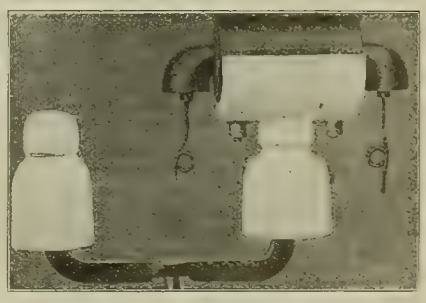


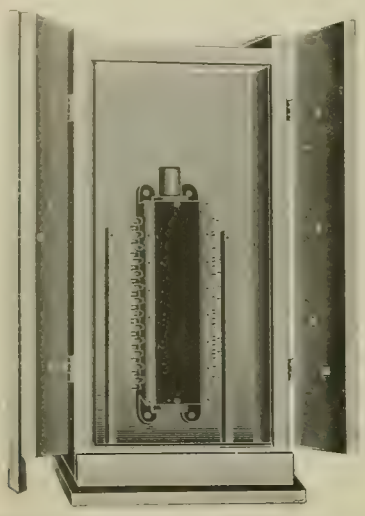
FIG. 2. PUPIN TELEPHONE LOAD COILS.—OVERHEAD ARRANGEMENT.

they were to be inserted double insulators were affixed, on one of which the coil had been mounted as shown in Fig. 2, and in this manner the alteration was effected without affecting the insulation of the line. In the course of this experiment it was discovered that each such coil must be provided with a lightning protector; this could have been so arranged that at both ends of the coil the discharge could be led to earth, but as actually erected the coils were bridged by a vacuum protector. The conclusion from this test was that for telephone conductors on Pupin's system one-quarter the weight of copper hitherto used will give the same efficiency, or, in other words, at least four times the distance can be covered by the same weight of copper.

Many of the citizens of Buffalo, N. Y., responded to neatly printed invitations sent out by the officers and directors of the Frontier Telephone Company of Buffalo to inspect the new Independent exchange at 332 Ellicott Street, on the afternoon and evening of March 10th. The exchange is one of the finest in the country.

Noblett Cable Box.

[illegible] fully realize the importance of a well-built, substantial cable box. In order to give the very best service to their customers, telephone companies and others using these devices require boxes that are absolutely watertight and able to withstand all kinds of weather. The cable box illustrated herewith, manufactured by the E. J. Noblett Company of Chicago, is said to be everything that



NOBLETT AERIAL AND UNDERGROUND CABLE BOX.

could be desired. It is made of 1⅛-inch finished lumber, and all joints are tongued, grooved and white-leaded. The doors are framed and the hinges and locking device bolted and riveted. Each box is painted with two coats of asbestos paint inside, and two coats of white lead outside. The company furnishes boxes with any make of terminal head. The Noblett boxes are said to be used by the largest telephone companies and are built for any capacity. They are guaranteed watertight. Some of the Noblett boxes have been in constant use for over 10 years, and are said to be still as efficient as when first put up. The company also supplies lock-nut cable terminals, lightning arresters and combination cable terminals and protectors.

Telephoning on Telegraph Circuits.

An apparatus known as the Grauel telegraphone has recently been successfully installed by some of the large steam-railroad companies and is being experimented with by other companies. The device is used to provide telephonic communication between a telegraph office and any point along a telegraph line, where a train or car equipped with suitable apparatus may be caught in an emergency and desire to communicate with headquarters. Connection is made from the car with the aerial wire by means of a metallic rod which looks like a jointed fish pole. By means of a ground connection a telephonic current is established in one direction or the other without making a loop in the wire and without interrupting the telegraphic circuit. The outer end of the rod by which the connection is made is formed into a hook which supports the rod on the telegraph wire. The telephone in the car or engine has positive and negative connections; and the one or the other of these is used according to whether it is desired to communicate in one direction or the other. By means of a magneto machine on the car, a current is sent which produces a buzzing sound in the telegraph relay at the offices on the line, and the operator, understanding this as a telephone call, responds by means of the telephone in his office. In some of the experiments the receiving current was so strong that the sounds received were audible in any part of the car.

Bravery of Telephone Girls.

At the recent large fire in Cincinnati it is related that the girls in the Telephone Exchange Building, across an alley from the burning Pike Building, were badly frightened as the dark clouds of smoke rolled about the building. The exchange rooms are on the top floor of a six-story building and the night force consists of eight exchange girls and the night manager, George Cappes. The girls pluckily stuck to their posts from 1:30 to 3:30 a. m., when the flames were blazing in their windows to such an extent that they were ordered out. Later they returned to their stations, and when the large day force of girls came on duty they fearlessly went to the sixth floor for work, although the fire waged all around them.

The City Council of Portland, Maine, after nearly an all-night session on Monday, March 2d, voted to give the Northern Telephone Company the right to erect about 800 poles on 125 different streets of the city and to build conduits about nine miles long for the purpose of installing an automatic telephone system.

Telephone Burglars in Chicago.

Telephone burglars constitute a new class of criminals for the police to contend with. Heretofore the thieves have been content with breaking open slot-machine attachments and stealing the contents, but now they actually tear the instrument from the wall and flee with it. The first complaint of this nature was received recently at one of the Chicago police stations, and shortly after its receipt messages were sent to police stations throughout the city warning the police to be on the lookout for "telephone burglars." Following the message was the description of a telephone and receiver removed from the wall in the establishment of Arthur Franke, 1800 North Clark Street. When the proprietor appeared at his place of business in the morning he was surprised to see the wires dangling from the wall in his office where his telephone had been. He was unable to account for the loss until later, when he discovered a rear door broken open. Further investigation revealed the fact that other goods, the total value aggregating $200, had been taken by the thieves. The screws and attachments holding the telephone had been neatly removed and the wires were not damaged.

Improvements in Colorado.

The Colorado Telephone Company, with headquarters at Denver, has made arrangements for extensive improvements to be made this year. The line will be extended to many points throughout the state, many old buildings will be replaced by new ones, and new and modern appliances will be installed. The switchboard that is being put into the new building at Denver is of the latest type. It is said that a fund of $1,000,000 has been provided to make extensions and improvements. At a recent meeting of the stockholders the following-named officers were elected: President and general manager, E. B. Field; vice-president, Alonzo Burt; treasurer, Edward B. Field, Jr.; secretary and auditor, H. W. Bellard.

GENERAL TELEPHONE NEWS.

A German company has recently installed a telephone system at Hanauk, China.

R. W. Storrs has been granted a franchise for the construction of a telephone system at Defuniak Springs, Fla.

The Crescent Telephone Company has been organized at Joslin, Ill., where a telephone system will be operated. The company has a capital of $12,500.

The Southern Bell Telephone Company, Jacksonville, Fla., will expend $30,000 in improving its system. The switchboard will be enlarged to 1,800 numbers.

Nampa, Idaho, having raised the guarantee required by the Boise Independent Telephone Company, is now having telephone connections made by that company.

The Coeur d'Alene Telephone Company, organized to place a telephone system in Wallace, Idaho, in opposition to the Bell, was to meet on March 9th to let contracts for construction.

Bureau County, Ill., is to have a telephone system. J. J. Stauffer, B. Monson and A. L. Martin are the incorporators of the company, which is to be known as the Bureau County Mutual Telephone Company.

A telephone cable connecting the lower mainland of British Columbia with Vancouver Island will be laid by the New Westminster and Burrard Inlet Telephone Company. This work will cost about $175,000.

A telephone line will soon be constructed from Springwater to Salem, Ore. The line will be erected and owned by a company at Dallas, of which Samuel Phillips is president, and J. R. Shepard, secretary and treasurer.

The Montana-Wyoming Telephone Company will meet at Billings, Mont., on April 4th, for the purpose of increasing the capital stock from $40,000 to $100,000. The increase is to make improvements and extend the company's lines.

The Grant County Telephone Company of Silver City, New Mexico, is preparing to install a telephone system in Douglas. Work will be commenced in a few days on a line from Silver City to the Lyons-Campbell Cattle Company ranches, a distance of 35 miles.

The Westerly Automatic Telephone Company of Westerly, R. I., has petitioned the Legislature for right to increase its capital stock from $25,000 to $100,000. The affairs of the company are in a prosperous condition, it is said. Preparations are being made to extend the system, and it is predicted that by next summer the company will have at least 300 subscribers on its exchange list.

At a recent meeting of the Senate judiciary committee of the Illinois Legislature the bill of Senator John Humphrey of Chicago giving telephone companies the right of domain and also giving them power to use any highway, street or alley for their poles was reported out with a favorable recommendation. The bill also provides that telephone wires can be strung across railroads or street railways if they are 25 feet above the rails.

NEW COMPANIES.

M. H. Wright is interested in a company which has been granted a franchise to install a telephone exchange at Odon, Ind.

Buckhannon, W. Va., is to have a telephone system to be installed by the Upshur Telephone Company with a capital stock of $25,000.

The Monroe Mutual Telephone Company will install a telephone system at Greenville, W. Va. The company has been incorporated with a capital stock of $8,000.

Farmers in the vicinity of Watson, Ill., are to have a telephone system. A company has been organized, to be known as the East Watson and Gilmore Rural Telephone Company.

The Pittsburg Financial Company of Pittsburg, Pa., capitalized at $1,000,000, has been incorporated to maintain and operate telephone and telegraph lines by William McKinely and Frank Haskell of Pittsburg.

The farmers near Abilene, Kan., have formed a mutual co-operative telephone company, and sent for a switchboard. They have already 25 farms connected with the lines, and expect to have over 100 by the first of April.

The Upsher County Telephone Company of Buckhannon, W. Va., has been incorporated with a capital stock of $25,000. J. W. Downs, C. E. Downs and G. V. Downs of Buckhannon, and others, are interested in the new company.

The York Eastern Telephone Company, with headquarters at Gatchelville, Pa., and a capital stock of $8,000, has been incorporated. The directors of the company are A. M. Grove, M. H. McCall and others. The treasurer is H. S. Merryman of Fawn Grove.

The West Shore Home Telephone Company of Catskill, N. Y., has been incorporated to operate in Ulster, Greene and Albany Counties. The capital is $10,000, and the directors are S. R. Rawson and J. M. Brush, Elyria, Ohio, and Howard Hendrickson, Albany.

MANUFACTURERS AND DEALERS.

The W. J. Barr Manufacturing Company of Cleveland has been incorporated, with a capital stock of $10,000, for the purpose of manufacturing and selling all kinds of telephone apparatus and appliances. W. J. Barr, T. E. Barr, W. F. Atterholt, J. W. Burrell and W. E. Patterson are the incorporators.

The Eureka Electric Company and the Advance Electric and Telephone Company, both of Chicago, have been consolidated with a total capital of $150,000, and will remove their factories to Genoa, Ill. Bids will be received for the erection of a two-story brick building, 96 by 225 feet, of mill construction. About 40 new houses, required for employes, and other buildings will be erected.

The Farr Telephone and Construction Supply Company of Chicago has issued its new catalogue (No. 16) for 1903, which contains in its 64 pages about 500 illustrations of telephones, parts, tools, supplies, etc. Pictures are also given of the company's plant and offices. The Farr telephones of the series, bridging, intercommunicating and other types are given special attention in the catalogue.

The New York Commercial Advertiser says: "It seems that after the adjournment of the directors of the Western Electric Company, who met in Chicago recently to declare a stock dividend of 20 per cent., it was learned that the gross business for the year exceeded $29,000,000, and that of the telephone estimate for new work in 1903, calling for at least $38,000,000, probably only $25,000,000 would be spent during the year."

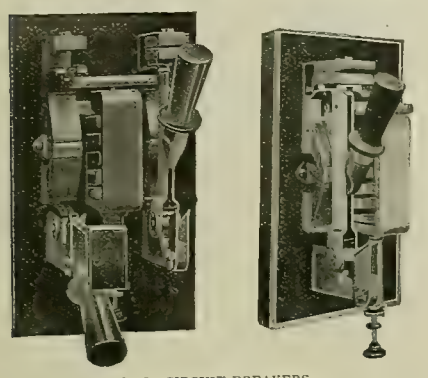
The Stromberg-Carlson Telephone Manufacturing Company of Chicago has recently shipped boards of various capacities to the following-named companies: Texas Construction Company, Port Arthur, Texas; Home Telephone Company, Waverly, Ohio; Twin City Telephone Company, Minneapolis, Minn.; Northern Indiana and Southern Michigan Telephone and Telegraph Company, Centerville, Ind.; Fort Wayne Electric Works, Fort Wayne, Ind., and the Inter Lake Telephone Company, Canandaigua, N. Y.

Eight months ago Frank B. Cook decided to embark once more in the manufacture of protective devices, distributing boards and cable terminals. He secured quarters at 240-244 West Lake Street, Chicago, and four months ago was ready to accept orders. Since that time he has accepted and filled orders or now has in work orders for a large amount of his goods. Prominent among his orders are 62 cable terminals and protectors for the Kinloch Telephone Company of St. Louis, 295 pole-top terminals and 18,000 tubular line fuses for the Home Telephone Company of Los Angeles, Cal., 19,500 pairs of protectors with No. 4 main distributing boards for the Automatic Electric Company; also orders from the North Electric Company for distributing boards and protectors; the Kellogg Switchboard and Supply Company, for 9,000 pairs of protectors; the Stromberg-Carlson Telephone Company, large orders for No. 4 distributing boards and protectors, among several exchanges. Many smaller orders were also received, requiring a total for all orders of 110,000 heat coils, 240,000 carbon-arrester plates and 61,000 tubular line fuses.

G. I. Circuit-breakers.

The General Incandescent Arc Light Company of New York being one of the largest switchboard manufacturers in the country, and having occasion to use a great number of circuit-breakers on its various installations, it was a natural course of events for the company to design its own circuit-breakers. The company's experience with circuit-breakers has been quite varied, as every type of circuit-breaker on the market has been installed by it at various times, so it was in a position to produce one of the best circuit-breakers on the market.

The company investigated the laminated-contact types of circuit-breakers and found the trouble did not lie in the laminated contacts themselves, but existed in the method of shunting the current around them when the circuit was open. It was discovered, in order to do this effectively, it was necessary to



G. I. CIRCUIT-BREAKERS.

have a shunt of very low resistance, and this could not be done in any manner other than by a metallic shunt, supplemented by a carbon shunt, so that the circuit was thereby successively opened, first, by the laminations, and then through the metallic shunt, and then, finally, by the carbon shunt. The present construction of the G. I. circuit-breaker has demonstrated the above principles to be correct by most tests on railway circuits by short-circuiting the breaker across the line repeatedly. Under such tests or in practical service there is said to be absolutely no arcing at the laminations. The G. I. circuit-breaker, after it operated under repeated short-circuit a great number of times, showed no deterioration, excepting a slight pitting of the carbons, due to their burning away under the heat of the arc.

In a laminated contact every portion of the surface of contact is made available for carrying current, whereas in knife-blade contacts the surface of contact is very much less than the total surface available. This defect, if it can be called such, in the knife-blade contracts is simply due to the fact that two plain surfaces cannot touch each other at all points, unless they are ground absolutely true to a plain surface, but this is impossible in the construction of knife switches, as the flexibility of the clips and the heating of the parts all tend to destroy the perfection of contact.

The G. I. company has, therefore, adopted the laminated form of contact exclusively in all of its circuit-breakers of whatever size, ranging from 25 amperes up to 12,000 amperes. The company has made circuit-breakers of all sizes between these limits, and has found the laminated form of contact to be the ideal method, when it is protected by a shunt described above, and when the arc is finally drawn on carbon contacts.

The laminated contacts always exert an effort to release themselves, and thereby open the circuit, whereas the knife-blade contacts do not tend to open themselves, but actually tend to hold themselves shut. The accumulation of dust on knife-blade contacts acts very effectively in preventing them from being opened, except by a very strong initial hammer blow or effort overcoming what might be called the "friction of rest." The laminated form of contact, on the other hand, requires no effort of any kind, much less a hammer blow, to start it to open the circuit. The G. I. circuit-breaker has its laminations mounted entirely independent of the rest of the apparatus, so as not to be a drag on the moving parts, the laminations being supported on a bearing, which is equipped with a spring assisting to throw the laminations open. The device is held closed by means of a latch, which is practically frictionless. When the circuit-breaker operates the latch is released with a minimum pressure.

Great Electric-railway Project Discussed.

The talked-of electric railway to extend from Duluth, Wis., to the Gulf of Mexico, and which it is said will cost $70,000,000, is attracting a great amount of attention and comment. Just how far the project has progressed and what assurance there is of its being carried to completion cannot be definitely stated. It is said that the road will be double-tracked and that the route is to be through St. Paul and Minneapolis to Des Moines, thence to St. Louis and on to the gulf. The company is to be known as the Texas, Iowa and Minnesota Electric Railway Company, and such prominent names as John W. Gates, Thomas Lowry and W. B. Washburn are connected with the project, according to newspaper report.

Platinum.

The constantly increasing demand for platinum in the arts and manufactures of the world and the present limited sources of supply have in recent years greatly enhanced the price of the metal. Because of the peculiar and valuable qualities of platinum it is believed that the consumption of the metal would be greatly increased if the supply were sufficient to lower the cost materially.

Contrary to popular impression, platinum and associated metals are widely distributed, although they have thus far been found in paying quantities in but few localities. This condition is perhaps largely due to the higher intrinsic value of gold and to the limited acquaintance of prospectors and miners with the means of identifying platinum ore and of its economic separation. Up to the present time, the platinum of commerce has been obtained entirely from alluvial deposits, although it has been reported in limited quantities in situ. About 80 per cent. of the present supply is derived from the alluvial deposits of the Ural Mountains, but there are few, if any, of the gold-bearing gravel beds of the world that have failed to yield platinum, and it is more than likely that large quantities of platinum ore have been thrown away with the black-sand washings from gold-placer deposits. The distribution of the ore may, in fact, be regarded as practically coexistent with gold-placer deposits, as is evidenced by the following list of localities, excepting Russia, that have yielded ore in varying quantities: In California in nearly, if not all, of the gold-bearing gravel and sands; in Oregon, Georgia, Alaska on the Yukon River, Canada, British Columbia, Mexico, Colombia and Brazil, South America and Australia.

The genesis of native platinum is not well understood. In two cases the metal has been reported as found in quartz veins, but these reports have never been verified, and are open to grave doubt. The undoubted occurrences of platinum in situ are in Russia, Brazil, New South Wales, Canada, and Colombia.

Platinum ore is usually found in the form of rounded or flattened grains or "sand," occasionally in irregular lumps of the size of peas; large nuggets are very rare—the largest as yet found weighing 21 pounds.

The ore has a metallic luster, and is distinguished by its steel-gray color, shining light-gray streak when rubbed on a hard white surface, high specific gravity (16 to 19), malleability, infusibility in the hottest blast furnaces and insolubility in any single acid. It is not affected by borax or salt of phosphorus before the blowpipe, except in the finely divided state, when reactions for iron and copper may be obtained. It is soluble only in hot nitro-hydrochloric acid (aqua regia).

Platinum ore is a complex body, consisting of the metal in combination with varying proportions of the other members of the platinum group, such as iridium, rhodium, palladium, ruthenium and osmium, together with from four to 20 per cent. of iron. In alluvial deposits, the ore is generally associated with iridosmine (a native alloy of iridium and osmium possessing a degree of hardness superior to that of hard-tempered steel), magnetic-iron sand, chromite, garnet, epidote and often with zircon, serpentine, ilmente, peridot, quartz, diamond and chrysolite. Russia is the only country, excepting possibly New South Wales, that at the present time mines platinum ore for itself alone.

In the former country the platinum-bearing sand is found at depths of between six and 40 feet, the "pay streak" averaging less than a foot in depth, resting directly on serpentine bedrock. In New South Wales the "pay streak" is from 60 to 150 feet wide and underlies a loam bed 60 to 70 feet deep, the ore occurring in the crevices of the bedrock and in the gravel resting thereon.

The method generally adopted for extracting the ore is to pass the sand and gravel with water through puddling machines or revolving conical screens; the platinum and fine sand pass through into sluice boxes beneath, while the coarser materials are discharged at one side. The contents of the sluice boxes are washed in the usual manner, and when gold is present in paying quantities it is removed by amalgamation with mercury, the platinum remaining behind. Experience shows that it is seldom profitable to work mines yielding less than three grams of platinum ore to the ton of gravel. The average yield of the richest Russian mines is about six grams per ton.

The refining of crude platinum is a difficult operation to perform, and requires apparatus and experience not generally available.

The platinum nugget illustrated full size herewith is undoubtedly the largest ever found in this hemisphere. It measures approximately three by 2¾ inches and weighs nearly two pounds. It was shipped to Baker & Co. of Newark, N. J., the well-known platinum refiners, from the western coast of South America in February, 1897, but the facts appertaining to its discovery and early history are obscured by reason of repeated transference of ownership.

A recent report is to the effect that large deposits of platinum have been discovered on the River Gusseva, a tributary of the Issa, in Western Siberia. It is stated that there are now on the field many miners who have been digging very industriously and have secured a large amount of platinum before police restrictions could be effective. It is believed that the new mines will be able, when properly worked, to supply a large amount of this valuable metal.

LARGEST PLATINUM NUGGET FOUND IN THE WESTERN HEMISPHERE. (NATURAL SIZE).

What Mr. Tesla Is Said to Have Said.

In a floating newspaper paragraph Nikola Tesla is thus reported: "The wireless telegraphy plants you may have seen are but networks of flimsy wire. We are not doing anything of that sort here at Wardenclyffe. We are building for the future. It will be some time before our preparations are complete, but when we are ready we will be able to accomplish what we desire. We shall not be handling a plaything. It will be something for business. I do not believe that messages can be transmitted without wires for more than 50 or 60 miles without the use of the principles which I have patented throughout the civilized countries of the world. By the use of my system you will be able to put an instrument in your house and talk to anyone who has a similar apparatus anywhere in the country without any metallic or artificial connection."

New Supply of Guttapercha.

Guttapercha trees of a very good quality have just been discovered in abundance in German New Guinea. These are said to yield an excellent quality, equal to "gutta merah" and the other finer grades. Samples sent for analysis to Germany are now undergoing a detailed technical investigation. It is already being predicted that in future German New Guinea will supply the trade with appreciable quantities of guttapercha, which will be welcome news to the cable industry, the supply of the better qualities having steadily declined. Mr. Oldemeyer, the discoverer, secures the prize of $750 offered by a Bremen merchant to the explorer finding a wild gutta plant in any of the German colonies.

The Economic Value of Testing.[1]

By George D. Shepardson.

In June, 1900, the writer had the honor of presenting to this association a paper on "Why Some Municipal Plants Do Not Pay." The title of the present paper might well be "Why Some Plants Do Not Pay Better." The aim is to show that it would be a capital investment to put more money into buying accurate instruments and to have men competent to use them.

The shrewd manufacturer desires to know not only whether he is conducting his operations about as economically as do others, but he wishes to know whether he is working as efficiently and as economically as possible. He is not satisfied to earn a 10 per cent. dividend because that may be the average performance of his neighbors, but he wants to know whether he can raise that 10 to 15 or to 30 per cent. In order to accomplish this, he must have detailed information about the actual working of his plant. He must know whether he is using the cheapest fuel, all things considered; whether a given amount of fuel is evaporating the greatest practicable amount of water; whether the steam is reaching the engine with best pressure and dryness; whether the engine is in best condition to utilize the steam; whether the transmitting system and the dynamos are in proper condition; whether the switchboard instruments are accurate; whether the lines are in good condition, properly proportioned for the load actually carried, properly connected and properly insulated; whether the regulation pressure or current is the best obtainable; whether the meters are accurate; whether the consumers' wiring, lamps, motors or other apparatus are in proper condition; whether the globes, carbons and adjustment of arc lamps are the best for the purpose; whether consumers are getting the proper quality and quantity of light at proper cost; whether an increase or decrease in the payroll would favorably affect the balance sheet; whether all parts of the system are properly protected against liability to accident.

Information such as outlined can be obtained only by testing. Where one man is superintendent, engineer, fireman, operator, lineman, trimmer, wireman, meter man, collector and general trouble man, the amount and quality of testing is necessarily limited. The larger companies find it practicable and economical to maintain an elaborate testing department with one or more experts who devote their chief energies to systematic examination of all the parts of the business, seeing that everything is kept in the best possible condition. The testing department should be developed with discretion. It would probably be a paying investment for almost any company to engage an expert engineer to examine its property for the purpose of pointing out sources of loss. This might at first be only a preliminary and casual examination which would indicate the more obvious losses.

In most stations, the testing can be done with reasonable satisfaction by the regular employes without seriously adding to their duties or responsibilities, and without imposing an alarming expenditure for equipment. When the necessary apparatus is installed ready for regular use, the ordinary employes can take the readings after a small amount of instruction and with proper care. The instruments should be checked at intervals, not more than a year apart, by comparing them with other instruments known to be correct.

Too much importance cannot be given to frequent and thorough inspection of the entire system by the superintendent or by some other person whose eye will notice apparent defects. An example may be noted where a 220-volt plant was so heavily overloaded that the owners were about to install larger machines. A young man who had not yet completed his technical course at the state university was sent to look over the situation; by careful inspection he was able to locate poor insulation. After overhauling the lines, he increased the number of lights installed by about one-third, and even then the load was one-fifth less than before his arrival. In the same plant, by the careful use of a portable voltmeter, he was able to locate a number of bad splices and to show where the circuits should be strengthened with greatest profit.

Every engineer recognizes the prime importance of feeling his bearings to detect any signs of undue heating. The electrician can also detect poor electrical bearings in similar manner. Dynamo operators make a practice of feeling various parts of their machines to see that the brushes, holders, studs, switches and other contacts make good connection and keep cool. The same vigilance should extend to the switchboard. Poor service due to excessive drop in the lines may frequently be traced to loose and poor contacts in switches and fuse blocks. Unless the fuses have hard terminals, they expand and squeeze out from under the screws and then become loose. The insurance rules call attention to this point, but fail to note that the screws in the switches as well as on fuse blocks work loose and often introduce so much resistance as to lower the voltage quite appreciably. In such cases, local heating always occurs, unless the circuit becomes opened entirely.

Flexible cables often heat excessively when soldered into terminal lugs, due to the fact that the individual wires were not properly cleaned and tinned before soldering, so that only the outside layer of wires are connected, and these have to carry the whole current.

An occasional inspection of fittings and conductors at time of full load will often locate unsuspected sources of trouble.

One of the first sources of loss may be found in the boiler room, where the fuel may have been exposed to the weather and is in poor condition for use. The appearance of the smoke will indicate something of the quality of the firing. In one case the correction of leaky boiler settings and insufficient stack, which had affected complete combustion, effected a saving of 20 per cent. of the fuel bill.

In another case, proper cleaning of the feed-water heater and of the boiler cut down the fuel consumption by 30 per cent. Grates not suited to the fuel, poorly proportioned grate area, poor boiler setting, poor draft, poor water, cold feed water and dirty flues are, as a rule, discoverable by the skilled eye without many instruments. Periodical cleaning and inspection of the boiler will increase efficiency and diminish accidents. Steam gauges are not uncommonly inaccurate. Track scales for weighing fuel and ashes, thermometers for checking temperature of feed water, are of great importance, and the meters or tanks for measuring the amount of water evaporated will generally pay for themselves. Insufficient covering of steam pipes may be detected by the eye and hand. Excessive drop in steam pressure between boiler and cylinder will appear from the indicator card or from the difference between pressure gauges at boiler and at engine. A calorimeter for determining quality of steam is neither expensive nor very complicated in operation. The intelligent use of the indicator will detect improper setting or worn condition of valves. In one instance, poor valve setting increased the fuel consumption 40 per cent.; the engineer had an indicator, but did not know how to interpret the cards nor how to apply the remedy.

Tests of several stations operated by one of the largest corporations in the West showed that the inefficient heaters in two stations were costing more than $2,400 and $2,500, respectively, each year of operation, and the saving effected by changes paid a good interest on the investment and went far toward the maintenance of the testing department.

Improper condition of the engine governor or uneven belt will appear in the unsteadiness of the lights. Dirty condition of the dynamo and improper setting of brushes, which are liable to induce trouble, will be detected by visual inspection. Poor regulation of voltage, one of the most frequent sources of trouble and loss, may be caused by speed variation, by improper compounding of generator, by inattention to the regulator and voltmeter, by overloading or poor design and construction of the circuits.

On the switchboard, the most common sources of loss are the integrating wattmeters and the voltmeters. In a surprisingly large number of stations the switchboard wattmeters are like snakes in Ireland; there are none. Correct integrating wattmeters are of the greatest importance for registering the output of the factory. By comparing the fuel consumption with the kilowatt-hour output, the superintendent has at once a means of determining the efficiency of his station operation. It gives him records for comparing his work from week to week, and thus for detecting serious changes in the efficiency of the station as a whole; it gives him the data for comparing the performance of his station with that of other stations and indicates how much improvement he may reasonably expect from his equipment; it gives him a means of noting any excessive discrepancy between station output and the energy registered by the consumers' meters; it gives him a means of comparing lamp breakage with service rendered, and so gives a check on poor lamps and on poor regulation; it gives him a record of the changes in daily, monthly and yearly load.

An interesting illustration of the value of station wattmeters was that quoted by Mr. Wirt before this association last January. During the year ending June 30, 1900, the station wattmeter showed 729,923 kilowatt-hours delivered to the commercial circuits, while the consumers' meters read in the aggregate only 309,001 kilowatt-hours, or 42 per cent. of the station output. This must have opened the eyes of the superintendent, for the next year the station wattmeter showed 671,006 kilowatt-hours, while the consumers' meters registered 393,223 kilowatt-hours, or 58½ per cent.; thus the paying load was increased while the station output was diminished. Another station reported a line efficiency of 75 to 90 per cent., showing a still better performance.

Care needs to be taken that the station wattmeters are properly installed and are properly calibrated. Station wattmeters are sometimes affected by the magnetic fields due to bus-bars or other sources; sometimes the jar makes them run fast. Direct-current instruments may be checked by ammeter and voltmeter without difficulty. With alternating currents, it is necessary to get a non-inductive load, such as a bank of incandescent lamps, or else to have a correct wattmeter for checking purposes.

When the station is not supplied with wattmeters the lack may be partially offset by readings taken every half hour from the switchboard ammeters and voltmeters. From these the output of a direct-current station may be computed from hour to hour and for the whole run. It is desirable to supplement the daily or hourly wattmeter readings by the voltmeter and ammeter readings. In an alternating-current station the product of volts and amperes will generally be greater than the true watts delivered. In any station it is desirable to preserve a record of voltage, either by readings every half hour, or, better yet, by a continuously recording voltmeter.

The consumers' wattmeters naturally come in for consideration at this point. It is now generally recognized that all customers should be on meters. Flat-rate customers almost invariably have the best of the company. The rates are generally lower than meter rates; customers have little incentive to economical use of current. One notable case maintained for seven years a flat rate of $1 per month for each residence, irrespective of number of lights. In one case the load was reduced 50 per cent. by compelling the use of meters, thus allowing the taking on of additional load without increase of equipment other than meters. Experience shows that the reduction of load by changing to meters does not involve a corresponding decrease in revenue.

Wattmeters need to be purchased with some discretion, and need to be tested for accuracy at least once a year. They should in every case be tested before being placed in service and when changed from one location to another. It is a practice of some makers to calibrate meters in a quiet place free from vibration. If the meter is placed in the business section of a city, where the whole ground is continually trembling from the traffic and other disturbances, it will be likely to run fast, and may even creep on no load. Nothing so shakes a consumer's confidence in meters as to find that his runs when all lights are cut off, and the most persuasive and hypnotic trouble man will have difficulty in convincing him that it is all right. The meter should be tested in a place where it will be subject to as much vibration as when in service. Some meter manufacturers have learned that in the average station the meters are rarely, if ever, cleaned; they therefore set them to run a few per cent. fast when new, on the assumption that they will slow down in a short time and will then more than make up for early overcharges. That this is no dream will be attested by every meter man. The available instances of slow meters would fill much space. Many consumers suspect meters of running fast, though the truth is that it is far more common for them to run slow, and so to favor the consumer. It is not uncommon to find meters that do not start unless several lamps are burning, and then run slow on full load; as the average small consumer ordinarily has but a small part of his lamps in use at once, the total loss through failure of meters to start, and through their slowness on full load, is not inconsiderable. Some cases are reported where a small residence meter would not start on less than six lamps; another would not start on four lamps, and was over 40 per cent. slow on full load. In one of the largest power plants in the country, and which has been in operation several years, the new superintendent was led to suspect the accuracy of the wattmeters. These were marked "multiply by five," but he found the correct multipliers to be above 20. "One customer had been running a 36-horsepower motor at full load and had been paying for five horsepower."

One superintendent reports that when he took charge several years ago, it was quite common to find monthly meter charges of only a few cents, even in winter time; since cleaning and correcting meters, and establishing a minimum monthly charge, the improved financial showing has earned his salary several times over.

It seems not uncommon to find meters running from 10 to 40 per cent. slow on full load, and requiring considerable load before starting. Most stations would increase their income by using meters with greater accuracy at small load. In many cases this can be accomplished by using smaller meters. By using induction meters on alternating-current circuits, the light-load registration has been greatly improved. It is desirable to have all meters of the same kind, especially in smaller stations which cannot afford to keep a meter specialist. Cases are reported where customers buy their own meters, and where every different kind of a meter on the market adds to the trials of the superintendent; it is needless to say that choice of meter, and preferably the ownership of same, should rest with the company.

Meters should be cleaned and tested at least once a year. This should be done during the summer, both because the station men have more time, and because the lighting bills are so small that consumers do not notice the change. No sane meter man would choose December as a proper time to clean a meter that was found to be 40 per cent. slow.

Good voltmeters are even more essential than station voltmeters. The ammeters may be only current indicators, and their accuracy is of small secondary importance. But a good voltmeter, properly used, is vital to the satisfactory operation of the plant, and it should be accurate within at most one per cent. The voltmeter is the gauge by which the pressure is regulated, and proper regulation is the measure of satisfactory service. The voltmeter should not only be accurate in itself, but it should indicate the voltage at the main center of distribution, or at the point of important consumption. This may be accomplished by bringing pressure wires back to the station, or by using some sort of compensating device which will correct for drop in the lines.

On an alternating system it is very much better to bring the pressure wires back through a secondary circuit. Then, in regulating, you take care not only of the drop on the lines, but also take care of the

1. Paper read before the Northwestern Electrical Association at Milwaukee, January 22, 1903. The author is professor of electrical engineering at the University of Minnesota.

transformer drop. If you regulate for secondary voltage, it is not so essential that the transformer should regulate so closely as would otherwise be necessary.

Good station instruments should be supplemented by accurate portable instruments, by which to test conditions prevailing on the circuits. Good portable instruments are as essential as those in the station, if close regulation is to be attained.

The importance of close and correct regulation of voltage is not sufficiently appreciated. Lamp makers have insisted for years that the life of a lamp is greatly shortened by excessive pressure; that an increase of three per cent. above normal voltage cuts off the life of an incandescent lamp by one-third, and that an increase of six per cent. in voltage takes away about seven-tenths of the life of the lamps. High pressure not only shortens the life of the lamps, but it educates consumers to expect 30 to 50 candlepower from a 16-candlepower lamp, so that much dissatisfaction follows the correction of the voltage. Moreover, high pressure increases consumers' bills out of all proportion, an increase of 10 per cent. in the pressure causing an increase of more than 20 per cent. in the watts taken by the lamps, while the cost of lamp renewals is appalling. Low pressure is almost as bad as high pressure, for while the lamps last much longer, they give so poor light that the people resort to oil lamps, candles and anathemas.

Excessive high or low pressure is often experienced in various parts of the system when the station operator believes that the pressure is normal. The station voltmeters frequently read low, so that the pressure is actually higher than indicated. Reports at hand show station voltmeters reading from one to 20 per cent. low, only a very few reading too high. The general tendency is for ammeters and voltmeters to read low as they age. Comparatively few stations seem to be provided with portable voltmeters. These are essential for checking line losses and distribution of load. No matter how skillfully the circuits may have been designed, the load is sure to change from the conditions assumed; some circuits will be overloaded, while others are light. The result is the drop varies in different parts of town and at different hours in the day. Poor service means dissatisfied customers and slow increase of business. The use of a portable voltmeter will show what lines have too high voltage, what ones are too low; by a systematic study of the situation the causes may be located. A few cases may be cited to illustrate. One company was renewing about 1,000 lamps per month, about one-tenth of the entire number installed, on account of poor regulation caused by improper balancing of load on the different feeders, and by not tying secondaries in the business district. Another case of poor lights was located by a portable voltmeter showing 128 volts where 110 was intended, the trouble being traced to some intelligent wireman who connected service wires to the pressure wires running back to the station. Poor service on a secondary four blocks long, with a transformer at each end, was found to be due to the blowing of the primary fuses of one transformer. Other cases of poor service were traced to poor splices, not soldered, but carefully taped, to small mains, to improper interior wiring. In two adjacent stores connected to the same transformer the full-load voltages were found to be 93 and 102 respectively. In a three-phase plant with power house five miles from town a voltage variation of 15 per cent. in different parts of the town on moderate load was corrected by transferring part of the load to other legs of the circuit, by installing heavier transformers and heavy secondary circuits in the crowded district and by moving the smaller transformers to the thinly lighted districts. When my informant took charge of this plant there was no portable voltmeter in the county, and the only station voltmeter was five miles from the load. The purchase and intelligent use of a portable voltmeter quickly indicated the causes of dissatisfaction, and the remedies became plain.

A supply man reports a case where the incandescent lamps were not giving satisfactory life; queries about the regulation were always answered that the regulation was first class and that the lamps gave good light. A personal visit developed that the engineer had no voltmeter at all and did not wish any, for he could tell by his eye when the lamps were at proper voltage. As a corroboration of his judgment, the supply man tried his voltmeter, and found that the 104-volt lamps were operating at 116 volts.

One superintendent reports his success in determining the distribution of his load by putting a maximum-demand meter into the primary circuit of transformers or into branches of secondaries. By moving this instrument from place to place, cutting it in at the fuses or wherever convenient, he is able to locate the causes of dim lights.

The importance of testing all transformers before putting into service, and of testing them occasionally when in service, was emphasized so clearly in Mr. Wirt's paper last January, that the paper is heartily commended for consideration. Poor insulation has cost many a station most of its profits through damage suits; excessive iron losses give abnormal dead loads; poor regulation causes excessive lamp breakage, generally unsatisfactory service and slow growth in business.

The importance of testing the incandescent lamps was well brought out in Mr. Williams' paper before this association in June, 1901. Since many conflicting statements are made by lamp agents, each of whom has positively the best lamp on the market, and, in fact, the only one that an up-to-date station can afford to use, the only wise thing to do is to make tests, or to secure the results of impartial tests made by others. Many central-station men are suspicious of photometers, feeling that only experts can use them correctly. As a matter of fact, it is far simpler than an engine indicator, and with a good voltmeter and careful operation, will easily give results reliable within two per cent. It is also an open secret that lamp makers are apt to furnish a more uniform selection of lamps at the same rate to stations known to have photometers for testing, and that they dispose of irregular stock to stations which do not know whether they get what they want or not. (This is not saying anything against the lamp men, for if they do not dispose of irregular products profitably, the cost of good lamps must increase accordingly.) As an example, a recent test of 35 lamps furnished to a station without a photometer, showed only six out of 35 which came between 13½ and 17 candlepower, the others ranging all the way from nine to 20 candlepower. Remarkable tales are told of the performance of bargain lamps sold by drug and department stores where the stations do not furnish renewals free or at a cost below competition.

The importance of close regulation of voltage is emphasized at almost every electrical convention, yet poor regulation is one of the most common faults in station practice. A recording voltmeter on an important feeder from one of the largest stations in the Northwest, and operated by one of the large syndicates, shows a pressure fluctuating from 112 to 140 volts on a secondary supposed to give 110 volts. The effect on the lamps and on the cost of lamp renewals may be imagined. Photometric tests of 45 lamps from one building served by this feeder showed a range from 4.1 to 15.7 candlepower, with efficiencies running from 3.27 to 7.7 watts per candle, the lamps having been bought for 16 candlepower at 3.1 and 3.5 watts per candle.

In securing equipment for methodical testing, it is well to keep in mind that satisfactory service is more important than efficiency, for "the better the service, the more customers; and the more customers, the cheaper the cost of production." The most important testing instrument, therefore, is a portable voltmeter, known to be accurate within one per cent. With this the station voltmeter can be tested and then be retained, corrected or replaced. The engine indicator is of next importance, for it is most likely to locate causes of poor economy. With this should come a tachometer or a speed indicator. Then should come scales for weighing fuel, switchboard wattmeters for each class of circuits. Then a portable ammeter, accurate within about one per cent., for measuring direct currents; this may be a "round-pattern" instrument, provided with a number of shunts from one ampere up, so as to obtain a variety of ranges; for alternating currents, an ammeter about 15-ampere capacity and one about 50 or 100-ampere capacity, will generally answer; then add water meters and thermometers and calorimeter and pump register; then add photometer, recording voltmeter; then for an alternating-current station add two or more wattmeters, one for testing watt consumption of incandescent lamps, and one for testing meters, motors and arc lamps. There is a difference about the relative importance of the instruments, and the order in which they should be secured, but the above order will be about right. The cost will vary with quality and size, but will be somewhat as follows:

Portable voltmeter	$30 to $80
Steam engine indicator	25 to 75
Speed indicator	1 to 3
Or tachometer	55 to 80
Platform scales, 1,000 lb	28 and up
Or floor scales, 1,000 lb	45 and up
Switchboard wattmeter	15 and up
Portable ammeter	15 to $80
Water meter	10 and up
Thermometers	1 and up
Calorimeter	20 to $40
Photometer	15 to 300
Recording voltmeter	60
Portable wattmeters	40 to 90
Two handbooks	10

The question of the extent to which a station of moderate size should afford to maintain regular testing is an open one. A consulting engineer of excellent reputation, who has been helping better the performance of central stations, says: "My procedure is to get the owner to mail me daily an hourly record of coal consumption, feed-water consumption and kilowatt-hour output as measured by the integrating wattmeter; also kind of coal, temperature of water, steam pressure, and any readings of ammeters, voltmeters, indicating wattmeters, steam-indicator diagrams, etc., which would affect the economy of operation; also a daily record of load factor as measured by wattmeter, that is, the ratio of average load to maximum load for one hour. By preparing an hourly record, operators get down to business and educate themselves on the subject of pounds of coal per kilowatt-hour. I will not take charge of a station using old-style or 133-cycle transformers or any decidedly inefficient apparatus, nor unless there is provided a Weston voltmeter in reserve, an indicating wattmeter, thermometers, a cold-water meter, coal scales, an engine indicator, a counter on pump, and keep these instruments calibrated. The monthly financial statements must also be furnished. Some of the results now obtained are excellent, and the improvement most satisfactory. Systematic cleaning, inspections, tests and hourly records are, to my mind, necessary to pay maximum dividends."

All agree that the best men available should be secured to superintend and to do the work about the station and on the lines. Where it is difficult to employ men who will keep sober enough to work six days in a week, it is, of course, difficult to secure the best results. The long hours required of station employes and the small salaries paid drive many good men into other lines, so that it is difficult under present conditions to keep them. This association might well consider the desirability and feasibility of adopting an eight-hour day for station employes instead of the 12-hour day required in most 24-hour stations, and the 18-hour day frequently required in stations which do not give continuous service.

We are often invited to recommend men for central stations, and the new graduate from a technical course is attracted to station work. There are opportunities there for a good man, but when they get out and find they have to work from 12 to 20 hours a day for seven days in a week and no let-up at all except in the summer time, they find it a pretty serious proposition, and unless the opportunities for advancement are unusual, you will find that the better class of technical graduates are going over into the factories, in with the construction engineers, and that they are going into the station operation less and less frequently. Now, it seems to me that that is unfortunate for the central-station people. My students have been going less and less frequently for several years into station work, and it is because of the long hours and the slow rate of promotion and low wages which they get as compared with the wages that they can get elsewhere. I am not here making a petition that you go after technical men, because the demand for college graduates exceeds the supply very greatly. I think in the last 12 months I have had fully six times as many applications for graduates as our last year's graduating class numbered, and there is no occasion whatever to beg for jobs; but looking at it from the standpoint of station operation, it seems to me that if the station man could make the condition of the employes more like those obtaining in other lines of practice, they would secure a better class of men for operating in the stations, and these men would stay longer with one concern.

The extent to which testing facilities should be provided and used is largely a matter of judgment. If the station is small and the employes are ignorant and careless, they will do little accurate testing; on the other hand, they will take more interest in their work and will improve the operation if they are required to keep records. In a larger station there is better opportunity to keep more accurate and detailed records. The writer has failed to find a large station where the superintendent, or those under him, did not recognize the desirability of better testing and records. Some men seem to believe that testing is of purely theoretical interest. Some seem to believe that testing is a good thing for some other company. Others believe that it might possibly be to their advantage to do more testing, and they hope that some time, when they are not so busy, they may be able to do it. It pays to do it now.

The Situation in Quebec.

There is at present every indication that the Quebec and Jacques Cartier Electric Power Company and the Quebec Railway, Light and Power Company will soon be amalgamated. The stock of the former company is controlled by American capitalists, while the latter is owned and managed by a number of Quebec citizens. A strong rivalry exists between these two concerns, with the result that the public has the benefit of cheap light and power service. The Quebec Railway, Light and Power Company, with its electric-railway service, the service to St. Anne de Beaupre and the waterpower at the falls of Montmorency, is a valuable asset. Nevertheless, the management has never yet succeeded in paying a dividend. The Quebec and Jacques Cartier Electric Power Company has made an offer to purchase the interests of the other company, but without success. Recently negotiations were entered into with a view to amalgamate the two companies, and are still in progress.

Electrical Course at Union College.

The electrical-engineering course at Union College, Schenectady, N. Y., has been reorganized under the immediate direction and supervision of Prof. Charles P. Steinmetz, the head electrical expert engineer of the General Electric Company. The conditions at Schenectady for an electrical-engineering school are unusually favorable, on account of the proximity and favorable disposition of the General Electric Company, whose works are open to the students. The complete course will give a thorough grounding in the fundamental principles and their application to all branches of electrical engineering, such as will enable the graduate rapidly to acquire the practical experience necessary to electrical engineering success. A post-graduate course in electrical engineering has been established, which will give advanced instructions, comprising many subjects, which, while of fundamental importance in the modern development of electrical engineering, are not taught by any college.

Mr. Ward on Space Telegraphy.

At the annual meeting of the Commercial Cable Company in New York last week General Manager George G. Ward spoke as follows of the possibilities of space telegraphy: "Admitting the recent transmission of a message across the Atlantic without wires, radical improvements would have to be made in its developments before wireless could possibly hope to meet the demands of trade and commerce and engage in successful competition with submarine cables. A good deal has been said and advertised about the many wireless systems for the last two or three years. As yet, there is nothing to show that messages can be transmitted without wires, even between short distances, with anything of the regularity, reliability, correctness and secrecy at any and all times of the day and night demanded of the existing telegraph systems and necessary for the protection of the customer's interest and the development of the telegraph business. Furthermore, the transmission of messages between the European and American coasts of the Atlantic is far from constituting a transatlantic telegraph service as it exists today. The essential adjunct of an extensive inland system for the distribution and collection of messages on the North American continent must not be lost sight of. Nothing has occurred since I last addressed you to cause me to modify the conservative estimate then expressed and which I confidently repeat, that telegraphy by means of wires has little to fear from telegraphy without wires. For the benefit of those who do not share my confidence I may say that the etheric waves will be as obedient to us as to anybody, if it should ever be found practicable to dispense with cables and wires. In conclusion, I wish to say that we have every admiration for the eminent scientists connected with the discovery of wireless telegraphy, at the same time we are satisfied it has its limits."

The report showed that the net revenue from the submarine cables and land lines (Postal Telegraph Company) increased $123,692.22 for the year, net earnings, including the amount brought forward from the previous year, amounting to $2,514,193,19. At a special meeting of the stockholders of the company held shortly after the annual meeting it was voted that the capital stock of the company be increased from $15,000,000 to $25,000,000. The board of directors now is as follows: Clarence H. Mackay, James Gordon Bennett, Lord Strathcona and Mount Royal, Gardiner G. Howland, Charles R. Hosmer, Col. William Jay, Thomas Skinner, George Gray Ward, Sir William C. Van Horne, Albert B. Chandler, Edward C. Platt, Dumont Clarke, W. Seward Webb and Edwin Hawley. The following-named officers were elected: President, Clarence H. Mackay; chairman, vice-president and general manager, George Gray Ward; vice-president, Charles R. Hosmer; vice-president, Albert B. Chandler; treasurer, Edward C. Platt; assistant treasurer, Charles E. Merritt; secretary, Albert Beck, and assistant secretary, John O. Stevens.

St. Louis Exposition Lighting.

The keynote of the lighting of the St. Louis Exposition is given by the plans of Chief Rustin for lighting the Varied Industries Building. The effort will be to make the night picture of the exposition entirely different from the day picture, so that two distinct artistic compositions will be presented to visitors. By day the columns which form the colonnades around the central avenue will be the most noteworthy feature of the main picture. They will stand out white and majestic. At night these columns will be silhouetted darkly against walls of light. This effect will be produced by inserting in the rear fluting of the column a close line of eight-candlepower incandescent lamps and by peppering the recessed ceiling of the cloister closely with lamps of similar power. These lamps will not be seen from the outside. The front of the columns will not be lighted, except by the diffused lamps in the avenue. To a spectator at a moderate distance the columns will be dark projections on the blinding white of the screened wall. During the day this wall and the recessed ceilings of the cloisters will attract little attention, because they will be in deep shadow. Here it is proposed to install mural paintings and to use color which can be used without detriment to the picture on the exterior walls. In the night these cloisters and shaded portions will blaze forth in their full glory, showing the great beauty of the work of the painters. This is the plan which Chief Rustin has devised for the Varied Industries Building. The architect has supplied plastic decoration which will lend itself well to the illuminator's work. The frieze of the cornice which runs completely around the building has at regular intervals a gigantic white wreath enclosing the letters N. J. in a monogram. These letters are the initials of Napoleon and Jefferson. This forms an attractive day picture. A three-cluster lamp will be placed in the center of each of the wreaths. The cornice lines will be marked with lamps at regular intervals, so disposed as to light the cornice throughout its height. The plan for lighting the domes has not yet been definitely fixed and cannot be until the staff decorations are more fully developed. The interior lighting of the big exhibit buildings of the exposition will be by arc lights.

CORRESPONDENCE.

London Letter.

London, February 28.—A return has just been issued relating to the tramway companies of the United Kingdom, and which consequently does not take into account the municipal tramways, practically all of which are now worked electrically. During the year ended June 30, 1902, the number of horses engaged in hauling cars on these company concerns has been reduced by 10,000, and the total mileage electrically worked is 870, as against 384 by horses, the remainder of the total of 1,484 miles now constructed being operated by steam, cable, gas motors or mixed systems. The number of locomotives has diminished by 150, and the total capital authorized now stands at over $200,000,000. The municipal tramways probably more than double these figures, so that the companies do not make a bad showing, in spite of the admittedly bad state of legislation respecting tramways.

The National Telephone Company appears to have overcome very successfully the obstacles with which it has been beset in Glasgow as a result of the municipal competition. In spite of the municipal system, the company's clientele has enormously increased, and, even suffering under the disadvantage that no facilities for laying its wires underground could be obtained from the corporation, its position is regarded as being stronger than ever. No less than 12,000 subscribers are on the books, and it is being proved, as in London, that co-operative and not competitive working between the company and the municipality is the best in the long run. The company is not easily put out of court, and Tunbridge Wells is a valuable lesson.

For a long time the Institution of Electrical Engineers has been at work drafting a set of conditions to be attached to all specifications for electrical work. A committee was appointed early in 1902 and the original draft was subsequently used as a subject for discussion at an ordinary general meeting, when suggestions were invited and taken note of. The final set has now been issued, and will very largely be taken up by consulting engineers, contractors and municipal authorities.

A question was recently asked in Parliament as to whether facilities would be given to the public, through the postmaster-general, for the transmission of messages by wireless telegraphy to America. A somewhat characteristic reply was given, viz., that the matter was sub judice, and that doubtless it would be possible to secure the use of this method of communication to the public when it was sufficiently developed for the purpose.

A report has been circulated to the effect that there is every prospect of the late introduction of a bill for the construction of the Hammersmith-City and Northeastern electric tube railway, which was refused last year, owing to the disagreement between Messrs. Morgan and the London United Tramways Company. A doubt exists as to whether this is a promotion of Messrs. Morgan again, and it is an interesting fact that bills for independent lines serving the same districts have already been lodged in which Mr. Yerkes has some interest.

Both the House of Lords and House of Commons are now lighted throughout electrically, and the big clock is now wound by an electric motor, as well as being illuminated by electric lamps.

The Central Electric Supply Company, which, it will probably be remembered, supplies power in "bulk" to two London electric supply companies, is installing a new 3,000-horsepower Willans engine for driving an Oerlikon company's alternator.

W.

New York Notes.

New York, March 7.—The announcement is made by officers of the New York and New Jersey Railroad Company, which is building the double-trolley tunnel under the North River, that the north tube will probably be completed early in the fall, but that it will not be possible to complete both tubes and their approaches so that the road can be opened for regular passenger business before the spring of 1904. When cars do begin to run through the tunnel, they will make the trip from New Jersey to the terminal at Christopher and Greenwich Streets in five minutes and possibly less, and the service will be frequent. About 300 feet of iron tunnel, 18 feet in diameter, has been built since the work was resumed last fall.

At Thursday's meeting of the Rapid Transit Commission Chief Engineer Parsons was instructed to prepare an alternate plan for an east-side subway, so that a choice might be made between Lexington Avenue, which was suggested in his original plans, and some other thoroughfare, like First Avenue. It was provided in the motion that the line, wherever built, should reach from the Bronx to the lower end of Manhattan, and must be capable of connection with Brooklyn and with the subway now in process of construction.

The Interborough Rapid Transit Company has awarded contracts for the electric equipment of the rapid-transit road. The General Electric Company received the order for the entire train-controlling equipment (using the Sprague-General Electric multiple-unit system) and half of the motor equipment, which is to be much the same as that of the Manhattan electric system. Half of the contract for motors was given to the Westinghouse Electric and Manufacturing Company. There are to be two motors for each car in order that the cars may be available for either express or local service. The amount involved in the contracts is about $2,000,000.

The Appellate Division of the Supreme Court has appointed General C. A. Whittier, Franklin Edson and John J. Delany as a commission to hear and report whether a tunnel railroad shall be constructed by the Pennsylvania Railroad Company across Manhattan Island, as recommended by the Rapid Transit Commission and approved by the Board of Aldermen. The road is to cross the island under Thirty-second and Thirty-third Streets.

A union of the motormen, conductors, trainmen and other employes of the Manhattan Railroad Company is being formed, but it is stated that no strike is contemplated.

A new schedule of wages has been put in force on all the lines of the North Jersey Street Railway Company in Jersey City and Newark, by which the men receive increases of five to 20 cents a day.

The State Board of Tax Commissioners at Albany has announced the final valuation of special franchises for the current tax year under the special franchise-tax act in New York, Buffalo, Rochester, Gloversville and Ithaca. The aggregate in New York city is $235,142,825 and among the individual valuations are the following: Metropolitan Street Railway, $18,413,000; Third Avenue Railroad, $10,310,000; Manhattan Railroad, $47,100,000; New York Edison Company, $10,175,000; New York Telephone Company, $3,207,500.

The Automobile Electric Pump Company of New York city has been incorporated with a capital stock of $20,000 by Horace G. Kimble and Edmund J. Fenn of Brooklyn and Frederick White of New York.

O.

New England News.

Boston, March 7.—The Massachusetts legislative committee on street railways is considering a bill by which street-railway companies are not to be allowed to carry on a car more than five persons above the seating capacity of the car, under a penalty of $50 for each person above that number. At a recent hearing representatives of electric railways stated that the bill would prevent the operation of cars in times of great crowds, as people would insist upon crowding the cars, and that all the employes of a company like the Boston Elevated Railway, would not be able to get a car away from a football game or circus. They said that the enforcement of the bill would lead to the growing up of a class of professional informants who would thrive on their half of the fines imposed by the bill; that the enforcement of the bill's provisions would require force on the part of employes, which would result in accidents and lawsuits; and that it would delay travel. One speaker suggested if the committee was inclined to report a bill on this subject, that it penalize any person who attempted to board a car carrying the legal number of passengers.

The New Milford Power Company has asked the Connecticut Legislature to amend its charter so that it may have authority to build dams across the Housatonic River at Gaylordsville and Kent Village, and to add to its present dam at Falls Village, and giving the company power to absorb other companies, distribute power, and erect conductors and conduits for conducting electricity. It is believed that the petition covers a project for the development of immense electrical power to be transmitted to New York city. The petition is strongly opposed by affected interests.

The Franklin County Traction Company, which recently received its charter from the Vermont Legislature, is preparing to build an electric railway that will connect with the Burlington Traction Company and compose a system between Highgate and Vergennes, Vt., a distance of 72 miles. The Franklin company has obtained water powers at Fairfax, Essex Junction and Vergennes. New York and Boston capitalists are interested in the company which proposes to make an attractive summer resort in this section of Vermont, and a number of summer hotels are projected. The new road will be assured a large amount of freight.

About 200 Chelsea, Mass., employes of the Boston and Northern Railroad Company have sent a communication to the management thanking it for the recent "generous increase in wages" and pledging their best efforts to serve the company. This is despite the union's vote ignoring the new wage scale and demanding a recognition of the union.

The Maine Legislature is considering a bill to incorporate the Winterport, Frankfort and Prospect Railway Company, which proposes to build an electric railway between the Hampden terminus of the Bangor and Hampden company's line and Prospect via Winterport and Frankfort. The company will equip the road with flat cars of standard gauge and haul granite fro mthe Mount Waldo quarries to Bangor, where the cars will be delivered to the Maine Central Railroad Company.

The building on Stanhope Street, Boston, formerly occupied by the New England-Weston Electric Light Company, will soon be made over into a garage for automobiles. It will be especially adapted for electric carriages. The basement will be fitted up as a battery room. Carriages in frequent use will be stored on the first floor and the upper floors will be devoted to carriages less frequently used. It is

expected that 200 carriages can be accommodated in the building. The building is 133 by 29 feet, and the show room will have 2,280 square feet of floor space. B.

Southern Developments.

Charlotte, N. C., March 7.—The most important development proposed in some time in the South is an electric line from Atlanta to Augusta, Ga., projected by Ohio capitalists. Charles H. Lemon of Ohio, has visited Atlanta to look into the proposition for the capitalists whom he represents. The proposed line would be 120 miles in length.

The Virginia Passenger and Power Company has decided to sell its old plant on Johnson's Island, which is valued at $100,000. The new additions to the company's plants elsewhere will fully compensate for the loss of the old plant. President Sitterding of the company has also received a proposition from G. C. Jacobs of Chesterfield County, Va., for power for two projected manufacturing plants.

The Asheville (N. C.) Electric Company has amended its charter, whereby it now has the right to absorb other local companies, several of which will be purchased.

The Sumter (S. C.) Ice, Light and Power Company (capital, $70,000) has been chartered by Charles T. Mason and Perry Moses.

J. W. Worthington of Birmingham, Ala., is working upon plans for an interurban electric line connecting Sheffield, Florence and Tuscumbia, in North Alabama. A hitch, however, has occurred with the Southern Railway.

An electric line is being projected from Jackson, Tenn., to the Mississippi River, touching several intervening towns.

The Natchez (Miss.) Gas Light Company has been indirectly absorbed by the Electric Street Railway Company, $100,000 being involved.

The Virginia Passenger and Power Company of Richmond has let the contract for the new power plant on Twelfth Street to W. B. Newell for $25,000. Work will be started at once.

The town of Bowling Green, Ky., will put in a municipal lighting plant.

The Columbus (Ga.) Railroad Company has offered to renew its expiring contract for lighting the city at $50 per light per year. This city is said to be the cheapest lighted city in the United States.

The council committee on lights, Atlanta, Ga., will immediately advertise for bids for furnishing the city with electric lights. It is believed that the proposal of J. Frank Lester to build a combined crematory and lighting plant will be adopted.

The purchase of a fine waterpower on Saluda River in South Carolina, recently mentioned, is said to have been by northern capitalists, and has no connection with the proposed Lexington-Columbia electric line. Col. G. T. Graham is counsel for both companies.

The Chattanooga (Tenn.) Light and Power Company has been reorganized with $750,000 capital. Improvements involving about $300,000, including a large new building, are being inaugurated.

Frank J. Gould, first vice-president of the Virginia Passenger and Power Company of Richmond, Va., has authorized General Manager S. W. Huff to expend $80,000 on suburban lines in improvements, including the rebuilding of a line and the purchase of new cars.

A company has been chartered in New Jersey (capital, $500,000), with Henry Parsons of New York as president, to develop the town of Sheffield, Ala., build an electric line to Florence and supply power for manufacturing.

The Cumberland Electric Light and Power Company of Nashville, Tenn., is furnishing wiring and fixtures free in order to secure new patrons.

The Georgia Railway and Electric Company, controlling the electric lines and lighting of Atlanta, is preparing to build a line to Marietta. The Atlanta and Marietta Street Railway Company is also advertising for a charter for the same purpose.

The Legislature has authorized the town of Huntsville, Ala., to issue $20,000 at any time for an electric-lighting plant.

The town of Scotland Neck, N. C., has voted bonds for electric lights. Dr. J. E. Shields is mayor.

John Graham, president of the local street railway at Huntington, W. Va., and others, will build an electric line from Washington, D. C., to the falls of the Potomac, 20 miles distant. L.

Michigan.

Detroit, March 7.—Westinghouse, Church, Kerr & Co., the engineers in charge of the new Detroit Edison plant, have received the plans for the steelwork for the new buildings to be erected. The main building will be about 225 feet square. Four steam turbines of 1,500 kilowatts each will be placed in operation as a beginning, as soon as the plant is completed. The engines will require 24 boilers, which will be fed by automatic stokers. It will take 1,200 tons of steel for the framework of the power house.

The governor has signed a bill authorizing an issue of bonds for a water and electric-light plant at Standish.

The United Electric Company, organized by A. H. Gaulker, Robert Kuhn and others, with a capital of $100,000, will manufacture electric appliances of all kinds.

The Wireless Sunglow Battery Company, with a paid-in capital of $300,000, has filed articles of incorporation. The stockholders are D. A. Ross, F. C. Ross and George W. Ross.

The Detroit, Plymouth and Northville electric road, running between Northville and Wayne, is tied up for non-payment of the state tax, and the people are without car service between these points. The Tax Commission assessed the company $6,000 a mile and more than doubled the assessed valuation of the cars and power house at Plymouth, and matters reached a point where the company believes it is impossible longer to bear the burden with the present low rate of fare. The patronage is light, as all that is to be depended on is the local traffic out of Plymouth, Northville and Wayne. The fare between Plymouth and Northville, four miles, is five cents, and to Wayne, 11 miles, is 15 cents.

A bill has passed the House at Lansing authorizing the bonding of Peninsula Township for $20,000, which is to be used to secure the building of an electric road between Traverse City and Old Mission. C. G. W.

From the Buckeye State.

Cleveland, Ohio, March 7.—An interesting question is before the court of insolvency in Cincinnati. The Cincinnati, Milford and Loveland Traction Company brought suit of condemnation for right-of-way, and in its petition declared that it was chartered as a street-railway company. The defendants have filed a demurrer, in which it is stated that if the company had been incorporated as an interurban company they would have no grounds to fight the case, but since it is a street-railway company it has not the right to condemn property or secure rights other than by the consents of the property owners.

The Kenton and Southern Electric Railway Company of Kenton has completed its organization. The new company will build lines in Kenton and a line from Kenton to Belefontaine. The lines will be built on a private right-of-way through the country.

The village of Hubbard has passed a resolution in favor of putting the question of issuing $10,000 electric-light bonds to a vote of the people at the next election.

The Banner Electric Company of Youngstown will build an addition to its factory 68 by 110 feet and three stories high. The company manufactures incandescent electric lamps and has found its business growing so rapidly that several additions have been necessary from time to time.

The Brill company is building an elegant private trolley car for Messrs. Everett and Moore and their associates. It has an observation compartment fitted up with everything convenient; also a library, buffet and other things of the kind. The interior will be handsomely hand-carved, and it is said it will be the finest car of the kind ever built. The order was placed before the syndicate became embarrassed over a year ago.

The Cleveland low-fare cases have been appealed from the United States Circuit Court to the United States Supreme Court. The cases were brought in 1901, when a permanent injunction was issued to prevent the city from enforcing what are known as the Hopkins and Cope ordinances relating to the Kinsman Avenue line of the Little Consolidated and the Euclid Avenue line of the Big Consolidated, in which it was sought to force the companies to carry passengers at a fare of four cents, or seven tickets for a quarter. The injunction was issued on the ground that the enforcement of the ordinances would impair the obligations of a contract already existing between the city and the companies, and that it would be taking property without process of law, two things which the United States constitution expressly provides to all.

James W. Holcomb of Cleveland has been in Buffalo the past week making arrangements to begin work on the line between that city and Dunkirk, 58 miles in length, which will complete the connections between Buffalo and Cleveland.

The Westinghouse company has secured the contract for the electrical apparatus for the Buckeye Traction Company's line between Norwalk and Plymouth. O. M. C.

Information from Indiana.

Indianapolis, March 9.—Track-laying on the Indianapolis and Martinsville electric railway has reached the public square in Martinsville, and with the exception of four miles of ballasting the line is completed. President Smith says a few days of good weather will suffice to put the trolley wire in position and permit the running of cars the entire length of the line. The steam road has now made a cheap rate, but the people of Martinsville will patronize the trolley cars in preference.

The Toledo and Chicago Interurban Railway Company, incorporated under the laws of Ohio last week, is to build an extension of the Toledo and Western electric line across northern Indiana. A portion of this line is in operation, and the remainder is building.

The appraisers appointed by the Circuit Court at Lafayette to estimate the value of the land along the Wabash canal bed, which was ordered condemned for the use of the Fort Wayne, Logansport and Lafayette Traction Company, has reported the value of the property to be $41,000. The traction company has asked the court to approve the report of the appraisers.

That the interurban railways are assuming proportions in this state is shown by the number of bills introduced in the Legislature concerning them. Those that were enacted into law provide for the voting of subsidies to interurban lines; for the condemning of right-of-way; requiring interurban roads to maintain sanitary conveniences on passenger cars; allowing interurban companies to issue preferred stock, that shall be preferred in the division of assets as well as in the division of dividends; permitting interurbans to charge one-fifth of amount of first-class fare on baggage in excess of 150 pounds; providing for the merging of interurban and street-railway companies; amending the law of 1901, so as to give towns and cities express power to regulate fares within their limits, as a condition to the grant of the right to operate therein; authorizing interurban companies to condemn a right-of-way across any steam railroad at grade or an overhead or subway crossing, but if at grade the interurban company shall put in and maintain at its expense an interlocking device to insure safety at the crossing; and providing that trainmen shall not work longer than 16 consecutive hours each day.

The new 100-horsepower gas engine recently purchased by the City Council of Knightstown has been installed in the power house of the electric-light plant.

The Legislature has amended the city charter so as to authorize the Board of Public Works of Indianapolis to enter into a 10-year contract for electric lighting for the city. The present contract expires in July, and bids will be advertised for in a short time.

The Legislature has authorized the city of Anderson to have a board of control for electric lights and waterworks.

The City Council of Richmond has refused the proposition of capitalists to purchase the municipal electric-light plant and has ordered new electrical equipments for immediate delivery at the following contract prices: General Electric Company, $2,755; Monarch Electric Company, $550; Westinghouse Electric and Manufacturing Company (October delivery), $4,100; total value of new machinery ordered, $7,325. The present value of the plant and equipment is $166,120.14. The plant made a better showing for February, the receipts being $951 in excess of expenses. Heretofore the plant has been operated at a loss. F.

Northwestern Notations.

Minneapolis, March 7.—F. H. Long of Chicago declares that his electric cyanide custom mill at Mystic, S. D., is an entire success, and the reason that the mill is operated periodically is because there has been a lack of sufficient ore for steady work.

Sioux Falls, S. D., is eager to secure an electric street-railway line. A bill is before the South Dakota Legislature to enable the securing of franchises.

The North American Telegraph Company has found the local business at Mankato, Minn., insufficient to sustain a local office, and has therefore discontinued it.

A. A. Buck has bought the electric-light plant at Mapleton, Minn. He at first concluded to dispose of the dynamo and engine, but has reconsidered and will continue the plant. Some improvements will be made to bring up the standard.

Newberry, Mich., has awarded contracts to the Westinghouse company for a dynamo and to the Bates Machine Company for an engine, which will more than double the capacity of the electric-light plant of the municipality.

A council committee of Mankato, Minn., recently visited Winona, Minn., to ascertain the steps taken at Winona for a municipal electric-light plant. Mankato then engaged W. I. Gray of Minneapolis to prepare plans for a municipal electric system. Plans will be prepared without delay, and bids will be secured as soon thereafter as possible. Bids are being advertised for $40,000 bonds for the construction of the plant.

The People's Light Company of Davenport, Iowa, is making extensive improvements to its power station, including additions, at a total cost of $75,000. Several carloads of new machinery have been received and are being installed. The work is to be completed about April 1st.

The La Crosse and Northern Railway Company has been incorporated at La Crosse, Wis., to maintain a street-railway system and to operate an interurban line to a point opposite Winona, Minn., 26 miles. It is believed that this is to be part of a line which will eventually reach the Twin Cities. A line is also being surveyed from Winona to Rushford, Minn.

The Duluth-Superior Traction Company has filed a statement of its business in Duluth and Superior for 1902. Gross earnings were $538,030, and expenses, including interest, $464,648, leaving the net earnings $73,382. The company came out from under a receivership two years ago. The company's plant and system is valued at $2,750,000 and the indebtedness is placed at $2,200,000.

The Carman Light and Power Company of Carman, Man., has installed a new light plant at a cost of $9,500.

The Janesville Traction Company of Janesville, Wis., has filed articles of incorporation to build an interurban line from Janesville to Madison. The incorporators are the same as those in the Rock-

ford, Beloit and Janesville Railway Company, but the two enterprises will be kept separate.

Sheboygan, Wis., is considering the cost of a municipal electric-light plant.

The City Council of Davenport, Iowa, has granted a franchise into that city to the Iowa and Illinois Interurban railroad. The officials of the company thereupon deposited a forfeit check of $5,000. The company has placed orders for steel rails for the proposed line. R.

On the Pacific Slope.

San Francisco, March 4.—Ground was broken on February 26th for the extension of the Independent Electric Light and Power Company's main power station in the Potrero, in the southern part of San Francisco. The extension will provide room for doubling the present capacity of the station. One two-phase generating unit was ordered several months ago from the Westinghouse company for delivery this year. It has a capacity of 1,500 kilowatts.

The San Francisco Water and Power Company was incorporated in San Francisco a few days ago by Henry F. Allen, W. B. Bourn, W. H. Crocker and others, to acquire water rights, build flumes, erect electric power plants, etc. The company will bring power from Nevada County, about 150 miles from here, and transmit it to this city. A prominent electrical power official says he does not think, however, the company will be in any hurry to build an electric-transmission line to San Francisco.

General Manager John A. Muir of the Los Angeles Railway Company of Los Angeles, Cal., has placed an order for four mammoth storage batteries for his system, involving the expenditure of a quarter of a million dollars, with the Electric Storage Battery Company of Philadelphia. The bidding for the contract was spirited. The contract calls for the delivery of the first battery within 45 days. This battery is to be of double size, and will be installed in the company's new sub-station now nearing completion at Agricultural Park. It will serve as a reserve factor in case of emergency for the University, Main Street and Grand Avenue lines. These batteries will run the entire system of the Los Angeles Railway Company for about three hours, in case all the generating machinery for any reason should remain entirely incapacitated.

The local union of the International Brotherhood of Electrical Workers at Portland, Ore., is asking a raise of wages. It wants $3.50 a day, the new scale to go into effect on May 1st. At this writing the employers has not yet expressed themselves in the matter, but it is thought they will agree to the new rate. A.

PERSONAL.

U. R. Brooks, Jr., has been appointed state electrician of South Carolina by Governor Heyward.

John U. May of Davenport is said to be negotiating for the control of the State Electric Company of Iowa.

John Koehler has tendered his resignation as superintendent of the Watertown Electric Company, Watertown, Wis.

Professor Ernest Fox Nichols has resigned the Wilder professorship of physics in Dartmouth College, to accept a similar position at Columbia University.

G. A. Scheeffer, late of the Scheeffer Instrument Company of Peoria, has entered the employment of the Fort Wayne Electric Works as meter expert, succeeding the late Mr. King. It is understood that Mr. Scheeffer has disposed of his meter and instrument business in Peoria.

An interesting sketch of the life of Charles P. Steinmetz, past-president of the American Institute of Electrical Engineers, appears in the March issue of Success, written by Herbert Wallace. Mr. Steinmetz discusses with Mr. Wallace many of the electrical problems of the present and those which are likely to be solved in future.

Austin C. Dunham, president of the Hartford (Conn.) Electric Light Company, has been elected president of the Federated Automatic Refrigerating Company, recently organized in New Jersey. Alden M. Young of New York, president of the Connecticut Railway and Lighting Company, has been elected vice-president of the same company, the secretary and treasurer of which is Frederick M. Kimball of the General Electric Company.

Prof. W. E. Goldsborough, chief of the Department of Electricity of the World's Fair, who has been in the East for the past two months in the interest of his department, has returned to St. Louis. Chief Goldsborough reports that the manufacturers are taking a lively interest in the affairs of the department, and that applications for space are coming in rapidly. It is reported that applications have already been received for over 80 per cent. of the space available.

A party of English and Scotch traffic and engineering officials, representing the London and Northwestern System and the Caledonian Railway of Scotland, arrived in New York on the Oceanic on March 5th. The visitors will spend a month in the United States studying the American methods of handling freight and passengers, signaling, speed, etc. In the delegation are Frank Ree, chief freight agent; E. H. Thornhill, traffic superintendent; Mr. Webb, chief engineer; Mr. Thompson, signaling superintendent; H. C. Craseman, goods manager; H. Trevetick, G. Fletcher, Jr., F. H. Dent, H. Goulborn, Robert Evans and D. Matheson.

ELECTRIC LIGHTING.

The Holt Electric Company was formed at Carthage, Mo., recently with a capital stock of $10,000. Besides furnishing electric power, light and heat, the company will deal in electrical appliances.

The residents of the village of Brocton, N. Y., have petitioned the village board to submit to a vote of the people at the coming election a proposition to bond the village for the erection of an electric-lighting plant.

The Independent Light and Power Company has been incorporated at Quincy, Ill., with a capital stock of $200,000. The company will furnish light, heat and power. J. W. Cassidy, C. E. Mead and L. P. Wheeler are the incorporators.

The proposition to bond the city of Springville, Utah, for the purpose of installing an electric-light plant carried at the election held there for that purpose. The bonds will be issued at once, and the plant will be installed next summer.

The Louisville Lighting Company will be incorporated at Louisville, Ky., with a capital stock of $3,000,000, to operate the plants of the Louisville Electric Light Company and the Citizens' company, which will be consolidated. T. E. Murray, D. F. Brady and Charles Werner of New York are interested.

At a special election in the city of Crowley, La., the City Council was authorized to issue $100,000 in bonds to improve its waterworks system and install a 10,000-light plant. Communications in regard to engine, dynamos, wire, etc., as well as water pipes and fittings, should be addressed to Armas Durio, superintendent.

ELECTRIC RAILWAYS.

A. J. Lovejoy, a prominent farmer of Roscoe, Ill., says that the value of his farm has been increased $20 an acre by the Rockford, Beloit and Janesville electric road touching it.

The daily average of passengers carried by the Metropolitan West Side elevated railway, Chicago, during the year ended February 28, 1903, was 108,351, as against 92,906, the preceding year.

The people of Prophetstown, Ill., are anxious as to which route will be chosen for the proposed trolley line between Rockford and Rock Island, Ill. Two routes are being considered, and if the one to the north of Rock River is taken Prophetstown will be left out.

At a recent adjourned meeting of the stockholders of the Lake Street Elevated Railroad Company the securities committee did not deem it advisable to proceed to formulate a plan with reference to the financial affairs of the company until more bonds are received under the agreement entered into by the stockholders. The meeting was again adjourned to April 1st.

The indications are that the Galesburg and Oneida (Ill.) electric-railway franchise has been defeated. The franchise has been vetoed and repassed, but the mayor of Galesburg refuses to listen to an appeal, saying that the council's action, in extending the time for the company to file its bond and taking other steps to get the measure through, has nullified the ordinance.

At a recent meeting of the stockholders of the proposed new electric railway between Williamstown and Moundsville, W. Va., plans were formulated which will connect Wheeling with the city of Parkersburg, W. Va. The new road will pass through Waverly, Friendly, St. Marys, Sistersville and New Martinsville, and will connect with the Wheeling Traction Company's line at Parkersburg.

The House committee on private corporations of the Legislature of Missouri has recommended favorably the bill introduced by Mr. Farley providing that all street-car companies shall provide seats for passengers or not exact more than one-half the regular fare. Violations of the act are made punishable by a fine of not less than $50 nor more than $500, one-half the fine to be paid to the informer.

Arrangements have been completed whereby there will soon be a continuous electric railway line between St. Louis and Alton, Ill. A new line will be constructed to connect the Alton street railway with the electric road connecting Venice, Granite City and Madison. This will give rapid-transit service through a thickly settled country. Harrison Barco of St. Louis and Philadelphia capitalists are interested.

The Englewood Elevated Railroad Company of Chicago has been recently incorporated. The company has been organized in connection with the South Side Elevated Railroad Company, to furnish a branch line from the latter's road to Englewood. The amount of capital stock for the Englewood branch is put at $50,000. The incorporators are Leslie Carter, Noble B. Judah, Henry G. Miller, F. E. Vaughan and Donald S. Trumbull. The Chicago Junction track-elevation ordinance, upon which the Englewood elevated branch depends, is now before the Chicago City Council.

POWER TRANSMISSION.

It is reported that the Muscle Shoals Power Company, Montgomery, Ala., has been granted full authority by Congress for undertaking its proposed developments of waterpower along the line of Muscle Shoals Canal.

The Feather River Power Company has been incorporated at San Francisco with a capital of $5,000,000. The company is about to install an electric power plant 20 miles above Oroville, where a tunnel over 12,000 feet in length has been driven and a dam constructed. It is stated that at least 20,000 horsepower will be transmitted to San Francisco at a high voltage.

Detailed reports of the power plant which the Walla Walla Gas and Electric Light Company will build have been given out. The site is in the foothills of the Blue Mountains, 20 miles from Walla Walla, Wash. The plant will be capable of producing 6,000 horsepower. Power will be transmitted to Walla Walla, Pendleton and other towns, and 65 miles of 33,500-volt transmission lines will be used. The engineering work has been in charge of T. A. Noble of Seattle.

The New Century Light and Power Company of Colorado has purchased 5,000 acres of land in Grand County, Colo., on which, it is said, will be built a reservoir that will hold 548,228,736,000 gallons of water. From the resources thus provided the company plans to produce perhaps as much as 50,000 horsepower for transmission all over the state. It also plans to store water for irrigation purposes, and will try to build up a summer resort with this artificial lake of about 20 square miles surface as an attraction.

SOCIETIES AND SCHOOLS.

The University of Minnesota devotes a recent bulletin to its College of Engineering and the Mechanic Arts, the information given including a general statement, lists of faculty and students, courses of study and instruction, equipment, etc. Of the 373 students in the college, 129 are studying electrical engineering. George D. Shepardson is professor of electrical engineering, and Frank W. Springer is assistant professor.

Plans are being completed by Henry Ives Cobb for an engineering building for Lewis Institute, to be erected on the east side of Robey Street, Chicago, 135 feet south of Madison Street, adjacent to the main building. It will be six stories high and will front 121 feet, with a depth of 66 feet. The exterior will be constructed of Roman brick with Bedfordstone and terra-cotta trimmings. The interior will be elaborately finished in hardwood. The cost is estimated at $100,000. Construction will be commenced at once.

TELEGRAPH.

At the recent annual meeting of the Chicago and Northwest Telegraph Company William T. Noonan of Minneapolis was elected president and A. R. Brewer of New York secretary and treasurer. George B. Manning of New York was elected a director in place of A. R. Brewer.

A recent Berlin dispatch states that Emperor William spent part of one morning watching the Pollak-Virag rapid-telegraphy system working in the technical university. The apparatus averaged 50,000 words an hour over a 300-mile circuit. The emperor sent for the empress, the minister of posts, the chief of the general staff, and other prominent persons and explained to them technically the way the apparatus worked. The German government will, it is stated, experiment with it between Berlin and Koenigsberg, a distance of 440 miles.

The steamship Stephan, launched on December 29, 1902, at Stettin, is the first vessel built at a German shipyard exclusively for the purpose of cable-laying. The main dimensions of the ship are: Length over all, 412 feet nine inches; beam, 47 feet 11 inches; depth, 32 feet eight inches; draft, 24 feet seven inches; tonnage, 4,600 register tons. The whole capacity of the steamer will be 6,050 tons, and she will be able to take 5,000 tons of deep-sea and coast cable in four water-tight, cylindrical tanks, of which the largest is 43 feet four inches and the smallest 36 feet in diameter. Two cable engines are fixed on the ship, one for taking in or for repairing a cable already in use and the other for laying the cable.

SPACE TELEGRAPHY.

President Newman of the New York Central Railroad has given permission to the De Forest Wireless Telegraph Company to equip the Twentieth Century Limited train with wireless apparatus, and the experiments of sending messages while traveling will continue for two months, beginning April 1st.

Sir Thomas Lipton has given permission to the DeForest Wireless Telegraph Company to equip his steam yacht Erin with a space-telegraph outfit during the international yacht races this summer, so that communication may be maintained with the shore through the five stations of the company.

Marconi is said to have nearly perfected an apparatus to measure the distance between a ship at sea

and a station on land. This will be accomplished by means of a movable disk, which will be affected by the current from the ship. The further the ship, the weaker the current, and the disk will have stationary marks, which will thus register the exact distance from ship to shore. Stations may be established all along the St. Lawrence River and Gulf to Belle Isle. Marconi is also said to be working on a multiplex system of space telegraphy.

Cardinal Gibbons on March 2d sent a congratulatory message to Pope Leo XIII., transmitted partly by the Marconi system of space telegraphy, it is said. The message was sent from Baltimore to Rome, and presumably it was over that portion of its course from Cape Cod, Mass., to Poldhu, England, that the wireless transmission was effected.

PUBLICATIONS.

The advantages of Flexduct are attractively set forth in an advertising folder sent to the trade by the Osburn Flexible Conduit Company of New York city.

A blotter issued by Hall L. Brooks of Tomahawk, Wis., calls attention to the white-cedar poles and posts which that dealer has ready for immediate delivery.

The American Brake Shoe and Foundry Company of New York illustrates miscellaneous small steel castings made by the Tropenas process, in a recent catalogue.

Electric hoists for manila or wire rope are described in an illustrated, 16-page bulletin issued by the C. W. Hunt Company of West New Brighton, Staten Island, N. Y.

De Laval steam turbines and turbine machinery are the subject of a 52-page catalogue distributed by the De Laval Steam Turbine Company of New York. Many different applications of steam turbines to electrical machinery, pumps, etc., are illustrated, and full descriptive text is given with results of tests.

A catalogue setting forth the advantages of the Garrigus boiler cleaner has been issued by the Mechanical Boiler Cleaner Company of Chicago, of which W. R. Mason is sales manager. This cleaner, which is said to be "the only device that will keep boilers absolutely clean and free from scale, mud and oil," is illustrated as installed in water-tube and tubular boilers. Its method of operation and saving effected by its use are given and several letters from users testify to its advantages.

The Kuhlman Electric Company of Elkhart, Ind., is distributing a new catalogue on its transformers, special mention being made of its oil, air-draft, arc-lighting and power transformers and also its subway type. The chief points in the mechanical construction of the transformers and also their electric performance are well brought out, several test curves being given. Mention is made on the inside of the cover that the catalogue is of the standard size, six by nine inches, as adopted by the Northwestern Electrical Association.

A treatise entitled "A Systematic Method of Calculating the Dimensions of Direct-current Dynamo-electric Machines," by Carl Kinsley, instructor in physics at the University of Chicago, has been published in separate pamphlet form by the University of Chicago Press, as a reprint from Volume IX. of the University's Decennial Publications. The essential dimensions are computed by solving the equations, showing their relations to the rise in temperature, efficiency and electromotive force. The calculations are outlined for one of the most satisfactory dynamos now being manufactured by a leading firm.

MISCELLANEOUS.

The Railway Supply Foundry Company of Harvey, Ill., whose plant was destroyed by fire February 22d, entailing a loss of more than $250,000, has purchased a five-acre tract of land and has awarded a contract for the construction of its new factory buildings, all of which will be of brick, stone and steel. The entire works will be operated with electric power.

The report of the engineering standardization committee of London, England, has been completed, and its recommendations in regard to the standardization of various iron and steel sections approximate very closely to those adopted in the United States and Germany. It is estimated that the standardization will result in saving millions of pounds sterling annually to the British manufacturers and will enable them to deliver more quickly and avoid the delay which has resulted in the United States securing so many locomotive and bridge contracts for South Africa and Egypt. The British government is determined to enforce the use of standards, so that in an emergency it may be able to get its requirements from British firms.

TRADE NEWS.

Late copper quotations are: Lake, 13½@13¾; castings, 12.30@12.60 cents.

R. E. Danforth and Alfred Green of the Rochester Railway Company, Rochester, N. Y., have perfected an electromagnetic brake which will be manufactured in Cleveland.

The Weeks Electrical Company has been incorporated in Chicago with a capital of $2,500, and will manufacture electrical apparatus and supplies. William J. Donlin, John Tully, Charles T. Mason are the incorporators.

The General Electric Company is said to be planning the erection of a large plant, 800 by 300 feet in size, on its property at Lynn, Mass., to be devoted to the manufacture of steam turbines. A tract of 50 acres of marsh land is to be added to the plant and equipped with dock facilities.

The supervising architect of the United States Treasury Department gives notice that the time for opening the bids for the enlargement (including plumbing, heating apparatus and electric conduits and wiring) of the government building at Minneapolis, Minn., has been extended from March 19 to 3 o'clock p. m., on April 6, 1903.

A Boston correspondent writes: "In the United States Circuit Court Judge Brown has refused to grant the General Electric Company's petition for a temporary injunction prohibiting the use of the letters 'G. E.' upon electric lamps manufactured by the Re-New Lamp Company of Malden, Mass. The plaintiff based its application upon a trademark it owns. The court decided that the plaintiff did not seek to protect a trademark, but to prevent or hinder the remaking of lamps and competition based on the use of burned-out lamps."

Dudley Farrand of Newark, N. J., has been appointed receiver for the Murphy Safety Third Rail Electric Company, of which Mathias Plum of Newark is president. The application was made on behalf of Herbert S. Whitcomb, a stockholder, who alleged that the company owes $70,000 and is unable to pay its debts. The company is capitalized at $2,500,000, and it owns patents for a device which makes a third rail alive while a train is passing over it and dead when the train has passed, as described in the Western Electrician some time ago.

Kilburn, Clark & Co. of Seattle, Wash., have been made the Pacific Coast sales and distributing agents of the Nernst Lamp Company of Pittsburg, and have established branch offices in San Francisco and Los Angeles, Cal. The increasing volume of business from that section of the country has made necessary special attention to its demands. The Nernst Lamp Company, having secured patent and selling rights in Canada, is now making arrangements for establishing a factory in the Dominion for the manufacture of its product. This move is not only necessary in order to conform with the Canadian laws of commerce, but is also advisable in order to meet the rapidly increasing demands for this lamp.

For the greater convenience of its numerous customers and to care better for the increase of business in New York city and vicinity, the Weston Electrical Instrument Company, Waverly Park, Newark, N. J., has opened a New York office at 74 Cortlandt Street. This office will be under the management of Mr. Caxton Brown, who has a theoretical as well as a practical knowledge of the different instruments manufactured by the Weston company and their particular adaptabilities. There will be a show room in connection with the New York office, in which will be exhibited the different types of Weston instruments and their special advantages, also the individual parts which make up the instruments.

H. O. Swoboda of New York city has, during the last 12 months, devoted a considerable part of his time to the development of a new and complete line of knife switches, panelboards and switchboards, and is now prepared to enter the market. The National Brass and Iron Works, Reading, Pa., have equipped an entirely new department with all the latest machines and tools to take care of the manufacture of his entire line. Mr. Swoboda's office at 277 Broadway, New York, under the name "The H. O. S. Engineering Company," will take charge of all sales and all engineering work. His designs, electrically and mechanically, are based on an experience of the last 15 years, and especially on his experience with the Falcon line, of which he says he is the sole originator.

The Clifton Manufacturing Company has devoted much time and money to the perfecting of its insulation, and says it has in Buffalo, N. Y., one of the best conduit factories in the country, and is producing a conduit second to none. The company has, in addition, perfected an arrangement with the Mackie Steel Tube Manufacturing Company of Hammond, Ind., which makes it possible to put conduit upon the market with only one profit in the net cost. The Mackie Steel Tube Manufacturing Company produces a fine line of special tubes and wrought-iron pipe, and this quality of manufacture renders it especially adapted to conduit uses. The Mackie company will sell the Clifton conduit in the West, Northwest and Southwest from its Chicago office and the Clifton Manufacturing Company in the East through its New York and Boston offices.

BUSINESS.

The Electric Appliance Company, Chicago, has lately added additional warehouse room and has increased its carrying capacity for all kinds of wires for which it is agent. It therefore claims to be able to make quickest and most satisfactory shipments on wire of any house in the West. The assortment is complete in "O K." weatherproof line and house wires, Paranite and Peerless, rubber-covered wires, Roebling's galvanized-iron telephone and telegraph wires, and, in fact, everything in wires.

The Monson Burmah Slate Company of Portland, Me., handles only Maine slate, which is said to be of superior quality for electrical uses, having a very high insulation test. This slate is closely grained, free from metallic veins and spots and of a firm, even texture, yet can be accurately and easily worked. The company's mill is located at Portland, which gives it facilities for prompt delivery by water or rail with low rate of freight. The company is supplying many of the largest manufacturers of electrical goods, its slate, the company says, meeting with their entire satisfaction.

A general impression has prevailed that the Weston Electrical Instrument Company only makes voltmeters and ammeters, which is not the case. Having what are credited with being the largest and best equipped works in the world for the production of electrical measuring instruments of all kinds, the company is particularly fitted to turn out work of any special character in which the highest excellence of mechanical and electrical work and design are the important features. The company has, in fact, been turning out a large amount of special laboratory apparatus for several years past, and is now prepared to make standard cells, standard resistances, galvanometers and the highest grade of special bridge work, speed indicators, etc.

Additional information has been received concerning the large contract for arc lamps given to the Western Electric Company of Chicago by the city of Columbus, Ohio, which was mentioned by the Ohio correspondent of the Western Electrician in the issue of February 28th. The equipment comprises 1,500 series alternating arc lamps complete, and is to be arranged in 20 75-light circuits. The contract includes transformers, regulators, and the entire switchboard for the new municipal plant. The contract was awarded after the installation of sample 25-light equipments furnished by several of the competing manufacturers. The Western Electric Company asserts that it has a most thorough, complete and reliable series alternating equipment, and is making installations rapidly throughout the country.

An order for 27,000 feet of wire rope, to be used for rigging upon the yacht now being built for the defense of the America's cup has just been completed by the John A. Roebling's Sons Company of Trenton, N. J. This rope ranges from one-half inch to 1⅝ inches in diameter, and is composed of six strands, each strand, for most of the rope, consisting of 19 wires, twisted together. The specifications under which the rigging for the new yacht was made required that pieces of all the different ropes should be tested before making shipment, and show a strength varying from 4½ tons for the smallest to 94 tons for the largest diameters. To obtain this strength the highest grade of steel which could be obtained for the purpose was used in drawing the wires. These wires were tested before stranding, and the tensile strength of the greater part was found to be over 300,000 pounds per square inch, while the finished rope developed in the breaking tests a strength from 15 to 20 per cent. higher than that called for in the specifications.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 3, 1903.

721,669. Electric Engine. William T. Clark, Schenectady, N. Y., assignor to the Tabor Manufacturing Company, Philadelphia, Pa. Application filed October 17, 1902.

In the engine are a frame, a coil, a plunger striker, a spring for moving the plunger outward, a blow transmitter rigidly connected with the frame and against which the coil draws the plunger, and a circuit-breaker operated by the plunger.

721,670. Electric Engine. William T. Clark, Schenectady, N. Y., assignor to the Tabor Manufacturing Company, Philadelphia, Pa. Application filed October 1, 1902.

Adjacent aligned electromagnet coils are combined with a casing having short cores projecting into the coils, a reciprocatory striker between the cores, a disk on the striker and between the adjacent ends of the coils, adjacent contact terminals connected with the coils, and an arm moved from one to another of the terminals by the disk to make and break the circuit through the coils alternately.

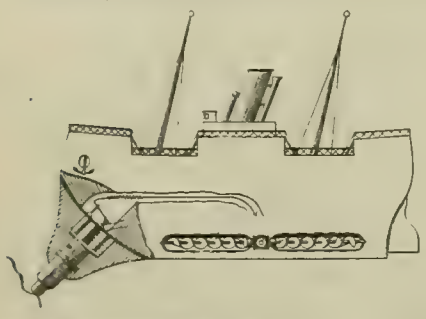
721,677. Grounding Preventer for Marine Vessels. Charles Dornfeld, New York, N. Y. Application filed July 1, 1902.

A steamship having a chambered projecting ram at its stem below the water line has a plunger slidably mounted in such ram and projecting beyond same. Tensional means behind the plunger maintain it in its pro-

jected position. A second plunger has a head projecting beyond and its stem yieldingly mounted within the first plunger, such stem at its rear end projecting within the chambers of the ram. A switch device is operated by the stem, and an electrical circuit controlled by the switch operates a device whereby the engines of the steamship may be reversed. (See cut.)

721,678. Magnetic Clutch. Edwin R. Douglas, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed July 14, 1902.

An armature adapted to engage the main clutch body consists of poles, one of which slides upon the other without breaking the magnetic circuit.



NO. 721,677.—GROUNDING PREVENTER FOR MARINE VESSELS.

721,679. Magnetic Clutch. Edwin R. Douglas, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed July 28, 1902.

A main body provided with a cylindrical recess is adapted to receive an energizing coil, and has a fixed pole on one side and a movable pole on the other side of the cylindrical recess. An armature having a pole piece is adapted to be clamped between the fixed and the movable poles. (See cut.)

721,682. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J. Application filed November 28, 1902.

See page 205.

721,689. Means for Protecting Gas or Vapor Electric Lamps. Stanwood E. Flichtner, Englewood, N. J., assignor to the Cooper Hewitt Electric Company. Application filed June 12, 1902.

See page 203.

721,703. Electric Furnace. Paul L. T. Héroult, La Praz, France, assignor to Sté. Electro Metallurgique Francaise, Froges, Isère, France. Application filed October 11, 1900.

A crucible adapted to carry a bath of molten material has two electrodes supported above it and connected in series. A conductor is in position to effect contact with material contained in the crucible and a voltmeter is in shunt between one of the electrodes and the conductor, the conductor consisting of a rod passing through the refractory material of the crucible and projecting outside and inside of the same, whereby the portion of the rod which is melted is replaced by molten material which fills up the space and thus insures good conductivity.

721,704. Shade-holder. Rolla M. Hill, Brasher Falls, N. Y. Application filed October 24, 1902.

A wire ring is combined with a series of spring-held arms pivoted to the ring and extending above and below the ring, with engaging fingers at the ends of the arms.

721,708. Telephone Transmitter. Albert F. Lawson, Buffalo, N. Y., assignor of seven-twelfths to Rensselaer W. Daniels, Lockport, N. Y., and John Atkins, Buffalo, N. Y. Application filed August 6, 1900. Renewed June 13, 1902.

See page 208.

721,734. Wire Holder for Trolley Wires of Electric Railways. Ludwig von Orth, Berlin, Germany. Application filed December 26, 1901.

A non-flexible holder is adapted to support the strained wire, and an auxiliary flexible holder connected at one end to the non-flexible holder and at its other end to the wire is normally under no strain from the wire.

721,737. Movement-cure Apparatus. Charles Owens, Chattanooga, Tenn., assignor of one-half to Dwight Preston Montague, Chattanooga, Tenn. Application filed December 13, 1901.

An electric motor is used to vibrate an implement which contacts with the body.

721,741. Protecting Device for Gas or Vapor Electric Lamps. Max von Recklinghausen, New York, N. Y., assignor to the Cooper Hewitt Electric Company. Application filed March 28, 1902.

See page 203.

721,742. Trouble Test for Automatic Telephone Systems. Frank N. Reeves, New York, N. Y., assignor to the Electromechanical Improvement Company, Charleston, W. Va. Application filed February 15, 1902.

See page 208.

721,770. Electric Thermometer. Anthony Zeleny, Minneapolis, Minn., assignor of one-half to C. E. Thayer, Minneapolis, Minn. Application filed June 9, 1902.

The inventor describes the combination with a galvanometer, of thermo-electric circuit having constant temperature and variable temperature thermo-electric junctions, the constant-temperature junction being located in the earth below the zone of changing temperature, and the variable-temperature junction being located at a point, the temperature of which is to be determined.

721,774 to 721,779. Plural-lamp Socket. Reuben E. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Applications filed May 20, 1898, to July 18, 1902.

The cluster sockets described have contacts arranged to hold the lamps in an oblique position relatively to the base.

721,780. Cluster of Plural-lamp Sockets. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed July 18, 1902.

In the socket combined with a suitable base are a number of insulating blocks mounted upon the base, each of the blocks carrying a lamp-holding device and associated contacts, a metallic cover or shell fitting over the insulating blocks and provided with an opening opposite each lamp-holding device, and suitable means for positively holding the cover in position rotarily.

721,794. Trolley. William H. Goodyear, Wilkinsburg, Pa., assignor of one-fourth to D. Karcher, Wilkinsburg, Pa. Application filed March 18, 1902.

In the trolley are combined a bracket, arms secured on the bracket, spring-pressed fingers carried by the arms, and means whereby the arms and fingers are partially rotated.

721,817. Telephone Transmitter. Lemuel Mellett, Somerville, Mass., assignor to the Microphone Transmitter Company, Boston, Mass. Application filed June 6, 1902.

See page 208.

721,858. Automatic Sprinkler System. John F. Brass, Chicago, Ill. Application filed February 3, 1900. Renewed September 6, 1902.

An electric alarm is part of the mechanism.

721,870. Funnel for Filling Storage-battery Cans or Analogous Purposes. Thomas A. Edison, Llewellyn Park, N. J. Application filed November 28 1902.

See page 200

721,877. Railway-motor Ventilating System. John H. Fedeler, Schenectady, N. Y. Application filed December 6, 1902.

Combined with a railway car are an electric motor thereon, a source of compressed air, pipes leading from the source to the motor and pipes from the motor to the interior of the car.

721,882. Telephone System. Samuel B. Fowler, Morristown, N. J. Application filed November 5, 1900.

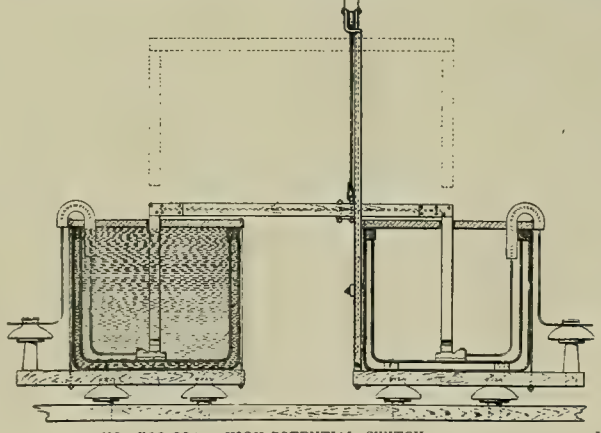
See page 208.

721,939. Lightning Arrester. William J. Chapman, Minneapolis, Minn. Application filed April 19, 1902.

A moisture-proof case having a detachable cover or side is combined with an insulating bridge detachably secured within the case and having electrodes secured to the bridge by nutted bolts, and provided with faces formed with pyramidal projections. The leads or wires are connected to the bolts and passed outward through insulated moisture-proof joints in the case.

721,942. Electric-switch System. Adolph L. De Leeuw, Hamilton, Ohio, assignor to the Niles Tool Works Company, Hamilton, Ohio. Application filed November 24, 1902.

Parts of the system are a first circuit, a first solenoid and core included therein, a mechanical connection from the core to transmit an effect therefrom, a normally open first switch in the first circuit, a second solenoid having a core connected with the first switch for operating it, a second circuit connected with the first switch and second solenoid, a second switch connected with both the circuits, a mechanical connection to serve in giving operative movements to the second switch, and band switches.



NO. 722,024.—HIGH-POTENTIAL SWITCH.

721,960. Means for Removing Sleet, Snow and Ice From Third Rails. Peter Lindemann, Westchester, N. Y. Application filed January 7, 1903.

A sand-blast nozzle connected with a car or motor adjacent to the contact shoe is adapted to discharge a blast onto the contact surface of the rail.

721,981. Electrical Cash Register. Johann C. Vahjen, New York, N. Y., assignor to John H. Vahjen, Brooklyn, N. Y. Application filed May 9, 1902.

An electromagnet is adapted to actuate the printing cylinder of the apparatus.

722,021. Telephone Transmitter. Charles Holmok, Cleveland, Ohio, assignor of one-half to Walther Kroelling, Cleveland, Ohio. Application filed February 21, 1902.

See page 208

722,024. Switch. Joseph N. Kelman, Colgate, Cal. Application filed January 30, 1902.

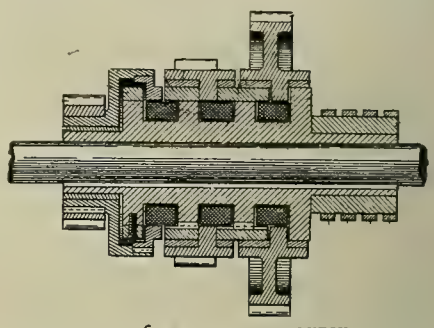
A switch for high-potential circuits is described. It consists of two vessels each containing thick layers of oil and water, terminals in each of the vessels, two electrically connected blades adapted to pass through the oil and water and make-and-break contact with the terminals, and means for raising the ends of the blades into the air, and lowering them into contact with the terminals. (See cut.)

722,030. Apparatus for Measuring and Indicating Electricity Supply. Charles H. Merz, Westminster, England. Application filed September 25, 1902.

The apparatus comprises an integrating electricity meter, and an indicating device driven from the meter and adapted to indicate the greatest amount of current integrated by the meter during any one of a number of intervals of time.

722,036. Trolley Stand. William B. Norton, Detroit, Mich., assignor to the Detroit Trolley and Manufacturing Company, Limited, Detroit, Mich. Application filed May 26, 1902.

The trolley stand has a fixed base with a ball-bearing groove, a revoluble base with upper and under ball-bearing grooves, a bearing cover plate secured to the fixed plate, and a pole socket pivotally secured to the revoluble base.



NO. 721,679.—MAGNETIC CLUTCH.

722,066. Automatic Rail Gripping or Locking Device for Electric Cranes. Samuel T. Wellman and James E. A. Moore, Cleveland, Ohio, assignors to the Wellman-Seaver Engineering Company, Cleveland, Ohio. Application filed March 18, 1902.

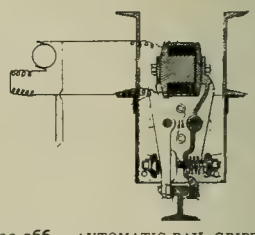
One claim reads: A vehicle, an electric motor therefor a pair of rail-gripping jaws carried thereby, a magnet secured to one jaw and an armature to the other, circuit connections between the motor and the magnet whereby, when the motor circuit is closed the brake is inoperative, and means for automatically applying the brake when the circuit is opened. (See cut.)

722,139. Self-decohering Coherer System. Alexandre Popoff, Cronstadt, Russia. Application filed March 8, 1900.

See page 207.

722,176. System of Producing Electrical Sparks for Igniting the Charges of Explosive Engines. George W. Euker, Richmond, Va., assignor to Edwin O. Meyer, Richmond, Va. Application filed July 9, 1902.

The sparking mechanism consists of a single main circuit, a battery and dynamo located in the circuit connected up in reverse order, and make-and-break mechanism also located in the circuit.



NO. 722,066.—AUTOMATIC RAIL-GRIPPING DEVICE FOR ELECTRIC CRANES.

722,189. Trolley Wheel for Electric Tram Cars. Adolf Selz, Flemingsburg, Ky., assignor of one-half to Dora Selz, Flemingsburg, Ky. Application filed November 14, 1902.

The trolley pole has a bifurcated upper end, and yieldable means are provided for normally holding the trolley wheel in its normal or central position.

REISSUE.

12,090. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 31, 1903. Original No. 717,973, dated January 6, 1903.

See page 208

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, MARCH 21, 1903 No. 12

Large Temporary Power Plant for Chicago City Railway.

An interesting example of the heavy investments that are frequently made by large public-utility corporations for temporary purposes is afforded by an electrical generating plant of 1,300-kilowatt capacity just installed by the Chicago City Railway Company at Dearborn and Twenty-first Streets, Chicago. This company, which controls the surface street-car lines on the South Side of the city, has for some time operated two electrical power plants, one at Fifty-second Street and Wabash Avenue and one at Forty-ninth Street and Oakley Avenue. The load on the company's electric system, especially in the downtown district, has increased so rapidly in the last year or two that it became necessary to make immediate temporary arrangements for additional power facilities. Accordingly, a storage battery with booster of about 800 kilowatts capacity was installed about a year ago in the company's cable power house at Twenty-first and State Streets. This installation was described in the Western Electrician of July 5, 1902. In order to supplement the battery, which is operated directly on the line during the morning and evening peaks of the load, the generating plant which is the subject of this description was installed and recently put into operation.

The new equipment is located in the company's old machine and repair-shop building, immediately in the rear of the State Street cable plant, the space being made available by reason of the moving of the shops to their new location on Seventy-seventh Street. The boiler installation consists of four 500-horsepower Babcock & Wilcox water-tube boilers, equipped with Babcock & Wilcox chain-grate engine-driven stokers. A coal conveyor of the overlapping-bucket type has been installed by the Link-Belt Engineering Company of Chicago. Coal is dumped from wagons in a driveway at the end of the boiler room into a shute which carries the coal, if it is screenings, direct to the conveyors, and, if lump coal, through a coal crusher and then to the conveyor. This crusher is driven by a 25-horsepower street-railway motor. The coal is elevated by the conveyor and dumped into steel hoppers placed above the boilers, from which the boilers are fed through pendulum shutes. The conveyor is driven by means of a geared 25-horsepower street-railway motor placed in the attic. There are about 250 buckets in the conveyor and each is 24 by 18 inches in size.

The generating equipment, shown in Fig. 1, consists of two Greene-Wheelock engines, direct-connected to 650-kilowatt General Electric generators. The engines are simple, and are run non-condensing at 80 revolutions a minute. They are duplicates, except that one is a right-hand and the other a left-hand engine. They were originally intended to be operated as twin engines for driving cable machinery. The cylinders are 32 inches in diameter, with a 60-inch stroke, and the flywheels, 20 feet in diameter, weigh 90,000 pounds each. The generator and flywheel shaft is 18 feet long and 22 inches in diameter. The engines operate on 120 pounds steam pressure. The generators are of the direct-current railway multipolar type and deliver a 575-volt current at full load. A 12-foot concrete foundation was constructed to support the two units.

The switchboard, illustrated in front and rear views in Figs. 2 and 3, is of the latest General Electric railway type. It is built of black enameled slate and has eight panels. On the right are the two generator panels, each equipped with a 2,000-ampere circuit-breaker, a Thomson astatic 2,500-ampere ammeter, two single-pole, single-throw switches, a Thomson recording wattmeter, and shunt-field switch and rheostat. There are five feeder panels and one auxiliary panel which can be used in place of any of the other panels. The feeder end of the board is provided with two bus-bars, the lower one being brought into service when it is necessary to cut out any of the other panels. Each feeder panel is equipped with a circuit-breaker, Thomson astatic 1,500-ampere ammeter and a single-pole, double-throw 2,000-ampere switch. At the extreme right of the board are swung two 750-volt, illuminated-dial voltmeters, one for the bus-bars and one for the machines.

The feeders leading from the board consist of 500,000 and 1,000,000-circular-mil, lead-covered cables and are carried underground to the points where they tap into the regular feeder lines. One of the feeders is carried over a mile to the Archer Avenue line, two tap into the Clark Street line a short distance from the plant, and the other two feed into the Wentworth Avenue system at a distance of about three blocks. Fig. 3 shows these feeders as they leave the board and are carried down into the cable pit for distribution. The picture also illustrates the construction of the rear of the switchboard. The two generator rheostats are seen supported over the cable pit. The large heat coils for the lightning arresters may be noted near the top of the feeder panels.

In the rear of the engine room are located two closed feed-water heaters, rated at about 1,200 horsepower each. They were built according to drawings prepared by the company's engineers. A Turner oil filter is installed with an engine-driven oiling system for the engines.

This generating plant is operated in parallel with the storage-battery plant and also the two older generating stations, which have a combined normal capacity of 10,200 kilowatts. As a rule, the plant is run from 6:30 to 11 or 11:30 a. m. and 3 to 9:30 p. m. on each day. It has helped out the peak load greatly, and during the heavier hours of traffic the terminal voltage of the Clark Street lines has been raised 100 volts over what it was formerly. Eventually the storage-battery booster and its switchboard will be moved to the new engine room and be erected on foundations already prepared.

All of this equipment, as already stated, is but temporary, and will probably be taken out in the course of two or three years. The time will depend upon the erection of the large alternating-current generating station already planned to be built by the company on Halsted Street, and this in turn is dependent on the settlement of the franchise-extension question. When the new plant is built the present boilers, which are capable of furnishing steam at 250 pounds pressure, will be used as part of the new boiler installation, but the generators and engines will be sold. The new temporary plant, as it stands to-day, exclusive of the storage battery, has involved an expenditure of $150,000.

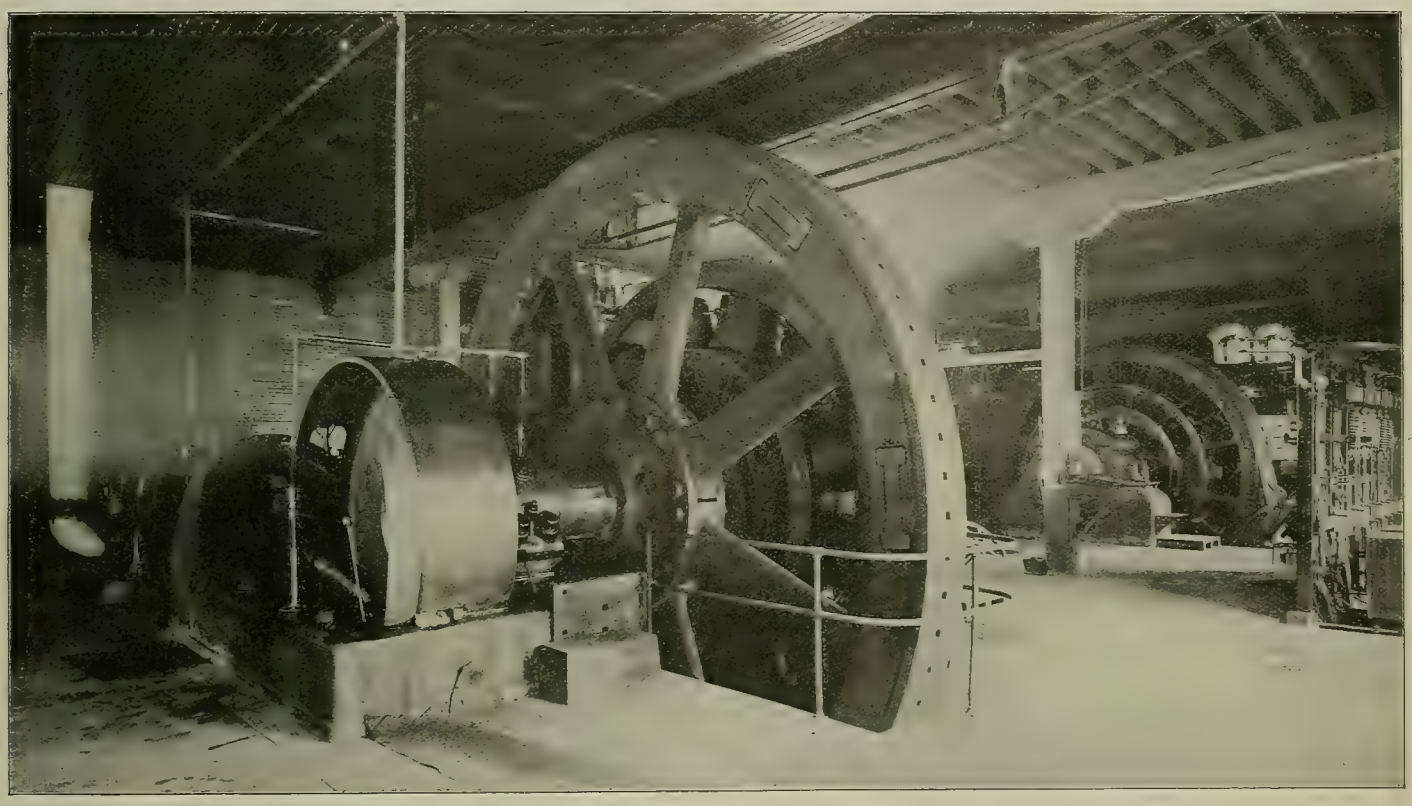


FIG. 1. LARGE TEMPORARY POWER PLANT FOR CHICAGO CITY RAILWAY.—GENERAL VIEW IN ENGINE ROOM.

The story printed in the daily papers last week to the effect that the Western Union Telegraph Company had cut all wires of the Postal Telegraph Company from Western Union poles, in the city of Baltimore, Md., seems to be without foundation. Chicago officials of the Postal company do not know where the story originated, and are informed that the report is absolutely untrue.

Many New Electric Railways Proposed in Canada.

Coincident with the session of the Ontario Legislature, which was convened last week, many electric-railway projects will come up for governmental sanction. A Canadian correspondent of the Western Electrician sends the following particulars, which will be of interest to American engineers, manufacturers and contractors.

Incorporation is asked for an electric road to run from Stratford, along the Huron Road, through Sebringville to Mitchell, through the townships of Downie and Blanchard, to St. Mary's, and through the townships of Downie and West Zorra, to Embro in Oxford County, Ont. A somewhat similar proposal is that embodied in an act to incorporate a radial-railway company, which proposes to run through the townships of West Zorra and North Oxford to Beachville, through East and West Zorra to Woodstock, through West Zorra and Downie to Stratford, and through East Nissourie or Downie to St. Marys. R. R. Lang, Stratford, or L. Harstone, St. Mary's, may be consulted.

The Middlesex and Elgin Interurban Railway Company is applying for running rights over the St. Thomas Street Railway Company. W. B. Doherty, St. Thomas, or C. A. Kingston, London, can give information.

The city of St. Thomas is applying for a commission to place its street-railway system in the hands of a board of commissioners, and to enable it to obtain running rights to Port Stanley, through Yarmouth Township.

A charter is asked for the Sarnia, Petrolia and St. Thomas railway, which proposes to connect Sarnia and St. Thomas, by way of Petrolia. Inquire of J. D. Stewart, town clerk, Sarnia, Ont.

An application will be made for a charter incorporating the London, Parkhill and Grand Bend Electric Railway Company, which proposes to run from a point on the south shore of Lake Huron, through the townships of Stephen, McGillivry, West Williams, East Williams, Lobo and London, to the city of London, taking in the town of Parkhill. John Pope, London, Ont., is interested.

A bill will be presented in behalf of the Huron and Bruce Electric Railway Company, amending its charter and changing the name to the Ontario West Shore Electric Railway Company. It proposes to run from Dungannon to Lucknow, thence to Walkerton, and also through West and East Wawanosh, to connect with the Canadian Pacific Railway at Wingham. The company also wishes to connect with London and Sarnia, a proposal which was defeated at the last session of Parliament. Inquire of H. Morrison, Lucknow, or W. S. Gould, Walkerton.

Another application seeks to extend the powers of the Guelph Radial Railway Company to enable it to build lines to surrounding towns and villages, including Elora, Fergus, Arthur, Mount Forest, Erin, Puslinch Lake, Galt, Hespeler and Preston. Hugh Guthrie of Guelph is interested.

An application which will largely increase the electric systems of the Niagara Peninsula is one to incorporate the Niagara, Queenston and St. Catharines Railway Company. This company has in view a triangular system which will connect Queenston with Niagara-on-the-Lake; the latter town with St. Catharines, and this place in turn with Queenston. J. S. Cambell of St. Catharines can give particulars.

The Toronto and Mimico Electric Railway and Light Company is renewing its application for lines through the counties of York, Peel, Halton and Wentort to Hamilton. This company is under the control of the Toronto Street Railway Company.

An application is also made on behalf of the Toronto Suburban Railway Company to extend its road on the line of the Davernport Road, through York Township, and then other sections of the city to East Toronto and Little York. S. W. Armstrong, 10 Richmond Street, Toronto, can give information.

The city of Ottawa is applying for power to incorporate and build a street-railway system of its own. John Henderson is city clerk.

The North Lanark Railway Company is also seeking to extend its line eastward to Ottawa, and west to Madawaska River, in Renfrew County. J. E. Rochester of Renfrew, Ont., can give particulars.

Reincorporation is sought for the Kingston and Gananoque Electric Railway Company, the charter of which has lapsed.

A charter is sought for a railway from Midland, on Georgian Bay, southwesterly to Penetangueshine, and thence to Perkinsfield, on the line of the Grand Trunk Railway. Write to W. H. Hewson of Penetangueshine for particulars.

The Grand Trunk is asking for the reincorporation of the Ontario and Sault Ste. Marie Railway, the charter of which has lapsed by effluxion of time. The line proposed is from Gravenhurst or some other point in Muskoka to the French River, and thence to the Sault Ste. Marie, with power to build branches to Lake Nippissing and Lake Temiskaming. This line is to be used in connection with the proposed Grand Trunk Pacific Railway, the application for which also will come before Parliament this session now commencing. For particulars apply to John Bell, Belleville, Ont.

The Canada Central Railway has a bill before the House to extend its power, to enable it to construct branches from Sudbury to Nova Scotia Junction, and thence southerly to Balsam and Sturgeon Lakes, and thence to the city of Toronto. In the same region the Huntsville and Lake of Bays company is making application for an extension of time and additional powers.

The Sudbury, Copper Cliff and Creighton Electric Railway Company is seeking incorporation. It proposes to start in the township of Snyder, in the district of Algoma, and run through Copper Cliff and Sudbury, and on to the township of McKim, in the Nippissing district. Steven Fournier, Sudbury, is interested.

Incornoration is asked for the Fort Francis, Manitou and Northern Railway Company, to run from the international boundary of Minnesota at or near Fort Francis, through the Manitou Lake district, crossing the Canadian Pacific railway at Dinornwick (main line), and thence northerly to Minnetakie Lake and Lake Saul, and thence to Dyment on the Canadian Pacific franchise. From this point to Dryden is also asked and the right to use either steam or electricity.

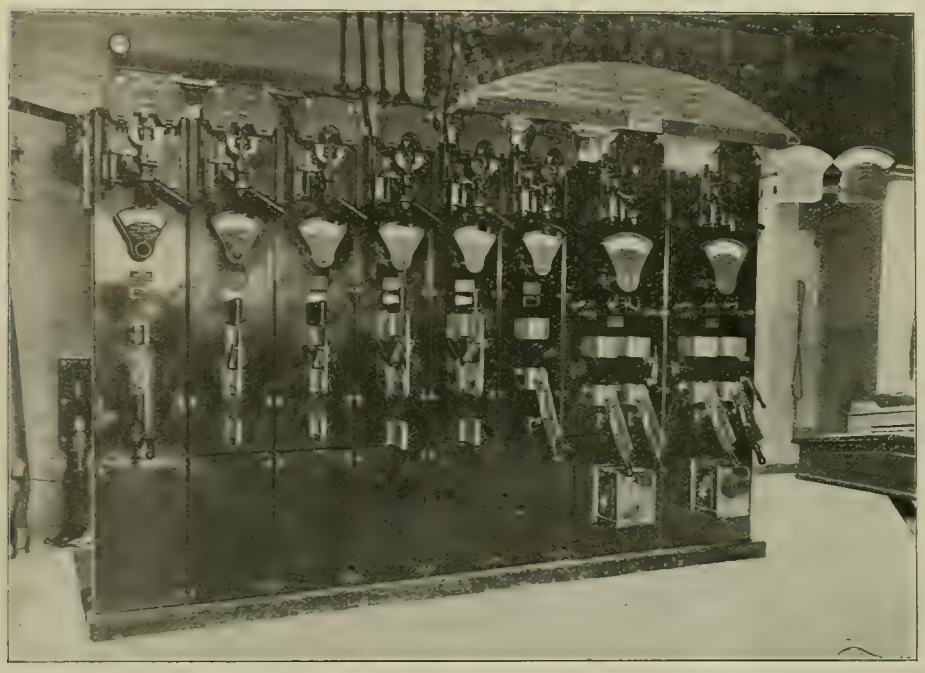


FIG. 2. LARGE TEMPORARY POWER PLANT FOR CHICAGO CITY RAILWAY.—SWITCHBOARD (PAGE 219).

Motermen Must Observe Rights of Vehicle Drivers.

In the United States Court of Appeals at St. Louis an opinion, handed down by Judge Thayer, concurred in by Judge Caldwell, defines the rights and privileges of pedestrians and vehicles upon street-railway tracks and the duties of motormen in running their cars. The court says pedestrians and vehicles have a right to cross the tracks of street railways at any point besides the regular crossings, and to use the tracks for any distance for a matter of safety or convenience, where they do not unnecessarily interfere with or obstruct the passage of the cars. A motorman, he says, has no right to act on the assumption that he is entitled to a clear track at all times. It was held that the plaintiff in the case under consideration had a right to use the street-railway tracks in avoiding a hole, and that the motorman was guilty of negligence in not reducing the speed of his car when he saw the vehicle.

High-tension Railway Work In Ohio.

The plans of the Dayton, Springfield and Urbana Railway Company for supplying its sub-stations are giving the citizens of Urbana, Ohio, quite a little concern; the more so, as the Urbana sub-station is planned to be located in the heart of the town. The company intends to furnish all power from the power house at Medway, a small town on the line about midway between Springfield and Dayton, and high-tension transmission wires have been strung from there to the sub-stations at Springfield, Urbana and other points. Along the line to a point some distance from Springfield this line is carried, and then, it branches and runs through the country to a point just within the corporate limits of that town. Crossing the Big Four tracks to the east it passes the suburb of Lagonda and goes on its way toward Urbana, where, as planned, it will have to pass through a portion of the most thickly populated section of the town to reach the station. It is said that the poles to be used will be about 40 feet high within the city limits. The voltage to be carried on the high-tension wires will be about 26,000, it is said, and the people of the town fear that frequent accidents may happen from it. The sub-station will have rotary transformers for reducing the current.

Some of the newspapers in Urbana, while not objecting to any reasonable plans, are urging that the wires be so arranged that there shall be no danger from them. They assert that the company will be compelled to secure the consents of property owners along the route to string the wires as well as authority from the town, as that will not come within the terms of the franchise granted. They have also made some inquiry in regard to how such high-tension wires are strung in other places where they have them, and make the statement that the poles should be at least 50 to 65 feet in height through the city, and that the wires should be mounted on double cross-arms, with extra heavy insulators; also that they should be fastened in such a way that they cannot fall to the ground.

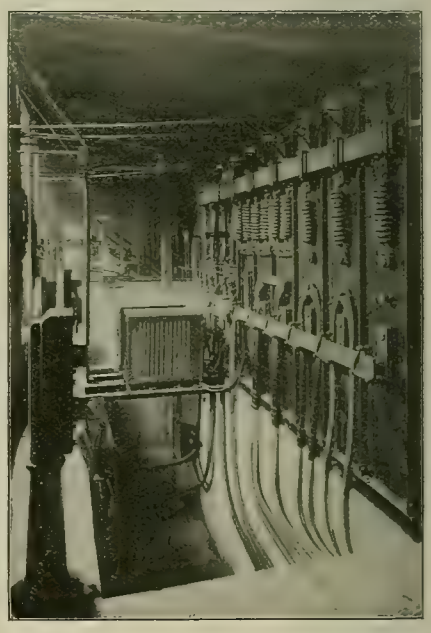


FIG. 3. LARGE TEMPORARY POWER PLANT FOR CHICAGO CITY RAILWAY.—REAR OF SWITCHBOARD AND CABLE PIT (PAGE 219).

Postal Telegraph Lines to be Extended.

An agreement has been reached between the Postal Telegraph Cable Company and the Union Pacific Railroad Company, whereby the Postal company's system will be more directly connected with the trans-Pacific submarine cable now being constructed by the Mackay interests. Poles and wire, it is said, have been stored at Omaha, Neb., for some time, and the work of construction over the right-of-way of the Union Pacific from Omaha to the Pacific coast has already begun. The line will carry six wires and the cost of construction may reach $1,500,000. C. M. Baker, assistant general superintendent, is at Omaha arranging details of construction.

French Automobile Carrying Complete Electric Generating Set.

French designers seems to have a partiality for electrically operated vehicles, either for car tracks or ordinary roads, which shall be entirely self-contained, even at the risk of decreased economy and added complications. One of the most recent examples of this tendency is the Mildé petrol-electric automobile, which is here represented.

The addition of a small generating group to the existing types of electric automobiles allows them to be used for long-distance touring, which has been hitherto almost impossible. This solution is thought preferable to that which consists in using one or two batteries of accumulators, weighing 2,600 to 2,800 pounds, in order to make a trip of less than 100 miles, and at the same time giving a very heavy weight to the vehicle. The new combination system permits of realizing, with a battery of 990 pounds and a generating group weighing 330 pounds, an automobile with seats for four passengers, which does not exceed the ordinary weight and is able to cover 150 miles in the same day without exhausting the batteries. The vehicle is thus made independent of charging stations, which is, of course, an advantage, and one which makes it practicable for long tours in the country.

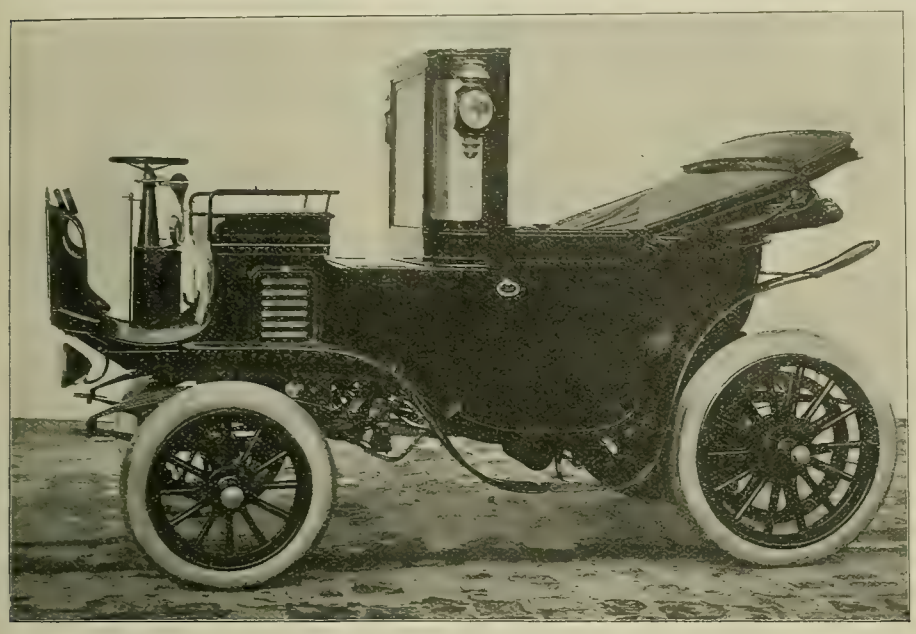


FIG. 1. FRENCH AUTOMOBILE CARRYING COMPLETE ELECTRIC GENERATING SET.

The generating group consists of a small petrol engine, cooled by water jackets and giving from six to nine horsepower. The motor is direct-coupled to a small dynamo of 40 or 50 amperes and 110 volts. The whole occupies but a small space and is placed underneath the driver's seat, together with its charging switchboard and the necessary gasoline and water tanks and carburetter for the petrol engine. The battery is connected to the electric motor through the controller, as usual, and also has a charging circuit running to the dynamo.

When the vehicle is running and also during stops the battery is always able to furnish energy to the motor, and at the same time is kept continually charged by the generating groups, which in this case work from 10 to 15 hours consecutively and under the best conditions of running and efficiency. As the battery has been previously charged before the start, and the rate of charge by the dynamo being superior, or at least equal, to the discharge to the motor on level grade, the battery only comes into play to furnish energy in the case of climbing grades or in hard pulls and afterward becomes quickly charged by the dynamo. Thus the duration of the trip may be almost indefinite on a flat ground.

FIG. 3. MOTOR OF FRENCH SELF-CONTAINED ELECTRIC AUTOMOBILE.

The picture (Fig. 1) shows one of the new combination automobiles, and the arrangement of the different parts is observed in the diagram Fig. 2. The generator group is mounted in front at (D), where it is conveniently stowed, along with its switchboard (H). Behind the group is the battery case (A). In front of the driver is the steering wheel (E), and below it the controller cylinder, which is operated by the handle (F). The two levers (LL') in front serve for the carburetter and ignition device of the motor. Below the accumulator box is the radiator (e) and at (b) the water tank, while the gasoline tank (d) is under the front seat. At (c) is the muffling box. In the rear is a second battery case (A'), and below it the electric motor which operates the rear wheels. A single motor is used in this case, and it is specially designed in order to secure a differential action. As will be seen in Fig. 3 (in which a separate armature is also shown), it has two independent armatures, each working in its own magnetic field. The whole is built together with a single magnetic circuit. The armature shafts are independent and each operates one of the rear wheels without reference to the other, thus securing a differential effect from a single motor. The armature shafts carry a pinion which engages with an internal crown gear fixed on the inside of the rear wheel. The motor takes 45 amperes and 85 volts, or about four kilowatts at 1,200 revolutions, and the vehicle makes 15 miles an hour on an average.

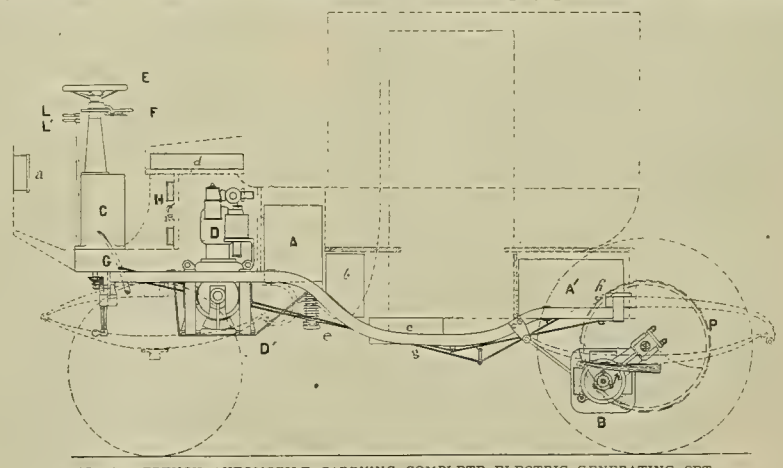


FIG. 2. FRENCH AUTOMOBILE CARRYING COMPLETE ELECTRIC GENERATING SET.

Question Box at N. E. L. A. Convention.

President L. A. Ferguson of the National Electric Light Association has asked H. T. Hartman of Philadelphia to take charge of the Question Box for the coming convention, to be held in Chicago on May 26th to 28th, and Mr. Hartman has promised to do so. It is hoped to make this a special feature of the meeting and to receive questions and answers in time to have them in print before the convention. Last year's Question Box brought out a wealth of material of interest to central-station men, and it is hoped that an equal if not greater interest will be shown in the box this year. The association's officers hope to have a very full list of questions in hand by April 1st.

Large Niagara Falls Power Plant at Water's Edge.

[Special Correspondence of the Western Electrician.]

Niagara Falls, N. Y., March 16.—The Niagara Falls Hydraulic Power and Manufacturing Company has commenced the work of building a new power station at the water's edge in the gorge. This new station will be of larger output capacity than the present station of the company. Its site is about 500 feet down the gorge below the present station, and north of the large flouring mills that stand on top of the high bank. While the output capacity of the present station is about 30,000 horsepower, the unit of development in the new power house will be 8,000, and there will be from eight to 10 of these units. This will make the contemplated output of the proposed station between 64,000 and 80,000 horsepower.

In order to supply this new power station with water, the company will extend the canal basin about 500 feet to the north at a width of 50 feet. This section of the canal will also be deepened. A forebay will be constructed at the top of the high bank, and the water for the operation of the wheels will be carried in penstocks that will run over the high bank down the face of the cliff. In the water service of the present station one large penstock is made to carry the water supply of several wheels, but in the new installation it is altogether likely that each wheel will have its individual penstock. Horizontal wheels will be installed in the station.

All this work is being done under the supervision of Wallace C. Johnson, consulting hydraulic engineer of the Niagara Falls Hydraulic Power and Manufacturing Company. This company has resumed the work of enlarging the canal, and a large force of men is at work between Second and Third Streets, taking out a large shelf of rock. Within recent years the company has made excellent progress in widening and deepening its waterway, so that now the water supply that flows through it gives the mills and power station dependent thereon an excellent service. As the contemplated full width of the canal is 100 feet, it will be seen that it will carry a large volume of water, quite ample to supply the new power house in connection with the supply already taken from it. It seems highly probable that in time all the pretty little streams that discharge from the various wheels to the face of the cliff, forming the picturesque sight at the lower milling district, will be captured and the water again made to do service in the operation of wheels likely to be installed at the water's edge. As the demand for power increases the importance of saving this apparent waste water will become more apparent. D.

Electric Heating for Street Cars.

The heating of street cars is a constantly recurring problem. Electric heating is good, but costly in current consumption. In Toronto the street-railway company, a few years ago, tried electric heating, but soon abandoned it as too expensive. In Ottawa, Ont., however, the system of electric heating has been in vogue in the street cars for some years past, with perfect success. The matter of expense is largely obviated by the fact, probably, that the Ottawa company is supplied with water-produced electric power. Under date of February 25th last Lord Kelvin wrote from London, Eng., to the editor of a Toronto newspaper, as follows: "Dear Sir—In answer to your letter I think it possible that when electrically transmitted energy is available, it might be advantageously used for the heating and ventilation of passenger cars on railways by air heated in winter and somewhat cooled in summer. Yours faithfully, Kelvin."

Western Electric Company Secures Large Factory Site for Heavy Work in Western Suburbs of Chicago.

An important real-estate deal was transacted a few days ago in Chicago by which the Western Electric Company comes into possession of a large and valuable factory site in the western part of the city. The property, which was purchased from the Richmond estate, is bounded on the north by West Twenty-second Street, on the east by South Forty-fourth Court, on the south by the Chicago, Burlington and Quincy Railroad and Ogden Avenue, and on the west by South Forty-eighth Avenue. It is something over six miles southwest of the City Hall and about five miles west of the company's present factories on Van Buren, Clinton, Harrison and Jefferson Streets. This land, which is indicated on the accompanying map, comprises an area of 99.899 acres. In addition to this tract, the company was required to buy, as a condition of the purchase, an area of 9.062 acres, northwest of the larger site and bounded by West Twenty-second Street, South Forty-ninth Avenue, West Twenty-third Street and South Fiftieth Avenue. The whole property comprises practically 109 acres and was purchased for $218,000.

This site will be used by the Western Electric Company for the location of its heavier manufacturing, and buildings will be erected there at an expense of about $1,200,000, exclusive of their equipment. Plans have already been drawn, and contractors are now figuring on a cable factory, a large machine shop, iron foundry and power plant. The cable factory will be situated on the eastern portion of the tract and will comprise a group of one-story buildings with an aggregate floor area of about 150,000 square feet. Side tracks will be built on the east and west sides, so that the material will be taken in at the east end and the finished cable will leave at the west end. To this factory will be moved the company's present cable plant, which, two years ago, was transferred from the main buildings at Congress and Clinton Streets, to a site on Polk Street near the south branch of the Chicago River. The space vacated on Polk Street will be used for warehouse and storage purposes.

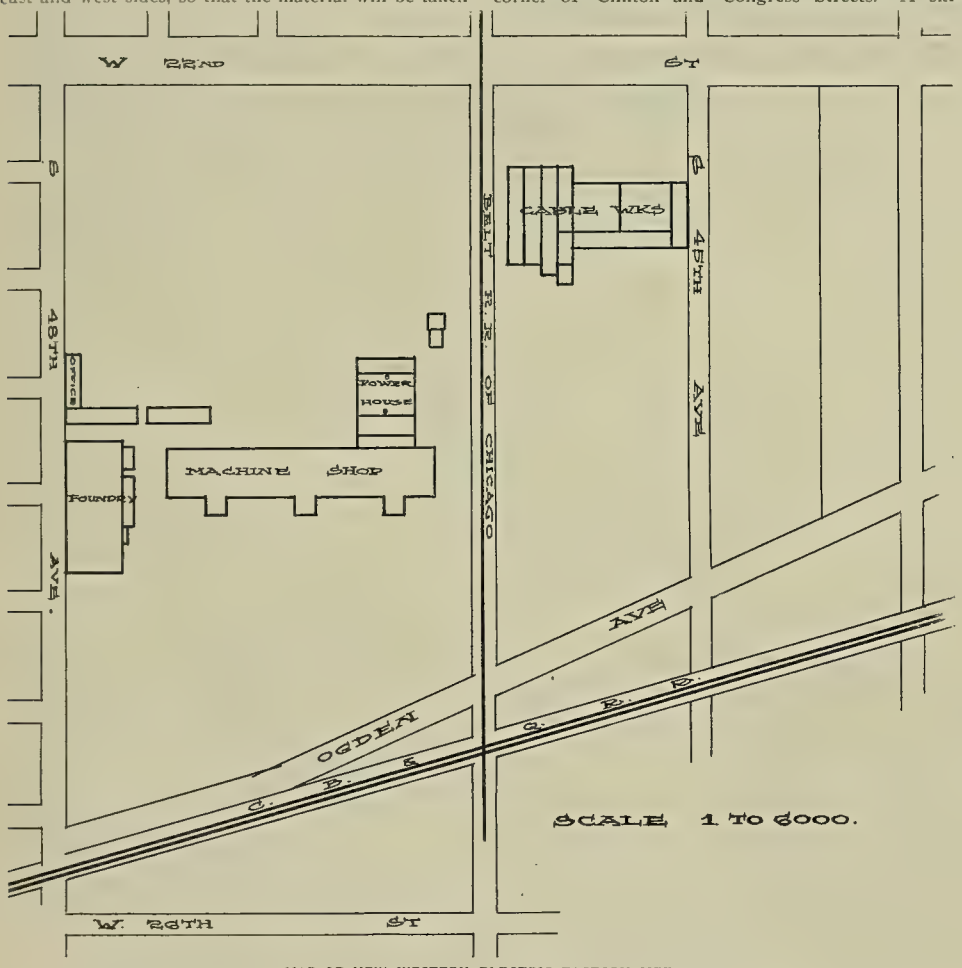
The machine shop at the new site will be a building 800 feet long and 150 feet wide, and will be divided into a main room with bay on one side and gallery on the other. A 50-foot and a 75-foot electric traveling crane will operate the entire length of the building. The iron foundry will have ground dimensions of 175 by 400 feet, and additional buildings will include the power house, warehouses, pattern shop, etc. In the foundry will be made all the heavy castings, such as are required for the company's generators and motors, and these will be worked up and finished in the machine shop adjoining. The armature and coil winding will be done in the gallery of the latter building, the wire being insulated in the cable factory. About 1,200 hands will be employed in the new works.

The power plant will have a present capacity of 4,000 horsepower and it will furnish steam for heating and electric power for lighting and driving the motor-operated machinery in all of the buildings. Connection will be made with the various buildings by underground tunnels. The structures at present contemplated and just mentioned will all be of steel and brick fireproof construction and, as stated above, will cost about $1,200,000. This cost is exclusive of the machinery, a good deal of which for the foundry and machine shop will be transferred from the company's downtown factory, while the cable machinery will be moved entire. The equipment of the power plant will be all new.

The location of the new site is regarded as an admirable one for manufacturing purposes. It is on Ogden Avenue, one of the best-known diagonal thoroughfares of the city, and also on two railroads, the Chicago, Burlington and Quincy and the Chicago and Western Indiana Belt Line, which connects with all the other railroads entering Chicago. It is just east of Hawthorne. The site is on both sides of the city boundary line, which at this point is South Forty-sixth Avenue.

An improvement is being made by the Western Electric Company to its existing downtown factory which is also worthy of mention. This consists of an eight-story fireproof building at the northwest corner of Clinton and Congress Streets. A six-story building which was built on this site by the company in 1883 is now being removed to make room for the new building. The new structure will front 150 feet on Clinton and 50 feet on Congress Street and will cost $150,000. The exterior will be of brick and stone. The steel required in the structure was purchased four months ago, and is now in the city. The Falkenau Construction Company has the contract for the construction, and the building is to be completed within four months. Plans for this building and also the new buildings at Hawthorne were prepared by Samuel A. Treat, architect for the Western Electric Company.

The new building at Congress and Clinton Streets will be used for light manufacturing for the telephone department of the company. The portions of the foundry and machine shop to be vacated will also be used for handling light castings and machine work. In other words, these recent moves of the Western Electric Company mean a virtual separation of the company's motor and generator department from the downtown factory and the handling of all that work at the new Hawthorne plant. The cable plant has been operated separately for two years. The changes, which are being made under the immediate direction of William R. Patterson, general superintendent of the company, will give additional room to both the telephone manufacturing and the generator and motor work, the former remaining in the existing factories and the latter going to the new works. It is probable that in the near future additional facilities will be secured for the arc-lamp department.



MAP OF NEW WESTERN ELECTRIC FACTORY SITE.

R. H. Pierce to Leave Chicago.

Electrical men of Chicago will sincerely regret the decision of Mr. Richard H. Pierce to remove to Boston, as that gentleman is one of the best-known and best-liked of the electrical engineers of this city. Mr. Pierce possesses technical ability of a high order and is also esteemed for an engaging personality which attracts and retains warm friendships. He is the senior member and president of Pierce, Richardson & Neiler, an incorporated company doing a large business as consulting engineers. Extensive private interests in the East, coupled with the intention of opening a branch office of the company in Boston, render it necessary that Mr. Pierce shall transfer his residence from Chicago to Boston. He will make the change about May 1st. Messrs. Pierce and Neiler have recently bought the stock of Mr. R. E. Richardson in the company. Mr. Richardson is now the general manager of the Kansas City Electric Light Company, which is a consolidation of all the electric-lighting interests in Kansas City, Mo., and Kansas City, Kan. Mr. Pierce will retain the presidency of the company and manage the new Boston office. Mr. S. G. Neiler, vice-president and treasurer, and Mr. H. A. Robinson, secretary, will remain in the main office in Chicago. The firm of Pierce & Richardson was founded March 1, 1894. It was incorporated in 1897 and became Pierce, Richardson & Neiler in 1900.

R. H. PIERCE.

Richard H. Pierce was born in Woonsocket, R. I., November 20, 1860. He graduated from Yale in the class of '82, with the degree of A. B., and from the Massachusetts Institute of Technology in 1885 with that of B. S. It is worthy of note that although Mr. Pierce is still a young man he was a member of the first class in electrical engineering graduated from the best-known technical school in the country. Soon after completing his education Mr. Pierce came to Chicago. He became connected with the Western Edison Electric Light Company and had much to do with the early development of electric lighting in the West. During the period of the World's Columbian Exposition he was at first assistant electrical engineer under Frederick Sargent and afterward full electrical engineer in charge of the many problems of electrical construction and operation that arose during the progress of that great undertaking. In 1891 and 1892 there were no precedents for the use of electricity on a large scale for light and power in a great exposition, and few of those who viewed the magnificent spectacle when completed were aware of the original work done, the harassing complications conquered and the quickly evolved expedients performed by such men as Pierce, Stieringer, Arnold, Sargent, Keller and others during the never-to-be-forgotten days of preparation and realization. After the World's Fair Mr. Pierce opened an office as a consulting engineer in partnership with Mr. Richardson, as has been stated.

Mr. Pierce is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers, as well as a foreign member of the Institution of Electrical Engineers of Great Britain. For several years he has served acceptably as local honorary secretary of the Institute in Chicago, resigning that position last week.

The Washington, Baltimore and Annapolis Electric Railway Company has taken charge of the Annapolis, Washington and Baltimore Railroad, which it recently purchased. It will continue to be operated by steam until the electric railway is completed between Baltimore and Washington, when the Annapolis road will also be electrified.

British Thomson-Houston Works at Rugby.

The British Thomson-Houston Company, which, since the inception of its business, has possessed a small factory at Rose Wharf, Bankside, London, recently secured a 25-acre site at Rugby, which is practically in the heart of England, 15 of which are now covered by the works depicted in the picture. On the northern side of the works is the River Avon, while on the southern are the railway tracks of the London and Northwestern and Midland Railway Companies.

The works comprise 14 buildings in steel and brick viz., timber stores, incandescent-lamp department, iron and brass foundry, main machine shop, general stores and warehouse, pattern shop, punch press and blacksmith shop, meter department, power house, offices, gate house, sand and coke sheds, extension of stores, warehouse and shipping department, and oil and paint stores. The nature of many of these buildings is apparent, but there are a few general features common to all. They are isolated to a certain extent to avoid fire risks and other serious inconveniences which are a consequence of having all departments under one roof. Careful study has been given to the entire arrangement and grouping, while in all buildings requiring the maximum of overhead light glass roofs have been fitted, in addition to large side windows. The artificial illumination is by incandescent lamps and enclosed-arc reflector lamps.

The power house contains three generators, two of which are direct-coupled to tandem-compound engines, and have a capacity of 200 kilowatts at 550 volts direct current. The third set is a 100-kilowatt, 550-volt direct-current dynamo, direct-coupled to a horizontal compound engine. The plant runs condensing. A third boiler is to be immediately installed. A balancer set, consisting of two small generators, is situated in the station for the automatic adjustment of the three-wire lighting circuits. The switchboard is provided with a duplicate set of busbars, so that the circuit to the testing department may be run independently of the other circuits on either of the generators. This provision is made so that the other circuits may be free from a disturbance, due to short-circuits in the testing department. The lighting circuits are run off the three-wire system and the circuit-breakers protecting the two outer conductors are electrically interlocked, so that it shall be impossible for the full voltage to be thrown on the lamps on either side in the event of a short-circuit on one side of the middle wire.

Of course, the main building is the machine shop, which contains seven bays, the total dimensions of which are 267 feet by 265 feet, aggregating 70,700 square feet of floor space. The main objective in designing this building was to avoid, as far as possible, material being carried backward and forward for different operations, and thus it is possible to bring the raw material from the stores, or the castings from the foundry and to pass it in one direction from tool to tool until it reaches the section of the bay where it is assembled and erected.

Other parts of the apparatus, such as armatures, coils, commutators and insulated parts, are constructed in the north end of this building and progress forward, meeting the machined portions in the center ready for assembling. The machine tools are of American, English and Continental makes and electrically driven for the most part. Five of the bays are devoted to work on iron and steel work, while the other two are devoted to brasswork and switchboard assembly. The heavier machine tools include an 84-inch by 20-foot planer, equipped with direct electric drive and magnetic clutch, which enables the operating motor to revolve in one direction continuously, a 24-foot boring mill and four special boring mills, specially designed by the company for the purpose of automatically boring out axle and armature-shaft receptacles for railway-motor bearings. A system of limiting the workmen to a certain number of tools is in vogue in the tool room, this being insured by a system of checks, a system which numbers among its advantages the one that the storekeeper may locate any particular tool at any moment. All the bays are fitted with electric traveling cranes.

BRITISH THOMSON-HOUSTON WORKS AT RUGBY.—ONE OF THE MACHINE-SHOP BAYS.

In the main machine shop described above is situated the testing department. In all rotating machinery very careful tests are applied, and these are designed to bring out whatever accidental faults might occur in the apparatus during the process of manufacture. There is also a special high-tension testing section for determining the value of the insulation of all materials used in the manufacture of the apparatus. The voltage which can be attained is 50,000.

The meter department is thoroughly equipped. Among other operations carried on in the laboratories is the admixture of pig irons to produce high permeability castings for the construction of motors and dynamos. Another important item dealt with is that of varnishes and japans used for insulating purposes. The purity and efficiency of lubricating oils and greases also receive attention. The very interesting and little-known subject of metal coloring is similarly studied, and the discoveries applied in the dipping and plating departments.

The offices of the company have a floor space of 15,281 square feet, the building measuring 48 by 150 feet, and consisting of three floors. The gate house is located at the entrance to the works, and has a floor space of 500 square feet. It is equipped with time-recording clocks, and throughout the works the clocks are electrically operated on the well-known synchronous principle. The hours for the operatives are from 7:30 a. m. to 5:45 p. m. on Mondays, and 7:15 a. m. to 5:45 p. m. on other days except Saturdays, when work ceases at 12 noon, thus making a total week of 52 working hours, an hour per day for dinner being taken.

BRITISH THOMSON-HOUSTON WORKS AT RUGBY.

Sórensen Range Finder.

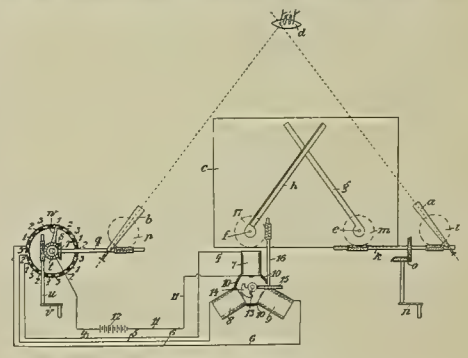
Johan Poul Sórensen of Copenhagen, Denmark, is the inventor of a distance meter or range finder which has recently been patented in the United States. The invention is a combination of two well-known arrangements. One of these is the arrangement of causing an armature to swing through a definite distance on a pivot by carrying an arm over one or several contacts suitably connected with electromagnets interposed in an electric circuit, which magnets are arranged in a circle around the pivot. The other arrangement is the method of adjusting a pivoted straight-edge rotating on the plane of a map parallel to the axis of a telescope, which is directed to a spot of country which corresponds to the position of the pivot on the map. In the present invention the telescope is directed to the telescopic station by means of the contact arm mentioned above, while the straight-edge or other indicator is rotated on the plane of the map by means of the armature connected to its pivot. In this way the straight-edge is made to follow the movements of the telescope automatically when the latter is rotated, which does not occur when the method already referred to is made use of, for in this known arrangement the proper position of the straight-edge is found by moving the latter to and fro until a galvanometer inserted in a Wheatstone bridge takes up a definite position.

The arrangement is shown diagrammatically in the accompanying drawing, being so arranged that the map, with the two straight-edges or indicators, is placed in the immediate neighborhood of one of the measuring telescopes at the latter's station.

The telescopes (a) (b) are pivoted on vertical axes. To these correspond upon the map two axes (e) (f), around which the two straight-edges (g) (h) can rotate. The vertical axis of the telescope (a) is provided with a worm wheel (i), with which engages a worm (k), which is also in engagement with a second worm wheel (m), having the same number of teeth as the first one (i). The telescope (b) at the other station carries a worm wheel (p), which engages with a worm (g), upon the axis of which is a bevel wheel (r). This wheel (r) engages with a second bevel wheel (t), which is fixed on an axis driven by means of a worm (u) and a crank (v). The axis further carries a contact spring or an arm (w), which, when the axis (s) is turned, slides over a row of contact buttons, which are placed in a circle concentric with the axis.

When the telescope (b) is turned by turning the crank (v), the arm (w) is at the same time made to pass over the contact buttons. Every time the arm touches a contact button a current passes through the arm (w), the contact button—e. g., that marked (1)—the line wire (4), the electromagnet (7), the line wire (11), and the battery (12). The armature plate (14) is then attracted by the electromagnet (7), so that the middle of its curve comes to lie in the produced axis of the electromagnet. By the rotation of the armature plate (14) the worm, which is in fixed connection with it the worm wheel (15), the worm on the axis (16), and the straight-edge (h) are also made to rotate.

The number of the contact buttons depends upon the exactitude which is desired in the observations; but if three electromagnets be used the number of buttons must be divisible by the number three. If in the present case 18 contact buttons are used, and the wheel (p) is provided with 120 teeth and the wheels (r) (t) and (15) with 18 teeth and the wheel (17) with 40 teeth, the straight-edge (h) will be caused to execute the same angular movement as the telescope (b), and the straight-edge will be moved by a motion of the telescope which corresponds to not less than five minutes of arc.



SORENSEN RANGE FINDER.

The Manila Franchise.

As stated in the Western Electrician of last week, Charles Swift of Detroit and his associates have been awarded the franchise for the street-railway and electric-light and power plant to be constructed in the city of Manila, P. I. The deal will be handled by a syndicate of New York, Pittsburg and Detroit capitalists, and the capital stock involved will be somewhere between $3,000,000 and $5,000,000. The franchise provides for first-class fares of six cents on the railway, second-class fares of five cents and six tickets for 24 cents. Governor Taft states that the Philippine Commission is much gratified with the transaction, as it is expected to mark the beginning of a new epoch in the Philippines in the investment of large American capital. The commission is also convinced that the franchise is beneficial to both the people and the investors.

New Electric Smelting Furnace.

Many applications of electricity for securing high temperatures are being made at present and the electric furnace has become a commercial and practical factor in many metallurgical and chemical processes. A smelting furnace recently invented by a Chicago man, Albert A. Shade, is an interesting example of the work that is being done in this line.

Fig. 1 is a vertical longitudinal section of the furnace, and Fig. 2 is a transverse vertical section taken on line (3 3) of Fig. 1.

The furnace is provided with a chamber or passage (A′) through which the material to be reduced is passed, the chamber having a refractory wall made of firebrick or like material. The passage is inclined downwardly from the receiving to its discharge end and provided at its upper end with means for feeding the granular material to the furnace and at its

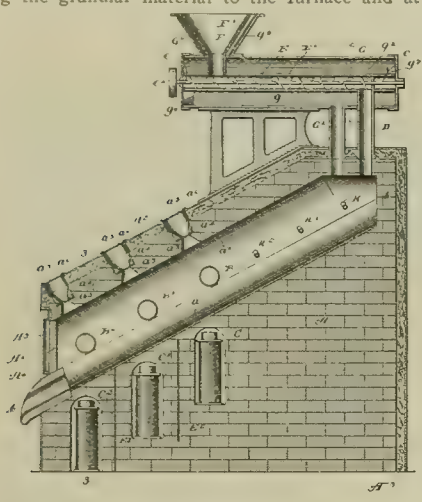


FIG. 1. NEW ELECTRIC SMELTING FURNACE.—LONGITUDINAL SECTION.

discharge end with means for withdrawing the molten material from the furnace. Extending into the passage are a number of electrodes arranged in opposing pairs between which the material passes, the electrodes being arranged to form arcs, by which the material passing between the electrodes is heated and fused, and the arcs are deflected or elongated toward the passing material, so as to localize or intensify the effect of the arcs on the material.

The bottom of the passage (A′) is transversely curved, so as to form an elongated trough-like receptacle (a), through which the material passes. The upper side of the passage is arched, as indicated at (a′), and made of suitable dimensions, to provide space for the gases generated by the fusing material. The trough-like depression of the passage is shown as provided with a lining of suitable refractory material.

Extending through openings in the side walls of the furnace and into the passage (A′) are a number of carbon electrodes (B B) (B′ B′) (B^2 B^2), the electrodes being arranged in opposing pairs, and those of each pair in axial alignment. The electrodes are located above the trough-like bottom of the passage (A′), and the series are shown as located closer to the lower end of the passage than the upper end thereof, the last pair of electrodes of the series being closely adjacent to the discharge end of the passage. Located centrally between each pair of electrodes and supported in any suitable manner in the wall of the furnace are a number of magnets (C) (C′) (C^2), which act upon the arcs formed between opposing electrodes to elongate or deflect the arcs into the trough (a) of the passage (A′), whereby the heat of the arcs is intensified and localized upon the material as it passes through the arcs. When making the furnace, the wall thereof is provided with a number of recesses opening at one side of the furnace to receive the magnets, and when the magnets are inserted in place the openings are desirably closed by permanent masonry.

In order to localize to an extent the fields of force of the magnets, so that each magnet will act effectively upon the arc of its associated electrodes, metallic shield plates (E^2) (E^3) are employed, which are embedded into the wall of the furnace between the magnets. These shield plates prevent the lines of force of the magnet adjacent to the same from influencing the arc of the electrodes not associated therewith, so that all of the force of each magnet is utilized to draw or elongate its arc downwardly into the trough-like depression of the passage (A′).

As a means for feeding the electrodes into the furnace as the inner ends thereof are consumed and withdrawing the same therefrom in the operation of the furnace, the inventor shows the electrodes as provided on one side with spirally arranged grooves and elevations, forming partial screw-threads (b^2), which are adapted to be engaged by the screw-threaded sections (I) of rotative shafts (I′), provided with hand wheels (i).

The operation of the furnace is as follows: In first starting the furnace in operation the electric current is turned onto the electrodes and the arcs produced between the same and the magnet circuit is closed, so as to energize the magnets, and thereby deflect the arcs into the trough-like bottom of the passage (A). The heat generated by the arcs acts to ignite the gas entering the furnace through the pipes (H) to (H^2), inclusive. The material to be fused is fed into the hopper (F′) and is conveyed by the spiral conveyor (E′) to the delivery pipe (D), and while passing through the conveyor shell is subjected to the heat of the exhaust furnace gases and, to an extent, heated and dried. The material is dropped from the pipe (D) upon the trough-like depression (a) of the inner passage, at the upper end thereof, and descends by gravity from the upper to the lower end of the passage.

As the material is brought successively opposite the gas pipes (H) to (H^2), inclusive, the material is impinged upon by the flames from the pipes and is further heated. The material after being subjected to the two stages of preliminary heating in the manner stated is thoroughly dried and raised in temperature, whereby the fusing of the material by the arcs is promoted. The inner ends of the gas pipes will be suitably arranged to protect the same from the intense heat of the furnace. The material thus heated and dried passes successively between the arcs formed by the electrodes (B) to (B^2), inclusive, and the magnets act to draw downwardly or deflect the arcs so as to impinge the same upon the material, whereby the force of the arcs is localized or intensified upon the material to fuse the same. The material as it passes successively through the arcs is gradually fused, and the number of the arcs and the length of the passage containing the arcs is such that when the material reaches the discharge spout (A^4) it is entirely fused and is deposited into a suitable crucible or like vessel, from whence it is drawn, and the molten material worked by any suitable mechanism, depending upon the purpose for which the material is designed to be used.

The furnace may be used for smelting or fusing all kinds of material requiring an intense heat to reduce the same, and is especially adaptable for reducing silica or silica compound in the process of making glass or like vitreous materials. By the use of the conveyor (E′) the rate of feed of the material through the furnace may be regulated so as to insure that the material shall be properly exposed to the heat of the furnace and properly fused. The angle

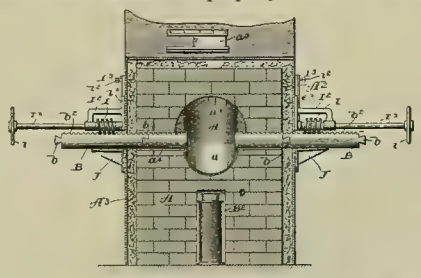


FIG. 2. NEW ELECTRIC SMELTING FURNACE.—TRANSVERSE SECTION.

of the trough-like depression (a) of the interior passage of the furnace will be disposed with a view to produce the required speed of the material through the furnace to fuse the same properly. The conveyor shell in the operation of the furnace will be maintained full of the granular material which is being fed to the furnace, so as to prevent the escape of the gases from the furnace therethrough and insure its passage through the superheating chamber (G).

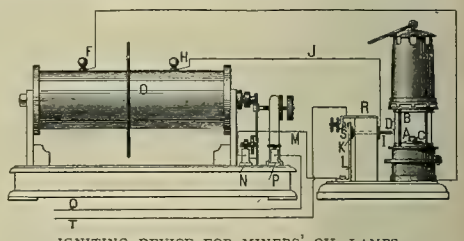
The Smoke Problem.

In an article on "The Smoke Problem and Its Possibilities" in Feilden's Magazine of London, W. C. Popplewell says: "When a furnace is giving trouble in regard to smoke, the first thing to be done is to have it very carefully fired by a man who thoroughly understands his business, care being taken with regard to the manner in which the coal is put upon the fire, and in the regulation of the air supply. Every chance should be given to the furnace to do its best under the existing circumstances; and, if there is still smoke produced, some more drastic measures must be applied. The trial of hand firing will probably have indicated in what directions improvements are required, and will show the engineer in charge whether the draft is deficient, or whether more air is required above the fire, and so on. Very likely, one or two small and not costly modifications will be found to effect the desired result, or it may be necessary to go further and introduce a forced-draft furnace or a mechanical stoker. But the chief point to bear in mind is that it is a great mistake to plunge, without thoroughly considering the whole matter, into a large expense which may, after all, turn out to be so much money wasted. A millowner must remember that every maker of boiler furnaces, whether hand or machine-fired, says that his is the best, and is smokeless. Often this latter is true, but more often it may not be true when applied to the particular case in question."

Igniting Device for Miners' Oil Lamps.

Since Sir Humphry Davy's time there has been no radical improvement in the oil lamps used by miners. The electrical device illustrated herewith, and described in a French contemporary is designed to light, automatically, lamps of this character.

Before entering the mines it is customary for the miners to pass in procession before the wicket of the lamp room, and receive either a safety lamp if the mine is dangerous from the presence of explosive gases, or an open-flame lamp if this is safe, which, when lighted, is affixed to the cap. The lamps, arranged upon the racks have each to be lighted ready for the users, before they pass the wicket. This preparatory work consumes at least a couple of hours, and consumes, of course, a very appreciable quantity of oil uselessly. Especially is time wasted in the case of the safety lamps, which, after lighting, must be securely closed and locked, so that under



IGNITING DEVICE FOR MINERS' OIL LAMPS.

no circumstances can the miner, through carelessness or intention, provoke a dangerous explosion. In the Marsant lamp, which is mostly in use in the French mines, the lamp is closed automatically, and an attempt to open the lamp at once extinguishes the flame before the danger point is reached. To insure further safety from possible harm the lamp is fastened with a lead seal, on which is imprinted a designating mark, with the time of the descent into the mine. The procession now passes an inspector, whose duty requires him to see that all lamps are properly closed and sealed. One can readily see what a consumption of time there is in all this preliminary work, for which there is no return.

Economy of time, labor and oil are the advantages claimed by the invention of E. Brown, illustrated in the diagram. A metallic conductor (AD) is carried through the glass of a safety lamp to the wick tube, and terminates exteriorly at the contact (D). One of the terminals of the secondary circuit (F) of an induction coil is connected by wire to a metallic plate which rests on the lighting platform of wood, fiber or other non-conducting substance; the other terminal (H) is connected through (J) to a movable contact (I). This contact presses against an insulating substance (K) fixed to a spring (L), which is attached permanently to the primary wire (M). Above this combination a metallic plate (R), adjustable through the screw (S), connects through the conductor (T) with an accumulator battery or other source of current energy. The terminal (P) is connected via (Q) to the principal source of energy.

The lamp of the miner, trimmed and closed, is placed on the lighting platform. Its weight closes the contact (DI), and this spring in turn closes the contact in the primary circuit through (S) and (L). The secondary circuit at once throws a spark through the wick at (C), igniting the oil. Removing the lamp cuts off the current by opening the circuits.

The whole is but a modification of the ordinary automatic gas lighter. Its chief advantage is that so little modification of the present lamp is necessary, and the end accomplished more than compensates for the expense required for the change. The lighting is instantaneous. The lamp is placed on the platform; the weight does the rest.

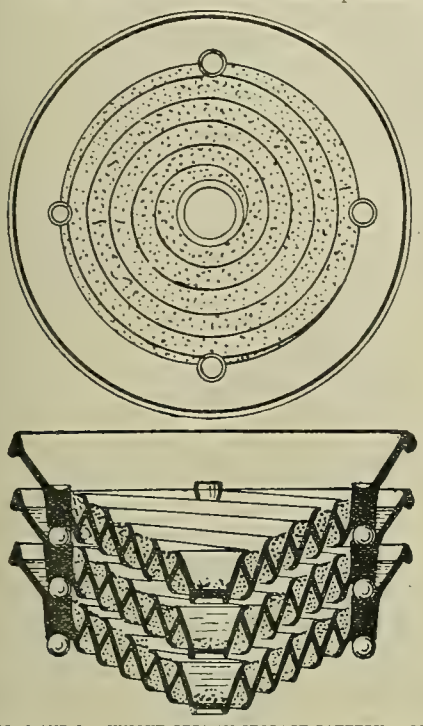
International Patent Legislation.

In its closing hours the recent Congress passed the bill to amend the patent law to carry into effect the reciprocal provision of the Convention for the International Protection of Industrial Property, held in Brussels in 1900. The design of the bill was explained editorially in the Western Electrician of February 21st. The new law has cleared the field for American inventors in the foreign countries which are signatories to the International Convention, for they may now claim all the privileges of the convention, without the fear that the courts may hold that they are not entitled to them, because of the failure of the United States to reciprocate.

Unique German Storage Battery.

German technical journals are describing the new form of accumulator illustrated herewith. It is known as the Tribelhorn battery. Its distinguishing feature is that of having its component cells built one above another rather than alongside of each other. The electrodes are made in the form of dish-plate-shaped and double-poled receptacles. A great saving of space is thus obtained, this saving being figured by the inventor at from 50 to 75 per cent., comparison being had with ordinary storage batteries in commercial use.

Considering the dish-shaped plates (Figs. 1 and 2) it is to be understood that the inside represents the



FIGS. 1 AND 2. UNIQUE GERMAN STORAGE BATTERY.—CONSTRUCTION AND ARRANGEMENT OF PLATES.

positive, and the outside the negative electrode. These plates are provided with grooves both on the outside and inside for the storing of the active material. The insulation of the plates from each other while building up the column is effected in the simplest way imaginable by the use of glass balls. The number of plates to be united in a column depends on their size. Of plates measuring from 28 to 32 inches in diameter, and weighing from 125 to 145 pounds, from 20 to 25 are usually taken. The column (Fig. 3) is mounted on wooden blocks in proportion to the number of ball-seats. The wooden

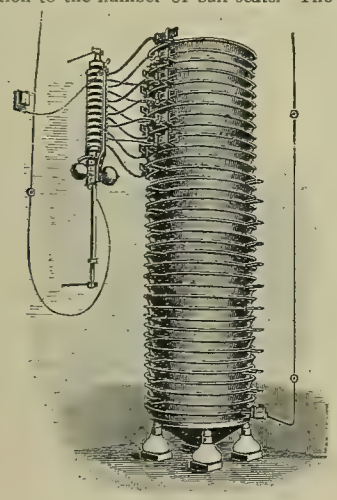


FIG. 3. UNIQUE GERMAN STORAGE BATTERY.—PLATES ASSEMBLED IN COLUMN.

blocks carry insulators made in two parts, which are provided with an oil-groove, and in their upper part there is a depression for the plug of a leaden support to be placed on top of them. The latter serves as a resting place for the glass balls carrying the lowest plate of the accumulator, whereon the other ones are to be piled, each supported by glass balls.

The advantage of the dish-shaped plate accumulators may be summed up as follows: Simplicity and quickness in mounting, there being no soldered parts; great saving of space; passing of the current through the whole surface, the whole of the negative surface being directly connected with the positive one.

It has been asserted as one disadvantage of the Tribelhorn accumulator that the electrodes cannot easily be inspected; to which it is answered that with this system inspection is not as necessary as with accumulators built in the ordinary way. Besides, it is an easy matter to take down the piles with the aid of a pulley (for the larger models), there being no soldered connections to be considered. Furthermore, the setting up and taking down of such a pile can be undertaken by an unskilled hand without injury to the accumulator, which is not the case with those of other systems.

A rather large Tribelhorn battery has recently been placed in position for lighting the Metropol apartment building in Zurich, Switzerland. This battery (Fig. 4) is arranged in two parallel rows, the capacity of each half being as follows: 840 ampere-hours with three-hour discharge; 1,000 ampere-hours with five-hour discharge; 1,200 ampere-hours with 10-hour discharge.

As the dish-shaped combination offers but one single electrode, the parallel switching of these receptacles may be resorted to (provided the connecting parts have been measured correctly) with the same result as is produced in the switching of several flat-plate electrodes into one combination.

This plant is constructed according to the three-

FIG. 4. UNIQUE GERMAN STORAGE BATTERY.—INSTALLATION IN ZURICH.

wire system. The tension amounts to two by 115 volts. The battery is charged during the day from a power plant placed some distance down stream on the river Limmat, and is sufficient for the entire lighting of the building at night.

It is further to be noted that the mounting of the battery took but a few days. The taking down and setting up of a pile requires but two hours and the cleaning out of the battery takes very little work and trouble.

Waterbury Unions Are Enjoined.

Judge Elmer of the Supreme Court of Connecticut on March 14th issued one of the most sweeping injunctions ever known in the state. The injunction was granted on application of the Connecticut Railway and Lighting Company and restrains the street-railway employes' union and all other unions of Waterbury, Conn., from interfering in any way with the business of the company or its employes. They are also forbidden to make use of the boycott to injure the business of the company under a penalty of $10,000. The complaint was made by John D. Sewell, the superintendent of the Waterbury trolley road. It declares that men in the plaintiff's employment were abused and assaulted with clubs and revolvers, and that some persons in sympathy with or connected with the defendants have murdered or caused to be murdered a policeman engaged in the performance of his duty; and that the business of the company will be ruined if the alleged conspiracy is continued. The complaint asks damages in the sum of $20,000. The list of the defendants is headed with the name of William J. Barrett, president of Union No. 193 of the Amalgamated Association of Street Railway Employes of America. Then follow the names of all the street-railway strikers and the names of the presidents and secretaries of 14 other unions. The company has also placed under attachment of $25,000 the funds of the union which are deposited in the various banks, which has intensified the bitter feeling.

Mr. Beggs Reported to Be Contemplating a Donation.

[From the Milwaukee Free Press.]

Racine, Wis., March 7.—It was reported here to-day that John I. Beggs, manager of the Milwaukee Street Railway and Light Company, owner of the local street-railway system and also the Milwaukee, Racine and Kenosha interurban line, would give to the city the local system, provided it was kept in repair and the cars of the Milwaukee, Racine and Kenosha line allowed to run through the city as heretofore. What reason Mr. Beggs had to make such an offer, if he did make it, cannot be understood. The company paid $200,000 for the local system, expended large amounts in erecting a power house, putting in new dynamos and in repairing tracks. It is claimed the local system does not pay, and if it does not, the city would not accept Mr. Beggs' gift under any circumstance.

C. F. Ames, Eastern District Superintendent for Western Union.

On account of ill health C. E. Page has resigned the superintendency of the Eastern District of the Western Union Telegraph Company. Charles F. Ames has been promoted from the managership of the Boston office to the position of eastern superintendent, and J. F. Nathan, until recently assistant manager of the Chicago office, has succeeded Mr. Ames as manager of the Boston office. Mr. Ames is also general manager of the Mutual District Messenger Company of Boston, having been appointed to that position last summer.

CHARLES F. AMES.

Mr. Ames made a good record as manager of the Western Union office at Des Moines, Iowa, coming from that position to the management of the Boston office about a year ago. He also made an enviable reputation in the district-messenger service in western cities, and he has continued to win the commendation of the company for his work in Boston. By the appointment of Mr. Ames to the superintendency the Western Union management has shown excellent judgment.

Prospects of the Toledo-Cincinnati Electric Railway.

The Mandelbaum-Pomeroy syndicate a few days ago closed negotiations with the Clegg-Winters syndicate for its road between Dayton and Troy, Ohio, and the leased line of the Miami Valley Railway Company between Troy and Piqua. The first has 10 miles of single track and 10 miles of double track and the latter has 17½ of single track, making 47½ miles altogether. The Dayton and Troy Traction Company was capitalized at $1,000,000, of which $500,000 is preferred and the same amount is common stock. This completes the Cincinnati, Dayton and Toledo line from Dayton to Piqua, where it connects with the Western Ohio, just being completed. The latter will soon be in operation the entire distance from Piqua to Lima and the branch from Lima to Findlay will be built as soon as possible. It is said that the line of the Toledo, Fostoria and Findlay from Findlay to Toledo will be constructed the coming summer also, which will give the Mandelbaum-Pomeroy people complete control of the situation from Cincinnati to Toledo, and it is believed that all the companies will shortly be merged into one, as they are all owned by practically the same people. This will be the first trans-state line in Ohio, and the prospects are now excellent for the completion of the plans, which have been under way for some time. No announcement has been made in regard to the details of the deal, but it is believed that Valentine Winters and H. P. Clegg have become interested in the Cincinnati, Dayton and Toledo company and may become active in its work.

Power Plant Levied on for Taxes.

Among the many causes for delay in the operation of street railways the one which recently tied up traffic on that part of the Chicago Union Traction Company's system, operated from the Cicero and Proviso power house, is probably unique. It seems that the company had neglected to pay its tax on that part of its system operated in Oak Park, Ill., and after repeated demands for the payment of the money, Village Clerk John Tristram gave the company three days' time to square accounts. By noon of Thursday, March 5th, the bill was still unpaid, and the entire police force—two men—accompanied by the clerk, went to the power house and ordered the engineer to shut off the power, which was done. The police were left in charge and Tristram returned to his office. Traffic had been at a standstill for 30 minutes, when the clerk received a telephone call from President Roach of the Traction company, saying that some mistake had evidently been made and that a check for $4,365 was on its way to his office. Upon assurance from the president that the money was forthcoming the engines were again started up.

Sharp Advance in Copper.

The copper markets of this country and England were more or less excited last week by an advance in the price of metal in each market to the highest figure in months. The rise in New York was to 15 cents a pound, which is four cents above the lowest price recorded since the Amalgamated company abandoned its efforts to maintain the price at 17 cents. The strength in the market is apparently not fictitious, but nevertheless considerable suspicion has been created by the adoption of the policy of secrecy in regard to the statistics of the trade by the companies handling the product.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

National Electric Light Association, Auditorium Hotel, Chicago May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Detroit, Mich., July 15th to 17th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

COPPER is again the subject of solicitous attention on the part of electrical men. Last week the price was advanced to 15 cents a pound, the highest quotation in some months. This may possibly be the effect of a legitimate demand, but is more likely to be the result of the work of manipulators. There is no one organization to control the price of copper, as is the case with petroleum products, but nevertheless three or four strong groups of producers seem to be able to work their will with the market. Electrical consumers—or, at any rate, the small consumers, for one great electrical manufacturing company is credited with the ownership of a copper mine—can only hope that the price will not be boosted to the record mark of two years ago.

MORE than casual interest attaches to the rumor that the American Telephone and Telegraph Company is preparing to increase its capital stock from $150,000,000 to $250,000,000. Whether the report is baseless and is set afloat to affect the price of the stock, whether some move of the kind is really contemplated or whether the whole story is pure conjecture is known, of course, only to a few insiders. If the authorized capital of the company is to be increased to the figure mentioned, the parent Bell concern will be one of the most heavily capitalized corporations in the country, ranked only by a few great industrials like the Steel Trust. It will be more than twice as large as the capitalization of the Western Union Telegraph Company and will be a very striking exemplification of the financial structure reared on an electrical invention which has been in use only a quarter of a century. If the increase is to be made, and the proceeds of the sale of the additional stock are to be applied to extensions, there will be much speculation in relation to the avenues of activity in which the company intends to expend so much money as is indicated by authority to raise all or part of $100,000,000. Perhaps some move of great importance is under consideration, but, on the other hand, the annual meeting, which should be held very soon, may pass off without any startling developments. But the possibility that there may be some foundation in the report will again direct attention to the greatest of telephone companies

ONE of the most fascinating fields for the exploration of the scientist is the light of the firefly and other light-giving animals, with the manner of its production and the possible lessons that may be of service in the production of artificial light for the use of man. The bearing of the light of the firefly on the light of the future may be very important, and the investigations carried on at the Smithsonian Institution a few years ago may yet prove to be more than academic researches. A brief account states that at that time some interesting experiments upon the nature and origin of the light emitted by the firefly were made by Prof. S. P. Langley. From the spectroscope he finds the light to be of exceedingly narrow range of refrangibility. The heat given out is scarcely appreciable, being less than one-half of one per cent. of that produced by an equal amount of light from a candle or other common illuminant. That the light is a chemical product would seem to be established by the fact that it decreases by products which check combustion (e. g., nitrogen) and increases by products which aid combustion (oxygen), and that the product of the process is apparently carbon dioxide. The subject of the origin of "phosphorescent" light is one that may develop very interesting features, for, as graphically stated by Professor Oliver J. Lodge, if the secret of the firefly were known, a boy turning a crank might be able to furnish the energy necessary for an electric-light circuit of large extent. Considering this possibility, Professor Lodge regards as enormous the waste of energy in the machinery of electric-light making now in use. And when one recalls the accounts given by travelers of the light-giving properties of the luminous insects of the tropics, it must be confessed that any one of our present methods of illumination seems woefully inefficient. The distinguished traveler, Kaempfer, described the fireflies of Siam as "settling upon the trees like a fiery cloud," and in Brazil Gardner compares them in brilliancy with "stars that have fallen from the firmament and are floating about without a resting place." Kidder says: "In the mountains of Tijuca I have read the finest print of a magazine by the light of one of these natural lamps placed under a common glass tumbler, and with distinctness I could tell the hour of the night and discern the very small figures which marked the seconds of a little Swiss watch. The Indians formerly used them instead of flambeaux in their hunting and fishing excursions, and when traveling in the night they are accustomed to fasten them to their feet and hands. And they are used by señoritas for adorning their tresses." But the exact method of producing so effectively light without heat is still one of Nature's strong-locked secrets.

A VALUED contemporary, the Railroad Gazette, brings to light a curious and interesting example of that proneness to error which is a mortifying characteristic of even the most acute of human intellects when exercised upon subjects beyond the accustomed range. It cites the following dictum of Herbert Spencer, who, born in 1820, is considered the greatest of living philosophers: "Numerous attempts have been made to construct electro-magnetic engines, in the hope of superseding steam; but had those who supplied the money understood the general law of the correlation and equivalence of forces, they might have had better balances at their bankers. Daily are men induced to aid in carrying out inventions which a mere tyro in science could show to be futile." This was written some 43 years ago when the author was about 40 years of age. Lewes, in his "History of Philosophy," said of Spencer that "it is questionable whether any thinker of finer caliber has appeared in our country." And yet what a "mere tyro in science," to repeat his own words, does this famous thinker appear in the light of electrical development. It is indeed well for the world that his dogmatic utterance did not discourage the men who developed the "electromagnetic engine" into its successor of to-day. It was humble Josh Billings who observed that it is better not to know things than to know even many things that are not so. Science is ever expanding and cannot be expounded ex cathedra in set phrase. It is well to avoid the setting forth of hard-and-fast individual opinions as scientific truths. And in no department of knowledge is this caution more necessary than in the science of electricity, where concepts are constantly shifting, changing, developing.

DISCUSSION of the advantages and disadvantages, if any, of the metric system of weights and measures continues in Great Britain as in this country. We observe that the London Electrician, while apparently favoring the introduction of the newer system, in common with most of the scientific and technical journals of the English-speaking countries, fears that any statutory enactment making the use of the metric system compulsory would be ill-advised. Our own belief, frequently expressed, is much the same. The official adoption of the metric units must come after the soil is prepared for it; it must come as the result of growth in knowledge, by agitation and educational processes, not forced by drastic legal enactment. Our English contemporary, in considering the question, seems inclined to be rather sarcastic. It says: "It is good to know that several large engineering firms in England have now definitely decided to use the metric system, and that it will, therefore, have a fair trial. So long as there is as strong a feeling as at present against making any change in our system of weights and measures, however, the establishment of a compulsory metric system will be premature. When the socialists' Utopia is realized, when free trade is universal, when English has become the universal language, when there are no more wars, when disputes are speedily settled by arbitration, and when trades unions and employers' federations recognize that their interests are identical, then Parliament, if there still be a Parliament, will be able to pass a metric-measure bill without opposition. But, in any case, whatever steps either Great Britain or the United States of America may take to abandon the inch and pound, if the time be ripe for it in the nearer future, let them act simultaneously and in unison." The suggestion in the last sentence is a good one, unless one country or the other should wait too long. For our own part, while we think this country is not yet ripe for the adoption of the metric system, we do not consider that it will be necessary to wait for such a time that there shall be no opposition; a clearly expressed preponderance of public opinion will be sufficient.

Polonium, Radium and Actinium.

Some interesting particulars of the new radio-active elements are given in a foreign scientific journal. In 1898 Mrs. P. Curie discovered in pitchblende and chalcolyte (two ores of uranium) a new metal—polonium. Subsequently, Mr. Curie, Mrs. Curie and Mr. Bémont determined another element—radium. In 1899 Mr. Debienne characterized a third simple body—actinium. The extraction of these metals is not only quite delicate, but long and costly. To give an idea, it is sufficient to say that about 0.10 gram of radium chloride is found per ton of ore; that is to say, the residue of the extraction of uranium. Radium resembles barium closely; its high atomic weight, 175, assigns for it a place in the elements of high atomicity in the Mendéelef tables. Polonium resembles bismuth closely and is precipitated by hydrogen sulphide. Actinium is precipitated by ammonium sulphohydrate, and is similar to thorium.

These new elements possess extremely interesting properties, among which is that of emitting rays similar to those discovered by Professor Roentgen in the light of the Crookes tube.

In 1896 Mr. Becquerel, in studying phosphorescent bodies, remarked that the salts of uranium and the double salts of uranyl and of sodium, or potassium, emit special radiations having great similarity to the X-rays. These have been called Becquerel rays. The three new metals emit Becquerel rays in enormous quantity, approximately 100,000 times greater than uranium. It seems, also, that uranium owes its property only to the presence of traces of actinium. The radiations of radium, like cathodic rays, are deviated partly by the magnetic field. Another part is not deviated like the X-rays. The deviable rays are charged negatively.

These rays are not reflected nor refracted, nor polarized, which is contrary to the existing conception of all vibratory movements. They discharge electrified bodies very rapidly, even through a covering of glass. The dust of the radio-active bodies renders all the objects of the laboratory radio-active. No electric measuring of precision can be done in their presence, the insulators becoming conductors. It seems that the radio-activity is an atomic property of these bodies; that is, a property connected with the matter itself and not capable of being destroyed, either by change of physical state or by chemical transformation. Certain bodies—zinc, tin, aluminum, brass, lead, paper, may acquire radio-activity by induction. The induced activity increases with the time of exposure, and is lost gradually.

Polonium, actinium and radium so act on certain substances as to render them fluorescent, as zinc sulphides, earthy alkaline and alkaline substances, uranium salts, the diamond, blende, paper, glass, cotton.

Radium possesses the property of being spontaneously luminous. This luminosity is readily observed in semi-darkness, and the light emitted may be sufficient to allow of distinguishing written characters. The most curious fact is that the light emanates from the whole mass, contrary to what takes place in the case of ordinary phosphorescent bodies, which shine only on the surface previously impressed by the light. In moisture the luminosity is diminished, but on drying it reappears in all its intensity. It is continuous, or at least appears to be so, for at the end of a year it is not sensibly diminished.

Radiferous salts have very interesting chemical and photographic properties, due undoubtedly to their radio-activity. They convert oxygen into ozone, and in general act as powerful oxidants or exciters of oxidation. Thus glass and porcelain, with oxidation of manganese, are colored violet under their influence. The chlorides of sodium and of potassium are colored strongly, the latter a deep blue. The rays exert an energetic action on photographic plates, even through opaque bodies, and produce radiographs—less distinct, however, than those of the X-rays.

The applications of these substances may be numerous, provided they can be prepared in appreciable quantity and at lower cost. Luminous indications might be made on the dials of watches and compasses. The physiological action is not less important. As slow producers of electricity the salts are indicated in the treatment of neuralgia. By application to the temples, and acting on the retina through the flesh, they may serve for diagnosing paralysis of the optic nerve. Radium was employed in the expedition of Mr. Paulsen in Iceland, for taking the electric tension of the atmosphere, replacing apparatus, complicated and less easy of transportation.

The curious properties of these new metals are for the most part opposed to all accepted mechanical theories, physical and chemical, for they appear to be spontaneous producers of light and electricity—in a word, of energy. Now, it cannot be admitted that a body can produce energy indefinitely, however small the production, without borrowing from external sources, and without losing from its mass, and yet this appears to be the case with the three new metals.

According to the measuring of Mr. and Mrs. Curie, the radiating energy is a ten-millionth part of a watt, or, expressed in the displacement of matter, about one milligram in a thousand million years.

To reconcile these phenomena with the data of science, different hypotheses have been applied. Thus, Mr. Le Bon holds that the energy proceeds from very mobile chemical reactions which may take place successively a great number of times in a very short period, under the influence of simple causes, such as slight variations of temperature. This explanation is perhaps premature, for the knowledge of these bodies is very limited, and nothing yet supports the theory. Is the source of this energy external? It may be supposed that space and material bodies are penetrated with rays of a nature yet unknown and capable of reacting on radio-active substances, so as to produce a secondary emission, manifesting itself in the observed phenomena. On the other hand, it is difficult to imagine electric conducibility in the absence of every material particle; and as these rays are conductors, it may be supposed that there is an ultimate form of very attenuated matter, which these radio-active bodies may be able to emit indefinitely without losing noticeably from their mass. However it may be, the spontaneity of the radiation remains an enigma, a subject of profound astonishment. There is ground for believing that the discovery of these bodies marks a new stage in the history of science, and that it supports the hypothesis of the unity of matter.

Chicago Institute Meeting.

The informal meeting of the Chicago members of the American Institute of Electrical Engineers, held at the rooms of the Western Society of Engineers on the evening of March 10th, was a pronounced success, nearly 80 members and guests being in attendance. Many of those present were new members and applicants for membership, who took the opportunity to get acquainted with the older members. The first part of the evening was spent in a social way and then R. H. Pierce, local honorary secretary of the Institute, called the meeting to order for a discussion of the papers on railroad train lighting which were presented at the recent New York meeting of the Institute. The papers were read by title, Arthur J. Farnsworth, the author of one of the papers, being present to explain some of the points of his system. The discussion was opened by Locke Etheridge, electrical engineer of the Pullman company, and was continued by Messrs. Kimbark, Gilman, Felt and others. Among the points touched upon were the manner of wiring the cars, the drop in voltage, the candlepower of lamps to be used, and other features which had come under the observation of the speakers. Mr. Etheridge suggested that an alternating-current motor might be used to operate the lights on a train, the storage battery being charged through the agency of a Cooper Hewitt static converter.

L. F. Mahler then gave a very interesting talk, illustrated with stereopticon slides, on the De Laval steam turbine, treating of its advantages for train-lighting systems. Richard H. Pierce, presented his resignation as local honorary secretary of the Institute. He stated that his successor would be chosen by a mail vote of the Chicago members. After the discussion an enjoyable smoker was held and an appetizing lunch, supplied by the local committee, was served by a caterer.

Announcement was made of the next meeting of the Institute, which will be held in conjunction with the Western Society of Engineers, on March 24th. B. J. Arnold will then present a resume of his report upon the Chicago transportation problem, his address being illustrated by lantern slides. Fullerton Hall, in the Art Institute, on Michigan Avenue, has been selected as the meeting place. The regular meeting room would be too small for this meeting, so this larger hall, which will seat 600 people, was selected. This meeting being a joint one of the two societies, is intended to be a step toward the possible unification of local engineering interests.

Ries' Electrical Patents Sold.

The public sale of the electrical patents owned by the late firm of Ries & Henderson, the members of which have been in litigation for some time, was held in Baltimore, Md., on March 3d. The sale was made by George Whitelock and Arthur Steuart, special masters, and the highest bidder was Arthur G. Thompson of New York city, who acquired the property at $60,000. The patents were first offered for sale in 13 groups, according to subject-matter, reserving the bids on the different classes until after the offer of the property as a whole. The aggregate of the individual bids was $59,670.

The competition for some of the patents was spirited. For the patents covering conduits for electric and cable railways there was a bid of $10,500 by the United States Electrical and Development Company, which also bid $35,000 for the patents on railway-system transformer, and $12,200 for the patents for induction railway.

Elias E. Ries, the defendant in the suit and the patentee of the various inventions, attended the sale and was the highest bidder for some of the properties. Patents for automatic railway signals, electric welding and tempering, electric soldering, induction coils, dynamos and motors, overhead conductor for electric railways, etc., were included in the list offered.

The litigation between the parties began April 28, 1896, when the bill of complaint was filed by Mr. Henderson, praying for the dissolution of the copartnership of Ries & Henderson and the liquidation of its affairs by receivers and an accounting of the business by its co-partner, Mr. Ries. The case has been, in its various aspects, frequently argued in the United States Circuit Court, and has been twice heard by the Circuit Court of Appeals, at Richmond, Va.

Developments in Space Telegraphy.

The steamer Coamo, in which Miss Alice Roosevelt sailed for Porto Rico on March 14th, was equipped with a De Forest space-telegraph outfit. Messages were exchanged between the boat and the station at Coney Island, but when Miss Roosevelt started a message to her father after the boat was some distance out it was rendered unintelligible by electric waves sent out by Marconi apparatus on some incoming ship or at some other station, and none of the actual message was received.

Marconi feels that the challenge which has been thrown down to him by London and New York newspapers is an insult, and speaks contemptuously of the skepticism which has been expressed as to the bona-fide wireless messages between Poldhu and Cape Breton. A London paper, it seems, challenged Marconi to prove that he can send wireless messages across the Atlantic, and suggested four New York and four London editors as judges. Marconi said: "I cannot accept the conditions, which would be an insult to the English, Italian and Canadian governments. Certainly messages have passed. If you doubt me, ask Lord Kelvin. I am prepared to demonstrate my claims to any responsible tribunal, but not to accept a newspaper challenge. Since the message from President Roosevelt to King Edward many others have been sent both ways, including messages in cipher." Lord Kelvin is convinced that Marconi has really succeeded in sending messages between North America and Cornwall by an enormously strong application of electric power. When asked for an opinion Lord Kelvin said: "I think it a roundabout and nonsensical way to try to solve a scientific problem."

The ocean liner Campania, on a recent western trip across the Atlantic, was in communication either with space-telegraph equipped vessels at sea or with Marconi stations on land during five days of the seven she was at sea. For two hours on the first day she talked with the Aallan liner Tunisian and then for three hours with the land station at Holyhead. Then the station at Rosslare, Ireland, was communicated with, and afterwards the station at Crookhaven, County Kerry. The Cunarder Ivernia, the Lucania, the Etruria, the Minnetonka and the La Savoie were picked up on the Atlantic, and the land stations at Nantucket, Sagaponack and Babylon, L. I., were communicated with on this side.

Lieut.-Col. H. H. C. Dunwoodie, chief officer of the Signal Service Corps of the Department of the East, officially supervised tests of a space-telegraph system on March 11th between Fort Wadsworth, Staten Island, and Fort Hancock on Sandy Hook in New York harbor. There were several hitches in the tests due principally to lack of power at Fort Hancock, but the trials were regarded as favorable. The tests will be continued for a month with the regular telegraphers of the service doing the work.

Chicago Street-railway Situation.

At a recent meeting of the Chicago council committee on transportation, Chairman Bennett was instructed by unanimous vote, to spare no effort to aid in passing the Mueller municipal-ownership bill now pending at Springfield. The committee also recommended for passage the Foreman resolution looking to the establishment of a department of local transportation. All matters connected with street-car service and the enforcement of street-car regulations are to be in charge of this department.

At a meeting of the Chicago City Council held on March 16th, the Root Street track-elevation ordinance was passed. The ordinance provides, among other things, for an extension of the "Alley L" from a point between Fifty-fifth and Sixtieth Streets west to a point between Wallace Street and Wentworth Avenue, and thence south to Seventy-second Street, and also for a western extension to a point between Center and Ashland Avenues. The "Alley L" is also granted the right to lay a third track south of Twelfth Street to accommodate express trains, the road in return giving the city a street paved with asphalt, which it must maintain alongside its right-of-way from Twelfth to Forty-third Street.

An ordinance known as the La Grange ordinance was also passed. It allows the Chicago, Riverside and La Grange street-railway company an electric line, which now reaches the city limits at Forty-sixth Avenue and Twenty-second Street to extend in Twenty-second Street to Fortieth Avenue.

The franchise ordinance of the new Southwestern Elevated Railroad Company also was recommended for passage. An amendment enables persons on this line, south and west of the stockyards, to ride for one fare to Washington and Jackson Parks and to other points on the "Alley L" by means of transfers. The fare is to be five cents for a ride from the most distant terminus downtown and around the Union loop.

DEVELOPMENT OF THE TELEPHONE FIELD.

Iowa Telephone Association.

The seventh annual meeting of the Iowa Telephone Association was held at the Savery Hotel, Des Moines, Iowa, on March 10th and 11th. The opening session was held Tuesday afternoon and was called to order by President U. S. Alderman of Nevada, who appointed as a committee on credentials George N. Bandy and Secretary Charles C. Deering of Des Moines, and Charles R. Kirk of Chariton. The committee reported the names of about 70 who had paid dues for the current year, and were therefore in good standing. Following this the treasurer's annual report was made, showing that the association was in good financial condition.

The annual address of the president called the attention of the members to the large amount of work that had been done in the Independent telephone field in Iowa during the last year. He referred particularly to the large amount of legislation which was proposed at the last session of the Legislature, which had been considered harmful by the Independent interests and was vigorously opposed by them. He strongly urged the members of the association to do all in their power to interest non-members in joining the society.

The first paper on the programme was presented by B. J. Carney of Grinnell, on the topic "Cedar Poles." This subject was of considerable interest to many members who were not familiar with the cedar product and how it is handled in the northern country.

Following this a new set of arbitration rules was read and proposed by President U. S. Alderman, who moved that they be referred to a special committee for their action. These rules cover very fully the proper method of arbitrating all differences between members of the association and between members and non-members. The committee to which these rules were referred reported them back without change, and they were thus adopted. The rules in full are as follows:

Arbitration Rules.

First—The president shall appoint, subject to approval by the executive committee, a committee of three on arbitration, whose duties shall be to hear and decide cases of disagreement submitted to them, if within the jurisdiction of the committee as hereinafter defined and in which the question in dispute refers to the telephone business or matters pertaining thereto, and does not involve any question of the policy of this association.

Second—Such committee shall have authority to hear and decide all questions referred to it properly under its jurisdiction, and its decision when made shall be final except the right of appeal to this association when next in convention assembled.

Third—Any member of this association who shall feel aggrieved by the act of another member or by the act of a person outside of the association, or any person not a member of this association who shall feel aggrieved by the act of a member and desires the case to be arbitrated by the committee, may state his grievances in substance in writing to the secretary, with his request for arbitration of it, also stating whether or not there is pending any action in court on the questions to be submitted.

Fourth—When the secretary receives the statement in writing of such grievance and he considers it a proper case to refer to the committee on arbitration, and no action has been begun thereon in court, he shall within ten days notify the opposite party to the case, who shall within ten days thereafter advise the secretary in writing whether or not he is willing to submit the case to the committee on arbitration for its decision, and if in the affirmative he shall at the same time furnish the secretary in writing a statement of the facts in the case so far as he knows them. The secretary shall then notify the applicant of said acceptance, who shall within three days thereafter furnish the secretary in writing with the material facts in the case so far as he knows them. Each party to the case shall verify under oath all evidence he submits in writing, and each party to the case before it is submitted to the committee shall agree in writing to submit the case to the committee on arbitration; that no action is pending thereon in court: that he will abide by its decision except only the right of appeal to the association while in convention assembled; that he will release all members of the committee from any responsibility for errors in judgment in any respect whatsoever, or for any damage or any loss suffered by reason of their acts, and will further deposit with the secretary the sum of five dollars ($5.00) if a member and ten dollars ($10.00) if not a member of this association, said money so deposited to be used to cover the expense of the arbitration. It being understood, however, that the party in the wrong, as so found by said arbitration committee, shall pay all of the expense of arbitration, and said committee shall have the full power and right to assess the costs of arbitration to either one or to both parties as they in their judgment may see fit. Said committee may, if they see fit, refund the money paid for purpose of arbitration to any party who has so paid in money. Any case on which an action in court is pending shall not be submitted to the committee on arbitration.

Fifth—When all of the requirements of section four have been complied with, the secretary shall refer the matter to the committee on arbitration for their decision. Said committee shall at their first meeting thereafter decide the case and render their findings in writing to the secretary, who shall at once notify the interested parties of such decision. It shall be the duty of the committee to tax the costs in each case in such proportion as they deem just and equitable, and their report of the case in writing to the secretary shall include a statement of the amount of costs each party is to pay. The parties to the case shall comply with the decision of the committee within thirty days after receiving notice of it from the secretary, unless an appeal is taken to the association in convention assembled, and the decision of the association as rendered on such appeal must be complied with not later than ten days after decision rendered and notice thereof.

Sixth—It shall be the duty of the committee on arbitration to hear and determine all cases submitted to it by the secretary within its jurisdiction and to render a just and equitable verdict thereon according to the evidence and the best of their ability. The committee shall have jurisdiction in cases arising in territory covered by this organization between members thereof, between its members and a non-member, by consent of the member. The members of the committee are not to be held responsible for errors of judgment in any respect whatever nor for any damage done nor any loss suffered by reason of their acts.

Seventh—The members of this committee before entering upon the duties thereof shall each subscribe to the following oath or affirmation: "I do solemnly swear (or affirm) that I will faithfully and fairly hear and examine all matters in controversy that may be submitted to this committee, and that I will make a just and equitable award or finding upon the same according to the evidence and to the best of my understanding, so help me God."

Eighth—If the parties to a case submitted for arbitration desire to present the matter to the committee in person or by attorney, they may do so by paying whatever amount in addition to the amount provided in section four to be paid, as shall be necessary to cover the additional expense of the committee, if any, of such personal hearing. The amount of the additional costs to be determined by the committee. All evidence submitted to the committee in person shall be given under oath when so required by the committee. Only members in good standing of this association or of a kindred association of this state may act as an attorney before the committee.

Ninth—When a case is referred to the committee on arbitration they shall fix a time for its hearing and notify the secretary of the date so fixed, which date so fixed shall be a sufficient time in advance to permit the secretary to give the interested parties and their attorneys five days' notice of the date and place of trial. The parties shall present all written evidence to the secretary on or before the date fixed for hearing and neither party shall postpone the hearing of a case longer than ten days after it has been submitted unless good cause can be shown therefor satisfactory to the committee.

Tenth—Notice herein provided to be given by the secretary shall be deemed completed service when such notice is mailed to the party's last known address, but the notice of date fixed for hearing shall be by registered letter.

Eleventh—The members of the committee on arbitration shall receive for their services five dollars ($5.00) per day for the time used in considering and deciding the cases submitted to them, also the amount of their traveling expenses and hotel bills.

Twelfth—The money received by the secretary to defray the expenses of arbitration shall be by him placed with the funds of the association and the expenses thereof paid by him out of the general fund, but he shall keep a separate account of such receipts and expenditures. The secretary shall collect from the parties such amount as the committee may designate as the costs each shall pay for cases arbitrated.

Thirteenth—Neglect or refusal to submit a case in controversy to the committee on arbitration if so requested when the opposite party is a member of this association, or to comply with the award of the committee shall be deemed unbusinesslike conduct and the penalty therefor may be a fine, suspension or expulsion as the executive committee may decide.

Fourteenth—In case either party desires to appeal from the decision of this committee to the association in convention assembled he shall so notify the secretary and pay to him such amount as the committee has taxed to him as costs together with the further sum of twenty-five dollars ($25.00) for accruing costs, within five days after receiving the notice from the secretary of the decision of this committee. Failure to comply with the requirements of this section within the time specified shall forfeit all right of appeal.

Fifteenth—When, from absence or disqualification of any one or more of the regular members of the committee on arbitration, or when a quorum thereof cannot be formed, the president of the association shall be allowed to fill such vacancies with any member or members of the association who is willing to serve. A majority award or finding of any such committee shall be as binding as of the regular committee, and any award or finding of the committee thus formed shall be made under the same rules and shall have the same effect as if made by the regular committee of arbitration.

Sixteenth—In case any person neglects or refuses to submit a question in controversy to the committee on arbitration for decision or to comply with the award of the committee in which either party to the dispute is a member of the association, it shall be the duty of the secretary to at once notify all members of the association of such neglect or refusal.

The morning session on Wednesday opened with a speech by J. C. Hume of Des Moines on "The Recent Supreme Court Decision." This decision relates to the right of telephone companies to occupy the streets and alleys of cities and incorporated towns of Iowa without a franchise from the municipality. It determined that companies organized prior to October, 1897, had such rights. Mr. Hume related the facts in the case and indicated the far-reaching import of the decision. Following his talk he answered a number of questions with regard to points in the telephone laws of Iowa. This was an able discourse, and the committee on resolutions reported a resolution thanking Mr. Hume for his helpful speech.

"A Uniform System of Toll Accounts," by Miss Flora B. Herr of Ottumwa, detailed the system which, through her, has been adopted by the Ottumwa Telephone Company, and is in use by many of the companies in the southeastern part of the state, where a well-defined start has been made toward checking up and settling inter-line toll accounts.

On motion of a member of the association, it was decided to bring together toll operators from a number of important points in the state to make a study of and adopt some uniform system of toll accounts and forms therefor, the association agreeing to bear the expenses connected therewith.

Wednesday afternoon's session was taken up with the election of officers for the ensuing year, together with considerable new business of minor importance. The officers elected were as follows: President, H. S. Herr, Ottumwa; vice-president, J. C. Sullivan, Creston; secretary and treasurer, Charles C. Deering, Des Moines; executive committee, the president, George N. Bandy of Des Moines, H. C. Raney of Fairfield, U. S. Alderman of Nevada and J. S. Bellamy of Knoxville.

Almost all of the leading manufacturers of switchboards and apparatus had extensive exhibits of apparatus connected up and in working order. Many of the supply houses also had exhibits of apparatus and specialties in their line.

Big Increase of Bell Stock Rumored.

A New York dispatch dated March 16th reads as follows: "A special meeting of the stockholders of the American Telephone and Telegraph Company, the holding company of the Bell telephone system, has been called for March 31st at the office of the company in this city to vote on a proposition to incease the capital stock $150,000,000 to $250,000,000. The authorized stock of the American Telephone and Telegraph Company was increased on June 3, 1901, from $100,000,000 to $150,000,000. One of the New York directors of the American Telephone and Telegraph Company said he had no knowledge of the proposed increase of $100,000,000 of stock."

It is true that the authorized capital stock is $150,000,000, but at the date of the last annual meeting, March 25, 1902, the actual amount of stock issued was given as $104,650,600. The company has also a bond issue amounting to $38,000,000, as stated in a letter by President F. P. Fish dated January 25, 1902.

The Boston News Bureau recently said: "It is understood that J. P. Morgan is taking a very lively interest in the American Telephone and Telegraph Company. It is said that he represents the largest stock interests in the company, and that the next month may find one of his active lieutenants vice-president and general manager in charge of the expenditures for new construction which, it is expected, will be, this year, the largest in the history of the company. It is said that the Morgan interest in the telephone company exceeds $15,000,000."

Annual Report of Pittsburg Bell Company.

The Central District and Printing Telegraph Company of Pittsburg, Pa., has issued its report for the year ended December 31st, showing gross earnings of $2,165,981, expenses of $1,587,900, net earnings of $578,081, dividends of $600,000 and deficit of $21,919. The previous surplus was $453,967, leaving the net surplus $432,048. This company's stock amounted to $8,750,000, of which the American Telephone and Telegraph Company owned $5,689,840. The company paid dividends on stock amounting to $7,500,000, the remainder having been sold to stockholders at par at the end of the year in order to obtain money for construction. The directors estimated that $1,250,000 will be required during this year, and the sale of that amount of stock will make the capital $10,000,000—the amount authorized. On December 31, 1902, the company had 46,859 subscribers and 118,403 miles of wire—an increase of 6,723 subscribers and 22,258 miles of wire, compared with the year previous.

Affairs of the Strowger Company.

Albert G. Wheeler, a heavy stockholder in the Strowger Automatic Telephone Exchange Company of Chicago, has put a new phase to the fight for control of the company by filing a bill in the Circuit Court, in which he asks for a receiver, that Adolph Nathan, Jacob L. Kessner, Louis M. Stumer, Joseph Siegel and Max Sello be enjoined from asserting that they were elected directors, and that Kessner, Sello, Siegel and Stumer be restrained from asserting that they were elected officers of the company. It is also asked that Stumer be enjoined from acting as secretary of the concern. The bill declares that the election held at the stockholders' meeting was irregular and should be investigated by the courts.

TELEPHONE MEN.

M. C. Allen, inspector for the American Telephone and Telegraph Company in Boston, gave a talk on "Telephony" before the Worcester Polytechnic Institute Electrical Society on March 13th.

E. B. Fisher was elected president of the Michigan Independent Telephone Association at the recent Lansing convention. Mr. Fisher is secretary of the Citizens' Telephone Company of Grand Rapids and connected with several other companies.

NEW COMPANIES.

Joseph H. McClintock, James A. Thompson and Frank M. Powell are the incorporators of the new McClintock Mutual Telephone Company at Denver, Ill.

The City Council of Port Townsend, Wash., has granted a franchise to the Independent Telephone Company to put in a local and long-distance exchange.

David Nelson, Louis Hogen and A. T. Perkins are the incorporators of the Farmers' Independent Telephone Company, which will install a telephone system at Pendleton, Ore., and extend from there into the country 20 miles.

Telephone News from the Northwest.

Joseph M. Nolan of Four Lakes, near St. Paul, has brought suit to recover $1,500 damages from the Wisconsin Central railway for the destruction of a telephone line from Four Lakes to North St. Paul.

The Wrightstown and Hewitt (Minn.) Telephone Company will construct five rural lines in the spring.

R. E. Thompson has introduced a bill in the Minnesota Legislature to regulate telephone charges. The bill bases the charge upon the population, and forbids charging more to one town than to another of the same size.

The Dane County Telephone Company of Madison, Wis., has ordered a 300-drop addition to its switchboard from the Ericcson Manufacturing Company.

The Zenith City Telephone Company of Duluth is negotiating for the purchase of the entire system of the Iron Range Telephone Compnay, covering a good portion of Northern Minnesota. Should the change be made it would give the Independent telephone systems of the state connection with practically all of northern Minnesota.

The Holt Mutual Telephone Company has been formed near Lanesboro, Minn., to build a rural line to that city.

The Le Roy Telephone Company of Le Roy, Minn., has been incorporated with a capital of $100,000.

The Minnesota Valley Telephone and Telegraph Company has been granted a franchise at Windom, Minn.

Business men of Plankinton, S. D., contemplate forming a company for a local exchange.

The Jackson Telephone Company has absorbed the lines and equipment of the Fairmont Telephone Company at Jackson and vicinity. In the spring the new company will make extensive improvements and will construct several rural lines.

The Edgerton (Minn.) Telephone Company has earned in its second year sufficient to pay a six per cent. dividend on preferred stock and nine per cent. on common stock.

The Citizens' Telephone Company has been granted a local franchise at Sanborn, Iowa, by the council. There is already a local company in Sanborn operating an exchange.

The Slater Telephone Company of Slater, Iowa, has been formed with $10,000 capital, and will start work on the exchange without delay.

Proceedings in quo warranto have been brought against the Nebraska Telephone Company at Council Bluffs, Iowa, to oust it from the streets. The validity of the ordinance granting it admission to the city is questioned.

The Ireton Local Mutual Telephone Association has been granted a local franchise at Ireton, Iowa, by the voters of that place.

The council of Lincoln, Neb., took up a petition for a franchise, presented by the Western Union Independent Telephone Company of Chicago, suspended the rules and read it the required three times, passed it, and the mayor signed it. The whole thing required but about half an hour.

The Electric, Water and Telephone Company of Tomahawk, Wis., has ordered a new switchboard of the Vought-Berger Company of La Crosse, Wis.

The Le Mars (Iowa) Telephone Company has been incorporated with a capital of $50,000.

The Clark Automatic Telephone Company of Sioux City, Iowa, seeks a franchise for an exchange at Hornick, Iowa, and the project will be submitted to the voters March 30th. R.

Ohio Telephone Notes.

The Colerain Telephone Company of Bevis has filed notice with the secretary of state of an increase of capital stock from $1,000 to $10,000.

The stockholders of the Home Telephone Company of Toledo have re-elected all the old directors, with the exception of General C. M. Spitzer, who withdrew. His place has been filled by the election of Attorney Clarence Brown. It was also decided to spend $30,000 in laying a new cable and enlarging the switchboard. Nothing was done in regard to the reported proposition to increase the rates.

The Madison Telephone Company of Warren will expend $10,000 in extending the lines in Ashtabula and Lake Counties and enlarging the exchanges at Geneva and Madison. The directors have authorized the expenditure.

The first two months of this year show an increase in the net earnings of the Cuyahoga Telephone Company, which, if continued through the year, will result in a surplus sufficient to pay a dividend of 2½ per cent. on the stock. President Dickson is using every means to secure an economical operation of the plant. It is said that one switchboard may be done away with until the business increases enough to require its use.

General Manager Hamblin's report of the business of the Home Telephone Company of Toledo shows very satisfactory results. The two exchanges employ 144 operators and receive on an average of 97,969 calls per day, including the night service. The total number of telephones in service at this time is 6,485.

The City and Suburban Telegraph and Telephone Company of Cincinnati will build a branch exchange at Westwood to accommodate the people of that village and surrounding territory.

The Carey Electric Telephone Company of Carey has increased its capital stock from $6,000 to $25,000.

Two points in Ohio, with several connections, have been connected with the Pittsburg and Allegheny Telephone Company's exchange during the last year —Warren and Wellsville. Oil City, Pa., has also been connected with it, and a new line to Johnstown is in contemplation. Arrangements have been made to connect it with the Western Maryland Telephone Company of Cumberland, Md. O. M. C.

Indiana Telephone Items.

The following-named telephone companies were incorporated last week: Carlisle Co-operative Telephone Company, Sullivan County; capital, $10,000; directors, John Wippes and Charles Griffin. Bicknell Telephone Company of Bicknell; capital, $6,000; to construct and operate a system in Bicknell; president, J. H. Barr; secretary, John S. Hoover. Star Line and Banner Telephone Companies of Greenfield, Hancock County.

An Independent telephone company has asked for a franchise to operate a telephone exchange and toll lines in Waterloo. One of the conditions offered in the granting of the franchise is that the company is to furnish free exchange to its subscribers. It is announced that the Bell company may grant free exchange in Waterloo, in order to retain its subscribers and prevent a dual system.

Word comes from Logansport that within a year nearly every barb-wire fence in Cass County will be in use carrying telephone messages. Old and new telephones are being bought up by the farmers and put in use by connecting the wire fences.

The striking linemen of the Central Union Telephone Company at Muncie are endeavoring to spread the strike, so as to involve all the principal Central Union cities in eastern Indiana.

The Richmond Home Telephone Company's business has so far exceeded expectations that the capacity of the plant is found wholly insufficient. Eighteen hundred telephones are in use and 700 applications on file. The capacity of the plant will be greatly increased this summer and new equipments added.

The New Telephone Company of Indianapolis held its annual meeting last week and elected the following-named directors: A. H. Nordyke, Louis Holweg, S. P. Sheerin, L. C. Walker and H. B. Sale. The directors in turn elected S. P. Sheerin president and general manager, Louis Holweg vice-president, and H. B. Sale, secretary-treasurer. The annual report of the company shows that the company had, on the first day of March, 6,716 telephones in use, an increase of 1,781 during the year. The increase during 1901 was 1,170. The gross receipts for the year were $180,471.61, being an increase in earnings over the previous year of nearly $40,000.

The case of the state against the American Telephone and Telegraph Company, wherein the latter was prosecuted and fined $100, for having placed its poles in the public highway, without first having obtained consent of the highway authorities, has been compromised and dismissed. Governor Durbin has signed the Harley bill, which provides that companies may place their poles in the public highways, when erected and maintained so as not to discommode the public in the designated use thereof. The act took effect March 7th, and is the first law on the subject the state ever had. F.

Southern Telephone Items.

A temporary receiver has been appointed for the Augusta (Ga.) Telephone and Electric Company. A. W. Blackshear was appointed temporary receiver, and March 20th was set as the day for hearing the case. The petition was presented by P. H. Langdon.

The Southern Bell Telephone Company of Atlanta, Ga., will soon establish a sub-station at West End to meet the increasing business requirements. A handsome building will be erected. The exchange will accommodate 1,000 subscribers. Cables have already been laid. L.

MANUFACTURERS AND DEALERS.

A statement from Rochester, N. Y., is to the effect that the Stromberg-Carlson Telephone Manufacturing Company will increase its capital stock from $3,000,000 to $4,500,000.

The Central Electric Company of Chicago has just placed on the market a new telephone bracket made to attach to the side of a desk so that a desk set may be swung out of the way when not in use. This bracket has a double swing joint and an adjustable clamp whereby it may be made to fit the base of any telephone. It is finished in oxidized copper and is sold at a low price.

The Automatic Electric Company of Chicago has received an order from the Delaware County Telephone Company of Manchester, Iowa, for an automatic switchboard of 1,000 capacity, with a present installation of 300 lines. Manchester has had automatic telephone service for seven years, the company being one of the early purchasers of automatic apparatus. The business has outgrown the ultimate capacity of the board now in use, and the new equipment was purchased to meet the increasing demands for service.

Government Telegraph and Telephone Service in Australia.

Data of some value on the telegraphs and telephones of the federated Australian colonies are given in an article on "The First Parliament of Australia," by Hugh H. Lusk, in the American Review of Reviews. What follows is a part of Mr. Lusk's article.

By far the most extensive, and almost, if not quite, the most important department of the government service transferred by the constitution to the administration of the federal government was that of the postoffice. In the case of Australia, as in that of its neighbor, New Zealand, the postal service includes also the telegraph and telephone services of the country, which have from the first been incorporated with the postoffice. From the first establishment of a telegraph system in all the colonies of Australasia, the telegraphs had been regarded only in the light of the most modern development of the postal system, and as such had been treated as a branch of the department. In this form they were handed over to the federal government, and it became necessary to pass an act to reorganize and unify the various systems that had grown up in the original colonies. The statute by which this is done is interesting in many ways, and not least in the evidence it supplies of the characteristic free-handedness shown by the people of Australia in supplying the needs of the community and of the economy with which it may be done.

The statistics on which the Australian postmaster-general founded his telegraph rates showed conclusively two things—that the facilities already supplied in Australia to the public for the use both of telegraph and telephone far exceeded those supplied either by governments or by private enterprise, in any country of Europe or America in proportion to the number of the population; and, further, that the charges for these services were much lower in Australia than in any of those countries. They showed that both in postoffices and telegraph stations the people of the young commonwealth were far better provided for than either in England or America, and, apparently, as a consequence, that they made more use of the conveniences, enabling all telegraph rates to be reduced to a point far below those charged elsewhere without any loss to the revenue. The new commonwealth rates provided for in the act illustrate the truth of this boast. For city messages, which includes a suburban area of a radius of 10 miles beyond the city limits, the rate is 12 cents for messages of 10 words and the address; for messages of the same length to any point within the same state—and the states are generally very much larger than any American state—the charge is 18 cents, while for similar messages to any station within the commonwealth—and from Rockhampton, in Queensland, to Perth, in West Australia, the distance of wire is more than 4,500 miles—the uniform charge is 24 cents. It is calculated, on the basis of past experience, that these rates will return a revenue sufficient to pay operating expenses of every kind, including the cost of maintenance, and, in addition, interest on the original expense of construction, amounting to fully $18,000,000. This apparent anomaly, when compared with American experience, is at least in part explained by the fact that Australians send more than twice as many messages over the lines at the lower rates as Americans do at the present charges, and that where every postoffice is also a telegraph station, and every country postmaster a telegraph operator, the cost is greatly reduced.

The telephone is a convenience of much more recent introduction in Australia than the telegraph, and for a time it appeared doubtful whether it would be taken in hand by the government, or left, as elsewhere, to private enterprise. Finally, however, it was taken in hand by one colonial government after another, and there is now probably not a town possessing a population of 3,000 persons or upward which is not supplied with a telephone exchange. There are at present, it would appear, fully a hundred more or less important centers of population in the commonwealth supplied with this convenience, and hitherto the cost has differed materially in the different states. This is one of the anomalies which can be done away with as a consequence of the federation, and hereafter the charges will be on a uniform scale, which, compared at least with some of the experiences of older and far more densely peopled countries, would seem to be moderate. There will be three different kinds of telephone service provided, for which different rates will be charged. The business telephone service will give the unlimited use of the telephone at all hours within the limits of the municipality, at an annual charge of $40; for a similar service, including both the town or city, and suburban area, the annual charge will be $50; and for private residences—without any restrictions as to the number of messages or limitations as to hours, the rate, which would seem to include both town and suburban service—is fixed at a uniform charge of $25. There does not as yet appear to be any provision made for long distances, which probably arises from the fact that the centers of population are widely scattered, nor does any provision seem to be made for public pay stations in the larger cities. As every postoffice and branch office in the towns is already a telegraph station, however, there can be little doubt that such an extension of the system for the public convenience will be made on reasonable terms as soon as the demand arises.

The Electrolytic Rectifier.[1]

By C. F. Burgess.

[illegible] electrical apparatus the use of which is increasing more rapidly than [illegible] Of the great variety of duties which electrical energy is called upon to perform, many of them are made possible by this device, and recent improvement as regards both product and price has greatly extended the use of the storage cell. The storage battery in the larger sizes furnishes enormous reservoirs for the storage of energy, and the equalization of loads in central-station work, and the uses of the smaller sizes are too [illegible] to detail.

The automobile is most satisfactorily operated by means of energy stored in batteries, and small boats and launches are similarly propelled. Police, fire, signal and watchman-clock services employ small storage batteries, and in telegraph and telephone systems the older forms of primary cells are being replaced by the cheaper and more serviceable secondary cells. They also furnish the power for operating automatic machines of the "nickel-in-the-slot" type. Physicians and dentists make use of them for cautery and similar purposes.

One of the serious limitations to an increase in the use of storage batteries, especially in the smaller sizes, is the difficulty in charging them from electric-lighting and power circuits. Where the electric circuits are of the alternating type this problem has been such as practically to prohibit the use of storage batteries, and in view of the fact that the majority of central stations employ alternating-current distribution, there are many localities where storage batteries cannot be used.

The problem of changing an alternating to a unidirectional current suitable for charging has been the subject of much study and experimentation, and various devices, such as the rotary converter, rotating commutator and vibratory rectifier, have been devised, the most successful being the rotary converter. In small sizes, however, the expense, low efficiency and trouble of operation have placed it beyond the reach of the ordinary battery user.

An ideal apparatus for rectifying the alternating current is one which has no moving parts, the analogue of the alternating-current transformer, and capable of operating at high efficiency and with little detention and deterioration. For the purpose of working out such a device a great deal of experimental work has been carried out in utilizing a peculiar property of aluminum, which was discovered about half a century ago. Wheatstone found that aluminum possessed the property of allowing current to flow freely in a direction from the electrolyte to the aluminum dipping into it, but opposing with a high resistance the current flowing in the opposite direction. The idea in utilizing this property is that if an electrolytic cell containing an electrode of aluminum and one of some other metal not having the same property and a suitable electrolyte be connected in series with the storage cells to be charged, the current in the desired direction for charging would be allowed to flow, but the impulses in the opposite direction would be shut off.

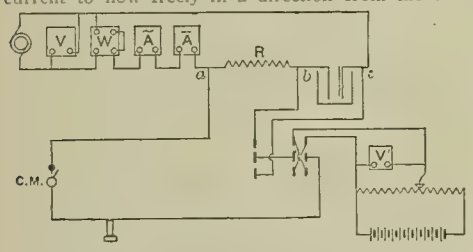


FIG. 1. THE ELECTROLYTIC RECTIFIER.—DIAGRAM OF CONNECTIONS.

The efficiency of such a device depends upon the completeness with which the current in the wrong direction is opposed, and this in turn depends to a large extent upon the electrolyte employed. A great many solutions have been tried, such solutions consisting of various substances, such as sulphuric acid, aluminum sulphate, sodium and potassium phosphate, and sodium potassium tartrate dissolved in water. Certain publications of results thus obtained would lead to the impression that the satisfactory rectification of the alternating current by this means has long since been accomplished. Efficiencies as high as 95 per cent. have been claimed, and various other statements have been made which would lead to the conclusion that we need look no further for a satisfactory solution of the problem in question. The facts show, however, that such devices have not been extensively used for commercial purposes, one reason being that under practical conditions an efficiency above 20 per cent. has not been realized.

The use of aluminum as a means of rectifying alternating currents has been the subject of study in the laboratory of applied electrochemistry of the University of Wisconsin during the last two years. Attempts were made to duplicate results which had previously been published, tests were made to separate the losses and determine their amounts, and a large number of new solutions and arrangements of electrodes were tried, in the hope of devising an economical apparatus.

1. Abstract of paper presented before the Science Club of the University of Wisconsin.

The attempts at duplicating previous work almost always led to the conclusion that erroneous data had been published, due probably to wrong methods of measurement or to neglecting some of the factors causing loss.

The losses of energy in a rectifier of the aluminum type may be subdivided as follows: C^2R loss, C being the current flowing toward the aluminum and R being the resistance of electrodes and electrolyte. CE′, where C is the current flowing toward the aluminum electrode and E′ is the counter electromotive force which is developed by the decomposition of the electrolyte. C′E, where C′ is the leakage current flowing from the aluminum to the electrolyte and E is the applied pressure.

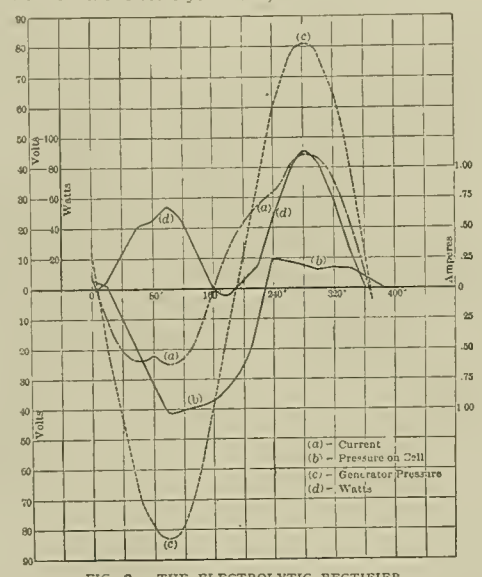


FIG. 2. THE ELECTROLYTIC RECTIFIER.

Inasmuch as the values of current and electromotive force are variable quantities, a determination of the same make it necessary to employ the instantaneous-contact method, and by means of connections shown in Fig. 1, curves were taken showing action of the rectifying cell under various conditions. In (C.M.) is indicated a contact-maker placed upon the shaft of an alternating-current generator, (R) is a non-inductive resistance, and (b) (c) are the electrodes of the cell.

The curves of Fig. 2 show something of the operation of an electrolytic cell containing an electrolyte of potassium phosphate having a density of 1.27 specific gravity, slightly acidified, in which were placed an aluminum sheet electrode, having an immersed area of 45.5 square inches and a lead electrode of similar size.

The portion of current curve (a) below the base line indicates the current which flows from the aluminum plate to the electrolyte, or the leakage current, and the remainder of the curve shows the current in desired direction. The pressure curve across the rectifying cell is shown by curve (b), the negative part being the pressure at which the leakage current flows through the cell and the positive part representing the CR + E′ in the cell, where C is current flowing, R is internal resistance, and E′ is the counter-electromotive force of polarization. The pressure applied to the circuit by the generator is indicated by the sine curve (c).

It is to be noted from these curves that there is a very considerable leakage current; the loss due to CR + E′ is seen to be much smaller than that due to leakage. The current curve being in advance of the pressure at the center of the cycle shows that there is some capacity effect.

The curve (d) showing the watts delivered to the circuit gives an idea as to the loss due to leakage as compared with the watts delivered during the remainder of the cycle. The average watts delivered to the circuit is 33.9. The average watts lost in leakage is 13.9.

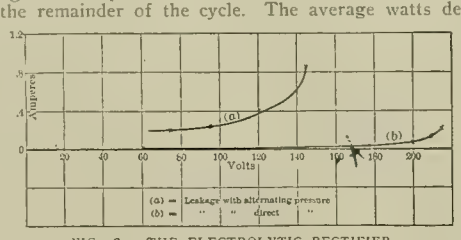


FIG. 3. THE ELECTROLYTIC RECTIFIER.

It will be seen from these curves that the principal source of loss is the leakage current, and this seems to be the most important subject for study in bringing the electrolyte rectifier to commercial efficiency. The leakage depends upon various factors, including the following:

Electrolyte—as to composition and temperature.

Aluminum electrode—as to composition and surface exposed.

Pressure.

Frequency.

These various factors were investigated, and, for a discussion of the same, reference may be made to the Transactions of the American Electrochemical Society, Vol. I., pp. 147-163.

That leakage will depend upon the pressure applied is evident upon taking the characteristic of a cell having two aluminum electrodes, using either direct or alternating pressures. The leakage increases proportionately with the pressure to a certain point, when the rate of increase becomes much greater. This is shown in Fig. 3, where curve (a) is for two aluminum electrodes in a sodium-potassium-tartrate solution, using an alternating pressure, and curve (b) is for the same plates with unidirectional pressure. It will be seen from these curves that the behavior on alternating and direct-current circuits is very different and that the amount of leakage in one case is not a direct indication of the amount of leakage in the other. An aluminum electrode may successfully withstand 200 volts unidirectional pressure and not operate successfully on 120 volts alternating pressure. It will also be noted that, with direct pressure up to 150 volts, the leakage was almost a negligible amount, while with an alternating pressure of 75 volts the leakage was many times greater. This difference was probably due, at least to a considerable extent, to the condenser effect which the aluminum electrode shows, allowing a capacity current to flow with the alternating pressure.

The various aqueous electrolytes tried showed little promise of commercial success, but through a discovery made by Mr. Carl Hambuechen that a fused electrolyte would serve more advantageously, a new field of investigation was pointed out. From a great many curves taken, Fig. 4 gives some typical results, these being obtained by use of an iron and an aluminum electrode in molten sodium nitrate.

Curve (a) represents instantaneous valve of current, the negative values indicating leakage. Curve (b) gives values of pressure at terminals of rectifier, and curve (c) shows form of pressure wave delivered by the alternator at a frequency of 58. These curves, compared with those of Fig. 2 and obtained under similar conditions as to pressure, frequency and output, show decided differences in operation between aqueous and fused electrolytes. The leakage is seen to be a much smaller percentage of the total current flowing.

The loss due to internal resistance and counter pressure is smaller in spite of the fact that the aluminum electrode in the fused salt was about one-fortieth the area of the aluminum in the aqueous solution.

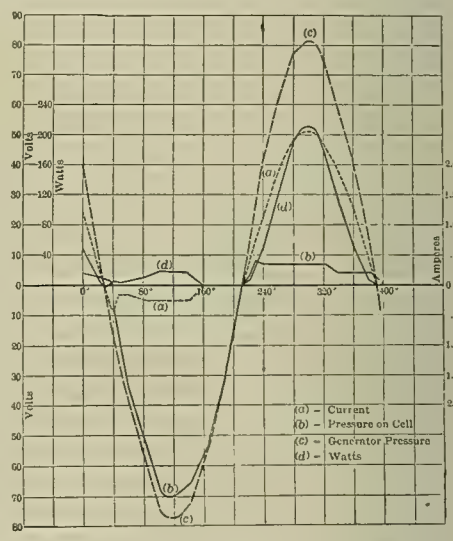


FIG. 4. THE ELECTROLYTIC RECTIFIER.

The portion of the curve (a) between 30° and 50° demonstrates, we believe, for the first time, the interesting fact that at the instant of reversal of aluminum from cathode to anode it offers little resistance to the flow of current, but that it quickly recovers itself and closes the current valve. The rapidity with which this action takes place is seen to be somewhere in the neighborhood of $\frac{1}{1100}$ of a second at the beginning of a sine pressure wave. After applied pressure has reached its maximum negative value, the leakage current rapidly decreases to nearly zero, where it remains until reversal of applied pressure again takes place.

The rapid increase, and slight elevation of curve (b) at the point 230° shows that the "formed" aluminum plate offers considerable resistance to the flow of current toward it, but the resistance almost instantly diminishes. The portion of curve (b) from 340° to 400° consists mainly of the counter pressure which maintains its value even after the direction of applied pressure has changed, as shown by the fact that (b) becomes negative, after (a) has reversed in direction.

A further observation is the fact that there is no evidence of capacity effect or difference of phase between pressure and current, which is so noticeable in curves in Fig. 3. This is undoubtedly due to the much smaller area of the electrode surface acting as condenser plates.

Curve (d) shows instantaneous values of watts delivered to the circuit, the portion from 30° to 160° representing the loss due to the leakage and from 200° to 380° the watts delivered during remainder of cycle. This curve shows an energy efficiency of over 80 per cent.

It will be observed that at a point at about 40° the value of the watts is negative to a very slight extent, indicating that energy is being restored to the circuit. This is undoubtedly caused by the aluminum plate acting in conjunction with the iron as a voltaic cell, delivering energy at the expense of corrosion of aluminum. This delivery of energy, however, at the expense of the aluminum continues only for a very short part of the cycle, or until the "valves" begin to work. While having no figures to demonstrate this fact, it seems reasonable to suppose that the small amount of corrosion of aluminum which takes place when used in a rectifier is due to, and proportional to, this energy delivered to the circuit.

Among the advantages which may be claimed for the fused electrolytes in comparison with aqueous solutions in addition to sharper and more clearly defined action, higher efficiency, and low inductive capacity effect, are large output per unit weight of cell, which is attained through ability of the cell to stand a high temperature in addition to the much greater conductivity which a fused salt may show over an aqueous electrolyte.

The form of current curve obtained by use of a single pair of electrodes is not suitable for most commercial purposes. Various methods of connection have been devised for use with the fused electrolyte whereby this objection may be overcome, and a form of apparatus has been designed which seems to fulfill commercial requirements.

The efficiency of operation of the smaller sizes is about 60 per cent., and very little attention is required during operation. The depreciation of electrodes and electrolytes is very small, and can be covered by a small fraction of a cent per kilowatt-hour delivered.

Electricity on the Kronprinz Wilhelm.

The Kronprinz Wilhelm, the latest express steamer afloat, furnishes an example of the use of electricity at sea. All the cabins have not only electric lights and call bells, but are fitted up with telephones as well. The first-class cabins on the promenade deck and the dining room are heated by 104 electric stoves. Electricity is applied to 40 small and 19 large motors, as well as to many cranes and ventilators. Current is supplied by four independent dynamos, driven by four compound steam engines. Three dynamos are situated behind the engine room and are protected by watertight bulkheads. The fourth dynamo is located in a large niche in the engine room, above the water line and on a level with the main deck.

An interesting feature of the application of electricity on this ship is the so-called schotten telegraph, or bulkhead telegraphy. In the moment of danger, caused by a collision, this telegraph enables the captain on the bridge to see whether all the watertight doors are closed. On board the Kronprinz Wilhelm there are 40 such doors, 21 of which are electric trap contrivances, which fall into place at a moment's notice. There is a watertight apparatus joined to each of these doors, which is connected by wire with an indicator on the commanding bridge. This indicator shows the captain a complete plan of all the decks, and every time a trapdoor falls into place he is apprised of the fact by the lighting of an electric lamp.

In case of danger the ship's crew receives the alarm by means of 36 electric bells, which are distributed throughout the vessel. These bells are on two circuits. The 12 bells of the first division are located in the boiler, machine, dynamo, and steerage rooms —that is, in every place where a watertight trapdoor is situated. The 24 bells of the second division are located throughout the entire ship and serve to summon the whole crew when necessary. The alarm apparatus is operated at 100 volts directly from the engine room. The fire-alarm signals are similar to those above described. The moment a fire breaks out it is exactly located on a chart in the pilot room by means of an electric lamp. There are 13 electric fire alarms distributed throughout the ship.

Stanley Instruments Held not to Infringe Tesla Split-phase Patents.

Judge Colt of the United States Circuit Court, District of Massachusetts, has handed down a decision in the suit brought by the Westinghouse Electric and Manufacturing Company against the Stanley Instrument Company of Great Barrington, Mass., for alleged infringements of certain Tesla patents, holding that the complainant failed to establish the conception by Tesla of the inventions in suit prior to April 22, 1888, the date of the Ferraris publication. The patents in suit are what are commonly known as the Tesla split-phase patents, and they were held to be non-infringed by the Circuit Court of Appeals in a similar suit by the Westinghouse company against the Catskill Illuminating and Power Company, as stated in the Western Electrician of March 7th. The same evidence was produced by the complainant in both cases, so that Judge Colt considers an opinion unnecessary, as it would be only a repetition of the decision of the Appellate Court. The bill is accordingly dismissed with costs.

How the Trolley Competes with the Steam Railroad.

Samuel E. Moffett, writing in McClure's for March, says that the number of passengers carried on American steam railroads is less to-day by 12 millions than it was seven years ago, notwithstanding the remarkable prosperity of the country. Commenting on the inroads the electric roads are making on steam-passenger traffic, Mr. Moffett continues:

"Of course, people are not really traveling less frequently than they used to, nor are they journeying longer distances. More passengers by hundreds of millions are traveling than ever before, but the steam railroads are not carrying the increase. Inch by inch, the field is contested, and slowly, sullenly, the locomotive is giving way before the insistent trolley.

"In Massachusetts, last year, four times as many passengers were carried by electric cars as on the steam roads. Of course, that was due chiefly to the dense city traffic; but still, the city street-car systems were pretty complete seven years ago, and the trolley-passenger business has doubled since that time, while the steam-passenger business has actually declined. The electric mileage of the state has increased from nine to 18 per cent. every year since 1894. In 1901, the increase was 242.7 miles. In the same year, the length of steam lines was reduced by 1.39 miles.

"In Connecticut, where there are no very large cities to inflate the trolley figures, and where one great steam-railroad system is supposed to be the feudal proprietor of the entire state, there were 20 per cent. more passengers on the electric lines in 1900 than on the steam roads. And that is the way the tide is running everywhere.

"Go, for instance, to Indianapolis, and take a spin of 53 miles to Muncie over the lines of the Union Traction Company of Indiana. It will take you two hours to make the run on an express car, or two and a quarter on a car making all stops, but of that 25 minutes are lost within the city limits of Indianapolis, where the through cars have to accommodate themselves to urban traffic on the local tracks. The fastest limited express train on the parallel line of the Big Four covers the same distance in one hour and 13 minutes. The local trains take 10 minutes less than two hours. The electric cars cover part of their schedule at the rate of a mile a minute.

"On the Buffalo and Lockport line, the present cars go, in places, at the rate of 50 miles an hour, with an average outside of Buffalo of 33 miles, but the General Electric Company has submitted estimates for machinery to develop a schedule speed of 75 miles an hour. If that rate could be kept up, it would carry you from New York to San Francisco in less than two days.

"The electric freight service is as flexible as an elephant's trunk, and as adept in picking up little things. It grows rich off the crumbs of business that a steam road would despise. It is always ready to go out of its way to accommodate the special needs of its patrons. There is no troublesome red tape about the trolley freight system. The Cleveland and Eastern Railway, for instance, handles milk on its 40-mile line at a uniform rate of two cents per gallon for any distance. The farmer buys packages of tickets at that rate. When his milk is shipped it pays its fare like a passenger. A 20-cent ticket is handed to the conductor for each 10-gallon can. The conductor punches the tickets, and passes them on to the office. The company returns the empty cans free."

Relative Value of Fuels.

Prof. Charles L. Norton of the Massachusetts Institute of Technology has made public the results of his experiments on the heat values of different fuels. A British thermal unit is the heat required to heat one pound of water one degree Fahrenheit. Following is Professor Norton's table:

	Heat Units per Pound.
Anthracite coal	15,000 to 16,000
Bituminous coal	14,000 to 15,000
Coke	10,000 to 14,000
Hardwood	8,000 to 9,000
Charcoal	12,000
Peat	10,000
Coal peat briquettes	10,000 to 13,000
Kerosene	20,000 to 25,000
Gasoline	20,000 to 25,000
Boston gas	650 per cubic foot

This gives a basis for an estimate of the relative economy of fuels, reference being had to last winter's prices in Boston:

	Heat Units for One Cent.
Coal, $12 per ton	23,000
Wood, $10 per cord	27,000
Oil, 12 cents per gallon	12,000
Coke, $10 per ton	24,000
Gas, $1 per 1,000 cubic feet	6,500

Work on the proposed new electric railway which will run from Aurora to Joliet, Ill., will probably be commenced early in the spring. It is thought at present that the cars will enter Aurora over the Fifth Street or Lincoln Avenue line of the Aurora company. The line will be in operation, it is said, by fall.

Holding Power of the Stombaugh Guy Anchor.

W. N. Matthews & Bro., the enterprising selling agents of Stombaugh guy anchors, have issued the accompanying drawing to show the foundation of their claims for the great holding power of Stombaugh guy anchors. Their experience has been that the casual observer thinks that the lines of force work in a circle, the same as the diameter of the helix. The illustration shows a cone with the vertex terminating at the point of the anchor. It will be seen

HOLDING POWER OF THE STOMBAUGH GUY ANCHOR.

that the deeper an anchor is placed the greater the cone, consequently the rapidly increasing holding power of the device as the depth increases. This power comes because each particle of earth communicates its holding power to the next, and so on, until the outer edge of the cone is reached. Matthews & Bro. also have some improvements in their rodless anchor, which, they say, will greatly cheapen the cost of guying.

A Woman Manages an Electric Railway.

Women electrical engineers, electrical saleswomen and women managers of electrical properties are not unknown, but they are still very few in number, so that the following, from the Cleveland correspondent of the Western Electrician, is of more than ordinary interest: "Miss Julia Breen has been the active manager of the Cleveland, Painesville and Eastern Ralroad Company for the last few months, since President Charles W. Wason has been absent on a trip around the world. Miss Breen is the private secretary of Mr. Wason, and, considering her fully capable of the duties involved, he left her in charge of the business. On account of the scarcity of coal and the very cold weather that prevailed for a short time, Miss Breen had many difficulties, but she surmounted them all and operated her cars on time. More than that, she always had a good supply of coal and had everything else in such shape that there was no trouble of any kind."

BOOK TABLE.

TRADE AND TECHNICAL EDUCATION. By Carroll D. Wright. Part of the seventeenth annual report of the commissioner of labor for 1902. Washington: Government Printing Office. Pp. (six by nine inches) 1,333.

This is probably the most complete treatise on the subject of trade, technical and industrial schools that has ever been published; and the thoroughness with which the United States government takes hold of any problem, as shown by its many publications, characterizes this volume. All schools that give instruction of an industrial, commercial or technical nature are considered, and their chief examples or types are treated at length. The report does not deal, however, with any school of technology or institution which gives work leading to a degree. Chapter I. of the book, covering nearly 400 pages, is devoted to trade and technical education in the United States. Among the different subjects considered is instruction by correspondence, which is treated at length. In the succeeding chapter are given several paragraphs on the attitude of employers, graduates of trade and technical schools, and labor unions in the United States toward trade and technical education. The remainder of the report is given up to elaborate treatment of trade and technical education in Austria, Belgium, Canada, France, Germany, Great Britain, Hungary, Italy and Switzerland.

An electric fountain, like the one in the grounds of George J. Gould in Lakewood, N. J., may be erected by the King of Siam, only his royal highness desires it five times as large. The firm that furnished Mr. Gould with his fountain has been asked by the king's representatives for prices. The probable cost of the order is close to $200,000, although the estimate is not complete.

CORRESPONDENCE.

London Letter.

London, England, March 7.—The arbitration which extended over so many months to determine the price which the Marylebone (London) Borough Council should pay for the portion of the undertaking of the Metropolitan Electric Supply Company which lay within its boundaries has given great dissatisfaction within the borough, and the local authority would, if it could, escape its responsibilities in the matter. It will be remembered that the award stipulated that a sum approaching $6,500,000 should be paid for the undertaking, and it seems to have suddenly dawned upon the borough authorities that they could have erected a new plant sufficient for their purpose for much less than this. Legal opinion is that the council must abide by the terms of the arbitrator's award, and the matter has been again postponed. In the meantime, the Metropolitan Electric Supply Company is said to have made a claim against the borough council for interest on the amount of the award from December 31st last, which is the date upon which the undertaking was to have been acquired by the Marylebone local authority.

An important conference is now being held, at which no press representatives are admitted, of all the steam-railroad companies in the country, with a view to standardizing any electrically equipped lines which may be built or converted in the future. This conference does not portend any immediate action in the direction of the "electrification" of the steam railroads of the country, however, beyond what is publicly known to be going on. The chief topic of discussion is the position, size, etc., of the third rail, so as to permit of interchangeability of traffic, as is now the case. At any rate, it is extremely unlikely that any but the purely suburban lines will be electrically equipped within anything like a reasonable time.

The annual report of the Postoffice telegraph system once again shows a considerable loss, even when the total revenue takes into account the cost of interdepartmental telegraphy at something like $400,000, which, of course, goes on without payment. The total deficit now stands at very little under $5,000,000, and, for the first time, I believe, a question is to be put to the government drawing attention to the unsatisfactory state of affairs.

The agitation against the bill of the London County Council which seeks powers to enable London borough councils to undertake the electric wiring of premises, is being largely supported in Parliament, and over 40 members have already signified their intention to oppose it. The London Electrical Contractors' Association is the chief agent in the movement, which is being watched with great interest throughout the country.

The quarrel concerning the Birmingham street railways has now reached a more definite stage. The British Electric Traction Company has offered fresh terms for the acquisition on lease of the new lines in the city, and the special tramway committee has issued a report recommending the corporation to accept them, which is about the first time it has been in this mood throughout the negotiations. Under the latest offer, all the lines within the city are to be converted to the overhead trolley system, the corporation finding the capital for the road work and actually carrying out this part of the agreement, while the company will find the capital for the rolling stock, etc. The company will also, of course, pay rent varying from $60,000 per annum during the period of conversion (three years), then $100,000 per annum for five years, and $160,000 per annum to end of lease.

The first meeting of the Royal Commission on London traffic was held this week, but no public business was transacted. In a good many cases concerning royal commissions the press is excluded, but in the present instance it is pleasing to note a relaxation of this rule. Therefore, at the next meeting, which will take place in about a fortnight's time, the public will have the benefit of learning the opinions of the Board of Trade experts upon the present condition of tramway and light-railway legislation. In the meantime the majority of the "tube" railway bills deposited for the 1903 session will be delayed, this decision having been come to by the chairmen of the House of Lords and House of Commons committees. A complaint is being made that much expense would have been spared in parliamentary promotion fees had the appointment of the Royal Commission been announced a few weeks earlier, as then many of the "tube" bills would not have been promoted this year.

An addition to the list of local sections of the Institution of Electrical Engineers has been made at Leeds (Yorkshire), in which county and its neighbors some of our leading electrical engineers are located. This was shown by the excellent discussions which followed the reading of the first paper on "Motive Power Supply from Central Stations," by the city electrical engineer at Bradford.

The question of speed on electric-tramways systems is again attracting attention, and an influential conference of local tramway authorities has just been held at which it was decided to deputize the Board of Trade again as to the removal of certain restrictions, with a view to obtaining an increase of the present limits.

The Indian government is experimenting with Marconi's wireless-telegraph system across the mouth of the Hooghly River.

The contract for the permanent way and overhead equipment of the Wellington (New Zealand) electric-tramway system has been given to a British firm.

The South Wales Electrical Power Construction Company is actively canvassing its area, and, owing to the numerous applications for power which have been received, a number of semi-permanent stations are to be erected, pending the completion of the six large permanent ones which have been decided on.

W.

New York Notes.

New York, March 14.—At a meeting of the Board of Estimate and Apportionment yesterday, Robert Grier Monroe, commissioner of the Department of Water Supply, Gas and Electricity, made a report dealing with the lighting of New York city and urging that immediate steps be taken to establish and operate an electric-light plant for street lighting. The report was adopted and Cary T. Hutchinson, an electrical engineer, has been hired to report upon the cost of constructing and maintaining such a plant. Accompanying Commissioner Munroe's report was another report by C. F. Lacombe, engineer of surface construction in the department, and with it were voluminous charts, tables, and statistics compiled not only from the records of this city, but gathered from 175 of the principal municipalities of the country. It shows that New York pays far more for the lighting of its streets and public buildings in proportion to its population than any muncipality in the United States; that the city is woefully and dangerously deficient in the lighting of the streets; that the lamps used are for the most part of antiquated pattern and deficient in other ways.

Chief Engineer Parsons submitted to the Rapid Transit Commission on Thursday his report on a proposed complete system of transit for the Borough of Brooklyn. As in his recent report on Manhattan and the Bronx, he urged the construction of new tunnels and many improvements in the privately controlled elevated railroads. In order to hasten a final disposition of the plans, they were referred to a special committee of three, to confer with the Manhattan Railway Company, the New York Central and Hudson River Railroad Company, and the Brooklyn Rapid Transit Company, as to the terms and conditions upon which any or all of these companies will agree to make extensions and changes in their systems suggested by the chief engineer. The total number of miles of new road proposed by the report is 37, and the total amount of new tracks proposed, whether in new road or as additions to existing roads, is 120 miles. An approximate cost of these improvements, exclusive of abuttal damages, is about $52,000,000, of which about $31,000,000 represents the approximate estimated cost of extending the subway and of constructing the second tunnel with its Center Street connection in Manhattan.

This afternoon Mayor Low drove the first spike on the rapid-transit subway line amid appropriate ceremonies. The spike was of silver and it was driven by a gilded steel hammer. As soon as the mayor laid aside the hammer a hundred track-layers began laying rails along the already prepared cedar ties. The ceremony took place at the Fifty-ninth Street circle station, near the site of the Virginia Hotel. There were present, in addition to the mayor, President Forbes of the board of aldermen, Comptroller Grout, the borough presidents, a large number of aldermen; John B. McDonald, the subway contractor; August Belmont, president of the subway company, and many invited guests.

As a result of considerable unfriendly gossip which has been rife for some weeks concerning the property and bookkeeping of the Metropolitan Street Railway Company, the company has opened its books for the fullest inspection of accountants representing District Attorney Jerome. The Metropolitan company, in a statement issued yesterday, declared that the brokerage firm of Wormser & Co. is behind the charges against the company. The Wormsers already have brought suit to prevent a merger of the Metropolitan and the Interurban company. William N. Armory has been charged by President Vreeland with originating the charges, and he, in turn, has taken steps to prosecute Mr. Vreeland for criminal libel.

The preliminary step toward the merging of the North Jersey Street Railway Company, the Jersey City, Hoboken and Paterson Railway Company, the Orange and Passaic Valley Railway Company, and the Elizabeth, Plainfield and Central Railway Company was taken at the offices of the North Jersey Company in Jersey City on Thursday, when the directors of the companies first named met severally and afterward jointly to consider a proposition submitted by Thomas A. Nevins, who is a director of the Elizabeth, Plainfield and Central Railway Company. It is stated that Mr. Nevins proposes to unite all the companies under the management of a new corporation, to be known as the United New Jersey Railways Company, leases of the existing roads to be taken for 999 years. The new company will be capitalized at $50,000,000, and it will pay all operating and other charges of the leased companies, including all repairs and extensions necessary to bring the roads to a high state of efficiency.

President H. H. Vreeland of the Metropolitan Street Railway Company delivered an address on "Transit Facilities in New York" before the Men's Club of the Judson Memorial on Thursday evening. After briefly reviewing the history of the development of transportation in this city with respect to the changes in motive power from horses to electricity, he said: "Since I have been here $70,000,000 has been expended, about 90 per cent. of this in Manhattan and only 8½ miles of new lines have been built. When you consider that the number of people carried last year was 5,700,000 over the preceding year, you can see that the opening of the subway will furnish relief for virtually no more than a day. At the expiration of this decade there will be handled a thousand millions of people a year in Manhattan and the Bronx alone. In addition to the 2,000,000 people in Manhattan, its transportation lines have to take care of the population of all the places within 50 miles of New York city. The only hope of improvement in the future in New York lies in the development of the underground systems."

The Union Railway Company has obtained from the Board of Estimate the right to lay trolley tracks and operate cars over Macomb's Dam Bridge and extend the system in the Bronx. The franchise was granted after it had been considered section by section.

The New York State Assembly has passed the New York Central Terminal bills. They are three in number. They provide for the substitution of electric for steam power in the tunnel, for the depression of the tracks, and the erection of a new station, and for the necessary grade crossings.

O.

New England News.

Boston, Mass., March 13.—Last Sunday night four armed masked men appeared by the side of a Waterbury (Conn.) electric car and shot and killed a policeman who was stationed on the car to protect the company's property from strike sympathizers. The Waterbury business men held a secret meeting and voted to ride on the cars of the Connecticut Railway and Lighting Company, thus defying the strike sympathizers' threats of boycotts.

The Massachusetts Legislature has passed a bill compelling electric-railway companies to equip all cars with brakes and emergency tools.

The Worcester Consolidated Street Railway Company has notified its motormen and conductors of a new classification of service and schedule of wages to take effect April 1st. The wages of some 600 men will be increased. The company voluntarily makes this increase. It controls all the Worcester (Mass.) city lines and the Clinton, Leominster and Fitchburg, the Worcester and Marlboro, the Worcester, Leicester and Spencer, and the Worcester and Millbury electric railways.

J. G. White & Co. of Bridgeport, Conn., have filed a certificate of incorporation. The firm has a capital of $2,000,000, half of which is six per cent. cumulative preferred stock, and it proposes to deal in electrical supplies and equipment and engage in general construction. Louis B. Grant of Brooklyn, N. Y., and Richard F. McKiniry and Ashley T. Cole of New York are the incorporators.

The Massachusetts Legislature is considering a bill granting the land back of the Massachusetts Institute of Technology to that institution in fee simple, in order that the corporation may either build thereon or sell it. As President Pritchett desires to move the Institute from the thickly settled portion of the city, it is probable, in case the bill is passed, that the land will be sold and institute buildings erected on the corporation's land near Jamaica Pond. In this event the corporation would also erect buildings for the accommodation of students who now are quartered in various boarding houses. During the 40 years of the Institute's existence, the state has given it $300,000, besides scholarships which call for an expenditure of $8,000 annually.

Professor H. B. Smith of the Worcester (Mass.) Polytechnic Institute has received letters from the General Electric, the Westinghouse, the Stanley and the Bullock Electric Companies offering positions to graduates from the electrical-engineering department of the Institute, next June. The offers exceed the number of prospective graduates.

City Electrician Hopewell of Cambridge, Mass., has made a special report to the City Council of that municipality, in which he says that he understands that a blind pool has been formed in the interest of the Edison Illuminating Company of Boston, with the object of securing as many electric-light properties as possible within a radius of 20 miles of Boston. If the object is to consolidate or merge these separate plants into one organization, he believes that Cambridge should seek by every means in its power to prevent the absorption of the local electric-light plant by such a trust.

W. D. Howe of Readsboro, Vt., and E. W. Kelley of Providence, R. I., are planning to build a dam at the foot of Howe Pond, Readsboro, for the purpose of obtaining power for an electric plant. They expect to obtain 2,000 horsepower and will furnish it to points in the upper Deerfield Valley and North Adams, Mass.

The Massachusetts Legislature has passed bills reviving the corporate authority of the Rutland Street Railway Company and the Oakham Street Railway

Company. The former must construct and operate four miles of track before December 1, 1905, and have its road in operation within five years from the time of the granting of locations, and the latter must have two miles of road in operation by December 1, 1905, and the entire road must be in operation within four years from the time of the granting of the locations.

The Pittsfield Coal Gas Company has obtained legislative authority to furnish gas and electricity to customers in Dalton, Mass. B.

From the Buckeye State.

Cleveland, Ohio, March 14.—It is said that the officers of the Cincinnati Traction Company have a plan under contemplation of building an underground road in the congested portion of the city, if the city will build subways. This they feel the city will hesitate to do, but they think it is the only solution of the street-railway question in the business section.

The Brown Hoisting and Engineering Company of Cleveland is building three large electric cranes which will go to Belfast, Ireland. They will be mounted on trestles 120 feet high and 600 feet long. The cost will be something like $350,000.

The council of Port Clinton has granted a 25-year franchise to the Lake Erie, Bowling Green, Napoleon and Port Clinton Traction Company, which now has a strip of road in operation between Bowling Green and Pemberville.

The Toledo Urban and Interurban Railway Company of Toledo has been incorporated, with a capital stock of $100,000, for the purpose of building a line from Toledo to Grand Rapids, Wood County, a distance of about 25 miles. Charles F. Chapman, Thomas E. Tracy, Henry E. Riggs and others are interested.

The Bullock Electric Manufacturing Company of Cincinnati has made a contract to furnish $60,000 worth of motors and other electric machinery to the Pacific Lighting Company of San Francisco.

Survey is now being made for the Toledo, Port Clinton and Lakeside line. It is said that Port Clinton has made so many conditions in the franchise which it is willing to grant the road that it has been decided to run around the corporation on a private right-of-way. The power house will be built at Oak Harbor. There will be sub-stations every 12 miles.

The Cincinnati Electric Motor Company has decided to increase its capital stock from $50,000 to $250,000, and to purchase ground and build a factory.

The Dunkirk and Point Gratiot Traction Company and the Lake Shore Traction Company have been merged into one company, to be known as the Buffalo, Dunkirk and Western Railway Company. The officers of the new company are as follows: President, Luther Allen, Cleveland; first vice-president, Truman G. Avery, Buffalo; second vice-president, Albert J. Myer, Buffalo; treasurer, E. Bingham Allen, Cleveland; secretary, C. M. Bushnell, Buffalo. It is said to be the intention of the new company to build a direct line from Buffalo to Point Gratiot, near Dunkirk.

The Columbus, Buckeye Lake and Newark Traction Company has been granted a franchise to build a line through Pataskala.

Ray Williams and Charles Hubbell have applied for a franchise from the south corporation line of Brooklyn village, south of Cleveland, to Berea, to build an electric road.

The Muskingum Valley Street Railway Company, with a capital stock of $10,000, has been incorporated to build an electric line from Zanesville to Marietta. B. G. Dawes, H. B. Hoyt and others are interested in the company. W. B. Cosgrove has been chosen president of the company and N. P. Shurtz secretary and treasurer.

The Ohio and Pennsylvania Electric Railway Company of Warren has elected the following officers: President, S. Fenton, Orangeville; vice-president, E. W. Fisher, Cleveland; secretary, George Pomeroy, Cleveland.

The Supreme Court has decided that the law of negligence in standing on a street-car platform in a city is not applicable to standing on the platform of an interurban car in the open country.

The Delaware and Magnetic Springs Railway Company has been incorporated for the purpose of building a line between those two points. The capital stock is placed at $200,000.

The Toledo Union Traction Company is the name of a new company which will be organized in a few days to build an elevated loop in the business district of Toledo for the accommodation of the interurban lines entering the city. The matter is in the hands of a number of Toledo men who have back of them the bondholders and others interested in the interurban movement about that city. Besides the elevated loop, the plan contemplates a new bridge across Maumee River for the special use of the interurban lines. It is estimated that it will require the investment of about $5,000,000 to complete the improvement.

A company is being organized in Cincinnati to manufacture the motorman's electric glove invented by Dr. A. Zeckendorf of that city.

The electric plant of the Jeffrey Manufacturing Company, Columbus, was destroyed by fire a few days ago.

The council of Athens has passed a resolution calling upon the citizens to vote on April 9th on the issue of $15,000 bonds for the purpose of erecting a municipal light plant.

The Wheeling and Lake Erie Railroad Company has equipped its line from Cleveland to Canton, Ohio, with a device by which wires may be used for both telegraphic and telephonic service at the same time, without one disturbing the other.

The Canton-Akron Railway Company, Canton, has filed notice of an increase of capital stock from $1,600,000 to $2,000,000. O. M. C.

Information from Indiana.

Indianapolis, March 16.—The granting of a franchise by the city of Greencastle to Messrs. Benson and Holstead of Brazil for the construction of an electric line in Greencastle, is said to form the connecting link of the proposed electric railway from Indianapolis to Terre Haute and ultimately to St. Louis. Benson and Holstead are working in the interest of the Stone & Webster syndicate and other eastern capitalists who are quietly securing rights-of-way and franchises for their great enterprise.

The Mishawaka council has been asked for a franchise for a new company which proposes to build an electric railway from Mishawaka southward through Osceola, Wakarusa, Etna Green, Nappanee and Rochester. The road will be financed by H. E. Insley & Co., of Denver, Colo., representing, according to an interesting report, Spanish and Brazilian capital.

The Vivian Company, which is projecting a line of interurban railway from Marion to Kokomo, with a branch line to Converse, makes the announcement that it will build west from Kokomo in the direction of Lafayette and will change its incorporate name from the Kokomo, Converse and Marion Interurban Railway Company to the Marion, Kokomo and Western Interurban Railway Company.

Indiana people are wondering which of the numerous steam roads crossing or operating within the state will be changed for electric operation. Senate bill No. 350, recently enacted into law, authorizes any railroad company organized under the general railroad law to bring itself within the laws governing interurban, electric or street-railroad companies by action of its board of directors filing a certificate to that effect with the secretary of state.

The annual meeting of the stockholders and directors of the Union Traction Company of Indiana was held on the 14th inst. The board of directors was re-elected in entirety. The board organized by re-electing all the old officers. The greatest interest was manifested in the reports filed, which show the gross receipts from operating to be $951,193.10; miscellaneous receipts, $11,072.87; total earnings, $962,265.97; operating expenses, $516,503.46; total net receipts, $445,762.51; fixed charges, including dividends on preferred stock, $329,090. Net profits for the year, $116,672.51.

The Holland Palace Car Company of Indianapolis is preparing to build the Holland combination parlor and sleeping car for interurban lines. A pattern is now building at Wilmington, Del., under the supervision of Mason Rickert, who will be superintendent of the Indianapolis factory. F.

Michigan.

Detroit, March 14.—Saginaw people are taking an interest in the construction of an electric line between that city and Flint. This project was started by the Union Traction Company, which failed, after having built some 20 miles of roadbed. A meeting of the citizens is to be held and delegations from all along the line are expected to be present.

The Grand Rapids, Grand Haven and Muskegon third-rail electric line is expanding. It has been decided to build on to Highland Park from Grand Haven, and 33 miles of line will be constructed as soon as the frost is out of the ground.

A new Edison plant will be constructed on Flat River, near Lowell, to furnish electric light and power to Grand Rapids. The contract has been let to W. E. Tench of Detroit for the construction of the dam, power house and canal. The dam will have about 30 feet of head. The construction will take about six months.

J. C. Dick and 20 other residents of Buchanan, Mich., have started a suit against C. A. Chapin of the Buchanan Power and Electric Company, to restrain him from transmitting power from the municipal dam to points outside the village. A pole line has been erected by the company to South Bend., Ind., and the citizens say that the provisions of the lease stipulate that the power is not to be used outside of the town.

The Detroit United has purchased 3½ acres of land at the intersection of Gratiot and Harper Avenues, Leesville, for $10,000. The company will construct on this land a car barn at a cost of $20,000. The building will be of brick and of the most modern construction, with a capacity for 200 cars.

Marquette, Mich., is said to be well satisfied with its electric-lighting plant and municipal ownership. The plant last year earned $8,000 net profit, after paying for $10,000 improvements and furnishing light at rates said to be lower than any in the state.

One of the first acts of the new officials of the village of River Rouge will be to pass on the proposed electric-light system to be owned by the village.

The United Electric Heating Company of Detroit (capital, $100,000) has filed articles of incorporation.

The new Detroit Edison Company will, in connection with the furnishing of light and power, put in one of the largest salt plants in this country. It will have a capacity of 10,000 barrels a day, both vacuum-pan and grainer salt.

The Toledo Urban and Interurban Railroad Company of Toledo has been incorporated, with a capital of $100,000, to build an electric road between Toledo and Grand Rapids, Mich. C. G. W.

Northwestern Notations.

Minneapolis, Minn., March 14.—It is reported that the electric line being surveyed from Winona, Minn., to Rushford will be continued to Decorah, Iowa, a distance of 100 miles.

A. F. Graeter seeks a franchise for an electric-light plant at Dillon, Mont. It is proposed to operate the plant by waterpower from the Lovell warm springs, about eight miles above the city.

Pelican Rapids, Minn., has voted bonds for an electric-light plant.

The Twin City Rapid Transit Company has asked a dismissal of the suits brought by Benson Bidwell, Clara E. Bidwell and Charles F. Bidwell for alleged infringement on a patent held by Benson Bidwell for lighting street cars by electricity. The defendants assert that there has been no action on the case since March 3, 1901; that the patents expired in May, 1902, and that similar cases have resulted in decisions adverse to the plaintiff.

The Lynden Electric Railway and Improvement Company has been incorporated to build electric railways in and through Lynden, Wash. The capital stock is $160,000.

A recommendation has been made to the War Department to develop electric power from the dam at Meeker Island, between Minneapolis and St. Paul, and generate sufficient electricity to furnish light for the postoffice, custom house and army building in St. Paul, the buildings at Fort Snelling and the postoffice at Minneapolis.

Surveys are being made of waterpowers available on the Peshtigo River, near Marinette, Wis., to ascertain the possibilities for electric development.

A bill has passed the state Legislature of South Dakota, enabling the construction of street-railway and interurban lines, and H. H. Natwick and associates at Sioux Falls expect to construct a system for that city this summer.

A franchise may be granted at Dell Rapids, S. D., for the establishment of a private electric-light plant, as the town is hardly able to put in a municipal plant.

J. L. Bright is soon to start construction of a new electric-light plant at Lewistown, Mont. It will cost complete $25,000, and the machinery has been ordered. There is a fall of 64 feet of water, with a capacity of 500 horsepower, at the site of the new plant.

The proposition to buy the electric-light plant of the Fowler company at Morris, Minn., was voted down.

Mankato, Minn., is taking bids for the construction of a municipal electric-light plant.

The Electric Power Company has been formed at Keosauqua, Iowa, to develop electric power from the Des Moines River.

A street-car line is in course of construction between Hoquiam and Aberdeen, Wash., by the Gray's Harbor Power Company.

Marquette, Mich., has great success with its municipal electric-light plant. After deducting $10,000 for improvements from the net earnings, there is a cash balance remaining of $8,000. The watt-hour rates are under five cents and are said to be the lowest in the state.

The proposed franchise to furnish power to Superior, Wis., citizens by the Great Northern Power Company, was laid on the table by the council when the company declined to accept a maximum charge and the right to examine the books of the company.

Electricity was used successfully to thaw frozen water pipes at Brainerd, Minn. A four-inch city water main was thawed for a block in an hour and a half, 40,000 watts doing the work.

Daniel Stevens asks a franchise at Lewis, Iowa, for an electric-light plant. Power is to be secured by damming Indian Creek.

Seattle, Wash., is considering the construction of a municipal electric-light plant. The estimated cost is $590,000.

Fairfax, Minn., has voted to install an electric-light plant.

Plumbers at Butte, Mont., have struck against the use of an electric machine for thawing frozen water pipes. They demanded of the master plumber that he discontinue the use of the machine, and upon his refusal, went out. The master plumbers of Butte will uphold the contractor. R.

Canadian Intelligence.

Ottawa, Ont., March 14.—The Canadian Niagara Falls Park Commission has decided to submit to the Ontario government the names of two electrical experts, who will be asked to report on the cost of constructing the transmission line to Toronto, and the cost of operating it. Two hydraulic experts have also been named who will report upon the available power sites remaining at the Falls.

Following is the number of passengers carried by the principal street-railway systems in the Dominion

of Canada during the last year: Montreal, 48,858,373; Toronto, 41,689,258; Ottawa, 6,988,789; Quebec, 4,192,799; Hamilton, 3,845,789; Winnipeg, 3,845,666; Halifax, 2,540,000.

One by one the Montreal Light, Heat and Power Company is gathering in all its rivals, projected or otherwise. The latest acquisition of this company is the purchase of the St. Lawrence Power Company. This company controlled the power rights of the Soulanges Canal, and it was from this point that it was proposed to develop electric power to the extent of 40,000 horsepower, if necessary. It is estimated that this power can be developed at a very low rate, and it is thought that this consideration has largely influenced the light, heat and power company in favor of its purchase.

It is announced, on reliable authority, that there is a movement on foot by prominent Canadian capitalists to form a combine to control the mica mines of the Dominion. The object of the movement is to preserve Canadian minerals for Canadians and to offset American capitalists who, during the last two years, have been quietly securing the valuable mica deposits of Ontario and Quebec.

The Ontario government has incorporated the De Forest Wireless Telegraph Company of Canada, Limited, with a capital stock of $2,500,000. The incorporators of the company are Alex. Mackenzie, E. G. Long, Charles Bennet, George Templeton and James Ross, all of Toronto. The head office of the company will be at Toronto, Ont. The company's charter permits it to acquire all the inventions and rights of Lee De Forest, relating to wireless telegraphy, and to operate a system of telegraphic communication by means of wireless or other method. W.

Southern Developments.

Charlotte, N. C., March 14.—It is reported that the Nashville (Tenn.) Railway Company will secure electric power from the Great Falls Power Company, which proposes to expend $1,000,000 or more in developing Great Falls on Caney Creek. C. H. Fish of Onio is general manager of the company. The General Electric Company is said to be interested in the deal.

The town of Madisonville, Ky., has ordered all electric companies not having franchises to remove all wires, etc., from the streets. The city is attempting to do away with the plant of the Railway, Light and Water Company. Municipal ownership is being agitated.

J. M. Stephens of the Board of Electrical Control of Atlanta and others have visited Nashville, Tenn., to examine the city's lighting plant, with a view to erecting a similar plant in Atlanta.

The Sumter (S. C.) Light, Ice and Power Company (previously mentioned) has been chartered by Perry Moses, president, and others, with capital of $70,000.

The Tennessee Coal, Iron and Railroad Company is substituting electric motors for mules in the Pratt mines near Birmingham, Ala.

On March 23d the General Council of Atlanta, Ga., meets to consider bids for lighting the city, for one, three and five years.

It is reported that the Ohio syndicate proposing to build an electric line from Atlanta to Augusta, Ga., has secured figures and plans for the work.

The Knoxville Power Company of Knoxville, Tenn., is said to be interested, together with English capitalists, in developing a big waterpower near Knoxville for furnishing electric power to Knoxville and towns in East Tennessee.

The Rock Hill (S. C.) Water, Light and Power Company has been organized. George MacDonald of New York and associates have bought a controlling interest in the company. Extensive improvements are contemplated. L.

Among the Rockies.

Salt Lake City, Utah, March 12.—John W. Prestel & Sons have been granted a franchise in Payette, Idaho, to put in an electric-light plant. The life of the franchise is 25 years.

Colonel Dewey of Nampa, Idaho, has ordered from the General Electric Company of Schenectady, N. Y., a 50-kilowatt dynamo to place with the other dynamos at the plant at his hotel, and when it arrives there will be enough electricity to light the town of Nampa.

The Union Pacific Railroad Company is about to install an electric-light plant at Laramie, Wyo.

J. K. McCornack, G. W. Peddycord and C. E. Frederick, three business men of Palouse, Wash., have asked the City Council for an electric-light franchise.

A. F. Graeter of Dillon, Mont., has asked the City Council of Dillon for a franchise to furnish light for the city and other patrons. In case the franchise is granted, and the citizens generally are in favor of it, the waterpower at Lowell Springs, eight miles from the city, will be used to produce the current.

The construction of an electric-light plant will be begun immediately at Prairie, Oregon, by B. Reveille and brother of Denver, Colo. They have purchased a waterpower four miles above the town for $13,000, and the council has granted a 20-year franchise, reserving the right for the city to purchase at the end of that time. G.

PERSONAL.

Sir Oliver Lodge said recently in a London speech that "society might be divided into the overworked and the unemployed."

D. A. Belden has been chosen general manager of the Birmingham Railway, Light and Power Company of Birmingham, Ala.

R. J. Hewett of St. Louis, Mo., has formed a connection with the Hall Signal Company of New York city. Mr. Hewett has for a number of years been connected with the telegraph department of the Missouri Pacific Railway Company.

William Stanley, the well-known electrical engineer of Pittsfield, Mass., contributes a striking article on "The Inventor and the Trust" to the Springfield (Mass.) Republican of March 8th. Trust methods are arraigned in vigorous language.

Lieutenant W. F. C. Hasson, formerly of San Francisco, is now government electrical inspector for the territory of Hawaii, with headquarters at Honolulu. He is in charge of the government bureau for the inspection of interior, overhead and underground electric construction.

"The College Man in Business" was the title of a lecture given at the University of Michigan on March 6th, by G. E. Mitchell of the Western Electric Company, Chicago. Mr. Mitchell said that more and more attention was being given by large manufacturing companies to the problem of how to fit the college men for a business life.

Mr. Isaac G. Marks, accompanied by Mrs. Marks, visited Chicago last week on a honeymoon trip throughout the North. Mr. Marks is one of the firm of Stern & Marks, electrical supplies and construction, in New Orleans, La. While in Chicago Mr. and Mrs. Marks were entertained by John W. Brooks, western manager of Pass & Seymour.

John Davidson, who has for some time been connected with the Germania Electrical Lamp Company of New Jersey, has severed his connection with that company and associated himself with the Sterling Electrical Manufacturing Company of Warren, Ohio, manufacturer of the Sterling special incandescent lamps. Mr. Davidson can be found at the New York office of the Sterling company, 26 Cortlandt Street, New York city.

H. M. Lofton, railway-equipment dealer, with offices in Atlanta and New Orleans, has merged his business with that of the B-R Electric Company of Atlanta, Ga., and has assumed active management of the business. Mr. Lofton is a well-known electrical man in the South. He has constructed and managed a number of large plants and for some time was manager of the street railways of Savannah, Ga. He resigned from that position about two years ago and went to Atlanta to engage in business.

ELECTRIC LIGHTING.

H. Nail, James Sellers and James Crotty are the incorporators of the Center Point Electric Light, Power and Irrigation Company of Center Point, Texas.

The Chattanooga (Tenn.) Light and Power Company has awarded the contract for a new plant, aggregating $250,000, to the General Electric Company of Schenectady, N. Y.

The North American Company of New Jersey has purchased the Laclede Gas Light Company and the Missouri Edison Electric Company of St. Louis, Mo., for a price said to be $12,825,000.

The city of Chandler, O. T., has granted a 20-year franchise to S. W. Carver of Windsor, Mo., to erect and maintain an electric-light and power plant within the city limits of Chandler.

The Watertown Electric Company, Watertown, Wis., recently purchased a new street-lighting equipment, consisting of two 50-light series alternating circuits. The contract was awarded to the Western Electric Company of Chicago.

The Fox River Light, Heat and Power Company has purchased a site in Aurora, Ill., where work will soon be begun on the erection of a first-class plant, utilizing power from the Fox River. The company's business has grown to such large proportions that the old plant has become inadequate.

The Whatcom Electric Company has been organized at Whatcom, Wash., and has purchased the plant of the Fritzell Electric Company. The members of the company are H. L. Livesley, Herman Rowe and J. R. Francis. Mr. Livesley was manager of the old company and has installed 28 electric plants in Whatcom and vicinity.

ELECTRIC RAILWAYS.

It is reported that the Logan Square line of the Chicago Metropolitan elevated railway is to be extended to the city limits by way of Milwaukee Avenue.

Bernard Corrigan, president of the Metropolitan Street Railway Company of Kansas City, Mo., says the business of the company has increased to such an extent that the employes will be given a substantial increase in wages.

The stockholders of the Pensacola Electric and Terminal Railway Company, recently met at Jacksonville, Fla. Among other improvements to be made this summer, the dummy line to Fort Barrancas will be "electrified."

It is probable that the St. Louis and Suburban Railway Company will be absorbed by the St. Louis Transit Company. If such a merger can be effected, all the St. Louis street-car lines will be under one management. This is the situation which a coterie of interested St. Louis capitalists has been trying to develop for years.

In a recent issue of the United States Patent Gazette, Thomas A. Edison is granted a patent for an apparatus for handling cable-drawn cars on inclines. The winding drum of the cable is driven by an electric motor and a rheostat is provided for controlling the speed of the motor in a single direction. An automatic brake locks the motor when the current is cut off.

The St. Louis Transit Company has ordered 450 new cars, the first consignment of which is to be placed in commission about August 1st. At regular intervals the remainder will arrive and by May 1, 1904, the company expects to have ample facilities to handle the World's Fair crowds. The new cars will be of the latest type and will be provided with air brakes and powerful motors.

To test the question of universal transfers between the various street-railway companies in Chicago, the receiver of the Chicago General Railway Company has prepared a ticket good on its face for a transfer to connecting lines of the Chicago City Railway Company and Chicago Union Traction Company. It is said that the city is giving the Chicago General company its moral support in this matter.

At a long session at which a number of prominent citizens entered their protests, the Pontiac (Ill.) City Council recently granted to the Bloomington, Pontiac and Joliet Electric Railway Company a 50-year privilege to build and operate an electric railway within the city. It is said that some of the aldermen are connected with the street-car company and that the city interests are not well protected by the franchise.

President Leslie Carter of the Chicago South Side elevated road has voluntarily increased the wages of the employes of the road, which places the men among the best paid of their trade in the country. The increase includes all departments. The motormen were given 29 cents an hour, instead of 25 and 27½, the former rate. The conductors were raised from 20 to 21 cents an hour and the guards were given 18½ cents, instead of 16½ cents.

The St. Louis and Eastern Electric Railroad Company of St. Elmo, Ill., has recently been incorporated with a capital stock of $50,000. The road will be constructed from East St. Louis through the counties of St. Clair, Madison, Bond and Fayette to the village of St. Elmo, Fayette County, Illinois. The incorporators and directors are B. F. Johnston, P. M. Johnston, G. W. Bledsoe and G. W. Harlan, St. Elmo, and G. T. Turner, Vandalia, Ill.

It is stated by a New York daily that Professor A. C. Albertson, late of the Royal University, Copenhagen, Denmark, and now a resident of New York city, has invented a system of magnet propulsion for railways by which a speed of 300 miles an hour will be possible. The Delaware, Lackawanna and Western Railroad Company is said to have placed its shops and land at Jersey City at the service of Professor Albertson for his experiments.

The annual report of the St. Louis Transit Company, the operating company of the United Railways Company of St. Louis, Mo., recently published, shows that the gross earnings of the company for the year ended December 31, 1902, were $6,452,219 and the net earnings $2,484,498. The interest and rental charges including the five per cent. dividend on the preferred stock of the United Railways Company of St. Louis, which is guaranteed by the St. Louis Transit Company, amounted to $2,752,581, so that the year's operation showed a deficit of $268,083. The report states that the earnings of the company during the first quarter of the present year show sufficient increase over those of last year to warrant the prediction that the guaranteed dividend on United Railways of St. Louis preferred can be fully met this year from the company's net earnings.

POWER TRANSMISSION.

The Dixon Electric Power and Water Company has been incorporated at Dixon, Cal., with capital stock of $14,000.

A company is being organized of eastern capital which will develop a plant in Colorado to furnish power and water for the cities of Denver, Colorado Springs, Cripple Creek, Leadville, Pueblo, Central City and Black Hawk. F. F. Noxon is agent for the company which is said to have a capital of $5,000,000, and which, according to the Denver News, has purchased a tract of 20,000 acres of land on Tarryall, Michigan Rock and Jefferson Creeks. The name of the new corporation will be the Tarryall Water and Power Company.

The people of Butte, Mont., will soon enjoy the novelty of riding on cars propelled by power generated 100 miles away. The power plants of the street-railway and electric-light companies will soon be closed down and used only in cases of emergencies. All the

electric power to be used in the city is to come from three large Missouri River plants, one at Canyon Ferry, another at Big Hole, and the third, that of the Madison Power Company. The high-tension current will be received at sub-stations and there reduced and apportioned to different districts.

SOCIETIES AND SCHOOLS.

The Worcester Polytechnic Institute of Worcester, Mass., has issued a circular giving information about its courses of study, equipment, etc. J. K. Marshall is registrar of the Institute.

V. R. Lansing, western manager of the Holophane Company, will give a talk on "The Engineering of Illumination" before the Robert Fulton Association of Stationary Engineers at its rooms in the Masonic Temple, Chicago, on March 21st.

The Physics Conference of the Michigan Schoolmasters' Club will hold its annual meeting in Ann Arbor, Mich., on March 27th and 28th. Among the papers to be presented are the following: "The Electron Theory," by Dr. Karl E. Guthe; "A Modified Form of the Arons Lamp," by Professor John O. Reid; "A Discussion of the Collegiate Entrance Requirements in Physics as Recommended by the North Central Association of Colleges and Secondary Schools," by Professor Henry S. Carhart.

The next regular meeting of the American Institute of Electrical Engineers in New York will be held on Friday, March 27th. The subject of the meeting will be "High-tension Lines," and four papers will be presented. Ralph D. Mershon, who may be addressed at 29 Broadway, New York city, is chairman of the transmission committee, which has the meeting in charge, and he says he is not receiving as many written contributions to the discussion as are desirable. He wishes that everyone connected with the Institute who has had any experience or has any definite opinions in connection with the subjects to be discussed will take part in the discussions, either by mail or in person.

PUBLICATIONS.

"Smokeless Combustion" is the title of a booklet issued by the Duluth Stoker Company of Duluth, Minn. It contains several illustrations, a description, and testimonial letters about the Duluth boiler stoker.

A bulletin descriptive of reinforced concrete construction for building and engineering operations has been issued by Ambursen & Sayles of New York city and Walter I. Brock, 75 Dearborn Street, Chicago. Illustrations are given of a paper mill at Marseilles, Ill., in which this construction is used.

The Duncan Electric Manufacturing Company of Lafayette, Ind., has issued a 28-page bulletin descriptive of the Duncan integrating wattmeter for direct-current lighting and power service. Illustrations are given of the complete meter and its parts in detail, also diagrams of connections and dial readings. The explanatory text is very complete and information is also given on testing, cleaning, reading and installing of meters.

A catalogue of Gordon cells and supplies is distributed by the Gordon Battery Company of New York. Different styles of primary batteries are treated, such as are adaptable for use for railroad-signal alarms, telephone, telegraph, gas-engine ignition, fan motors, phonographs, cautery and dental work, etc. The capacities of the cells vary from 100 to 1,000 ampere-hours, according to the work they are intended to perform. The 1,000-ampere-hour battery is said to be the most powerful primary cell on the market. It is 8½ by 14½ inches in size and is designed to give long life and heavy current discharge. The Gordon spark coil and Banks' automatic resistance inserter are also illustrated.

MISCELLANEOUS.

William De La Barre, a director of the Washburn-Pillsbury Mills, Minneapolis, Minn., is in Magdeburg, Germany, buying machinery for the fuel briquette works that W. D. Washburn intends to build at Bismarck, N. D. It is estimated that 55,000 square miles of lignite underlie the Dakotas and Montana, while another wide belt extends through the Gulf States from Florida to Texas.

Chief Mersch of the Evanston (Ill.) Fire Department is reported as having ideas for the development of a circulating fire department to protect the seven towns between Evanston and Highland Park, Ill., a distance of 12 miles. According to his plan, the headquarters of the department would be at Glencoe, where the apparatus and horses would be kept in readiness on a motor car of special construction, which could be sent to the fire on any one of the electric lines leading to the group of towns.

An exhibition will be held in Dresden, Saxony, from May 20th to September 30th, which will have for its object the study of improvements in municipal government. The subjects to be discussed will include street paving, sewers, drainage, gas and electric lighting, street railways and kindred topics. Invitations are sent to prominent cities in the United States to appoint delegates to this exposition. Further information may be obtained by addressing Oberbürgermeister, Geh. Finanzrath a. D. D. Beutler, Dresden, Saxony.

With the establishment of the new power house of the East St. Louis and Suburban railway at Winstanly Park, East St. Louis, Ill., it is said that B. F. Clark, chief electrical engineer, and R. W. Bailey, superintendent of overhead construction, supervise the distribution of electricity to a territory covering 900 square miles. The primary voltage is 13,200. Five engines drive the generators, and there are 153 miles of wire and 148 miles of track. In addition to operating 80 cars now in service this power house supplies the light for East St. Louis.

TRADE NEWS.

The Admore Electric Company, recently organized, has changed its headquarters from Kansas City to St. Louis.

An increase from $20,000 to $100,000 has been authorized in the capital stock of the Illinois Electric Company, Chicago.

The Cleveland Woolen Mills of Cleveland, Tenn., is in the market, for immediate delivery, for one 100-kilowatt, direct-current dynamo, a good second-hand machine being preferred.

The Tuerk Manufacturing Company has been organized at Chicago, and will manufacture electrical machinery and supplies. W. H. Duval, Louis Salinger and G. E. Dickson are the incorporators.

The American Miniature and Decorative Lamp Company of New York city has been incorporated with a capital stock of $100,000. The directors are H. J. Jaeger, Conrad Hubert and Samuel Stern of New York city.

American electrical interests have obtained another important British contract, the constructing and equipping of the Shipley railway, the first section of the Mid-Yorkshire electric traction scheme having been undertaken by J. S. White & Co. of New York.

The Ampere Electrochemical Company of Portchester, N. Y., was recently incorporated with a capital stock of $200,000. Among the directors named are H. C. Mortimer, Jr. and C. W. Barnaby of New York city and W. H. Miller of East Orange, N. J.

The John A. Mead Manufacturing Company of New York has obtained a contract for the belt-conveying equipment to be installed in the Chelsea power station of the Yerkes Underground Railway, London. The conveyors will be operated by electric motors.

The Kuhn brothers and several other young Detroit business men have organized the United Electric Company, and will make and sell electrical appliances of all kinds. The company is capitalized at $100,000 and is the outgrowth of the United Electric Heating Company of Detroit, Mich.

The Central Electric Construction Company has purchased a site at Struthers, Ohio, upon which will be built a plant for the manufacture of general electrical supplies, including motors up to one horse-power. W. L. Goodhart of Youngstown, Ohio, secretary of the company, will superintend the construction of the plant.

The announcement is made that the A. A. McCreary Company has been re-organized as the McCreary Electric Company with increased capital, manufacturing and shipping facilities and several new electrical specialties. A. A. McCreary is president and H. W. Brooks, Jr., treasurer, of the new company, which has offices at 136 Liberty Street, New York city. The company is desirous of arranging for a western representative in Chicago.

F. D. Lawrence, formerly president of the Standard Electric Company of Cincinnati, Ohio, and well known in the electrical business, has associated himself with Mr. Hall of the Hall Electrical Supply Company of that city. The new company will be known as the Lawrence-Hall Electric Company, Mr. Lawrence being president and treasurer and Mr. Hall vice-president and secretary. C. S. Nolloth, also of the Standard Electric Company, is connected with the new company and will represent it on the road.

The Elblight Company of America, 114 West Thirty-second Street, New York City, announces the receipt of a letter from C. M. Goddard, in which he states that the Elblight system of electric-lighting boards has received the unanimous approval of the entire electrical committee of the National Board of Fire Underwriters and that rules to govern the same will appear in the next issue of the National Electric Code. In view of the long contest for this approval the Elblight Company feels that it is the subject of congratulation for this recognition of merit of its system.

The Chicago Inter-Ocean says: "Since January the American Steel and Wire Company has exported about 70,000 tons of all products. Its officials estimate the total volume of exports for the year at 180,000 or 200,000 tons. These go to nearly every country in the world, and the trade is growing steadily. Every plant included in the 27 subsidiary companies of the American Steel and Wire Company is being made to produce as nearly as possible the maximum of its capacity. The company is not able to keep up with its orders and is booking now for the second half of the year."

BUSINESS.

Baker & Co. of Newark, N. J., platinum refiners, are offering good prices for burned-out incandescent-lamp bases which have the platinum wire intact.

The three principal features of the Tolor system of conduit boxes are the "knockout" feature, the fact that any combination of outlets for one-half and three-fourths-inch pipe is possible, and the absolute completeness of the system in that no condition exists in which the boxes cannot be applied. The Electric Appliance Company, Chicago, has just issued a very complete catalogue of these conduits and conduit fittings.

According to General Manager Hayden of the Consumers' Carbon Company of Lancaster, Ohio, this factory has recently shipped as many as six carloads of carbons to one concern alone, the Western Electric Company of Chicago. This speaks well for the demand for the high-grade carbons manufactured by the Consumers' company. The Lancaster factory is now running full blast, and the company seems never to have been busier than at the present time.

Among the engine sales for February of the Allis-Chalmers Company are the following: Southwestern Missouri Electric Railway Company, Webb City, Mo., one 30 and 60 by 48-inch horizontal cross-compound Reynolds-Corliss engine; Vulcan Iron Works, San Francisco, Cal., one 14 by 36 girder-frame Reynolds-Corliss; Union Electric Light and Power Company, St. Louis, Mo., one 12 by 16 engine; George M. Moulton & Co., Chicago, Ill., one 24 and 48 by 48 steeple-compound Reynolds-Corliss engine; Louisville Railway Company, Louisville, Ky., two 40 and 78 by 60 vertical cross-compound engines; Denison Light and Power Company, Denison, Texas, one 16 by 36 engine; Albuquerque Gas, Electric Light and Power Company, Albuquerque, N. M., one 16 and 28 by 36 horizontal cross-compound engine; Denver Engineering Works, Colorado, two single differential electric motor-driven Riedler pumps.

The new firm of A. S. Doxsee Electrical Company, manufacturer's agent, 1110 Pine Street, St. Louis, starts off with a number of good agencies, as follows: New York Insulated Wire Company, Alphaduct Manufacturing Company, Peerless transformers, Loricated conduit, St. Louis incandescent lamps, Standard Underground company's weatherproof wire and Pass & Seymour's porcelain specialties. Mr. Doxsee is, of course, thoroughly well known to the St. Louis and southwestern trade, and Mr. W. H. Barrere has likewise a host of friends in St. Louis. Incidentally, it may be mentioned that Mr. Barrere was for years in a confidential capacity as credit man with the Commercial Electrical Supply Company before that company changed hands. Mr. Barrere was with Mr. Franklin for a number of years in that business and brings to the new firm of A. S. Doxsee Electrical Company a wide and complete knowledge of electrical credits which will doubtless be of much value to those disposing of their products through the new concern.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 10, 1903.

722,208. Electric Fan. Richard P. Chandler, Philadelphia, Pa. Application filed May 13, 1902.

The fan has a stationary base to which is secured a toothed ring. A fan body is pivotally supported upon the base and two oppositely arranged sectors carried by the body are adapted alternately to mesh with the ring. A fan shaft rotates in the fan body, and mechanism controlled by the shaft is arranged to drive the sectors in opposite directions.

722,212. Subscriber's Telephone Circuit. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 22, 1901.

722,253 and 722,254. Process of Reducing Iron from Its Ore. Marcus Ruthenburg, Philadelphia, Pa. Applications filed July 10, 1900.

A part of the process consists in assembling the reduced particles to form a path for fusing by an electric current.

722,255. Electrical Traction Device. Boyd M. Scott, Coalport, Pa., administrator of Walter W. O'Malley, deceased. Application filed April 3, 1902.

The device comprises suitable frame and carrying truck, combined with a motor operatively connected to the truck, a cable-carrying drum rotatably mounted upon the frame and operatively connected with the motor, a compensating cable connected to the drum and thus indirectly placed in communication with the motor, a controller for the motor, a compensating driving wheel having

a shaft mounted in movable bearings, a lever pivotally mounted upon the truck and a link connecting the lever with the shaft of the compensating wheel. (See cut.)

722,292. Electric Time Switch. Henry C. Froelich, Chicago, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed December 30, 1901.

The mechanisms comprise a clock mechanism, a trigger mechanism, operative connections between the clock and trigger mechanisms, an electric switch, a switch-operating weight held in its raised position by the trigger mechanism, a headed mechanism on the weight, a collar sliding thereon, and a section of chain forming a slack connection between the weight and the movable member of the switch.

722,301. Circuit-controller. John S. Hobson, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed July 30, 1902.

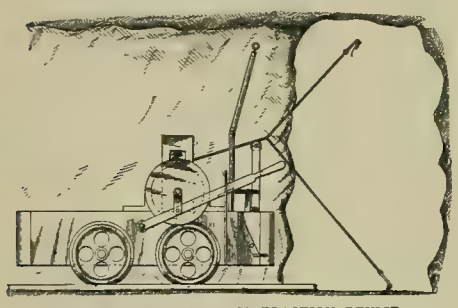
One claim reads: In a circuit-controller, the combination of means for controlling a circuit comprising a movable part, a disk and means by which it may be rotated, teeth or serrations provided on the disk and a cam adjustably mounted on the disk, engaging the teeth or serrations to operate the movable part comprised in the circuit-controlling means.

722,302. Automatic Gas-regulating Valve. Clarence M. Holley and Milton H. Rix, Ann Arbor, Mich., assignors to the Holley Heat Regulator Company, Detroit, Mich. Application filed February 3, 1902.

A thermostat provided with means for closing an electric circuit is combined with a valve casing provided with a magnet in its upper portion and having a longitudinal passage through the core of the magnet, an armature carrying a valve and arranged to be raised against the core to close the passage and an electric circuit connecting the magnet and the thermostat.

722,328. Motor. Charles H. Roth, Chicago, Ill. Application filed January 4, 1902.

One claim reads: The combination of a liquid receptacle having an inlet and an outlet for the liquid; suitable means for admitting gas to the receptacle; electromagnetic means for automatically controlling the admission of the gas; means for igniting the gas and causing same to expand and thereby lower the liquid level in the receptacle; an exhaust valve in the upper part of the receptacle; a float supported by the liquid in the receptacle; means connected with the float and adapted to open the exhaust valve when the surface of the liquid has been lowered to a certain point in the receptacle; and means for closing the exhaust valve when the liquid has returned to a certain higher level in the receptacle.



NO. 722,255.—ELECTRIC TRACTION DEVICE.

722,333. Electric Igniting Device. Friedrich Sturm, Stuttgart, Germany. Application filed January 26, 1901.

Combined with an electric igniter, and means for adjusting the moment of sparking of the igniter, is a generator arranged to supply an electric current to the igniter, and provided with an adjustable pole-piece connected to the adjusting means, whereby the moment of sparking of the igniter and generator may be simultaneously adjusted.

722,334. Electrical Alarm System. Henry M. Sutton, Walter L. Steele and Michael Coerver, Dallas, Texas. Application filed May 25, 1901.

Parts of the system are a protected structure, a battery, a relay comprising a pivoted armature, a controlling magnet therefor in circuit with the structure and battery and having a polarized core and its coil differentially wound with branches from the battery circuit, and means for alternating the polarity of the current from the battery between the magnet and protected structure.

722,345. Synchronism Indicator. Jonathan E. Woodbridge, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 30, 1900.

The synchronism indicating means consists of a dynamometer having separate coils relatively movable under the influence of the dynamic effect of currents in the coils, means for feeding one of the coils with current of a given phase derived from a given dynamo-electric machine, and means for feeding another coil with current of a different phase derived from another machine. (See cut.)

722,348. Telephone Support. John S. Young, Brooklyn, N. Y. Application filed May 21, 1902.

Means are provided for attaching the receiver holder to the transmitter and other means are arranged for adjusting the holder along a line parallel to the axis of the transmitter and also vertically with respect to the transmitter.

722,362. Lock-out Party-line Telephone System. Charles L. Goodrum and Jacob W. Lattig, Philadelphia, Pa. Application filed September 12, 1902.

722,367. Telephone System. Jacob W. Lattig and Charles L. Goodrum, Philadelphia, Pa. Application filed September 12, 1902.

722,379. Trolley Pole. Harry P. Oler, Camden, N. J., assignor of one-half to Joseph Davis, Camden, N. J. Application filed August 9, 1902.

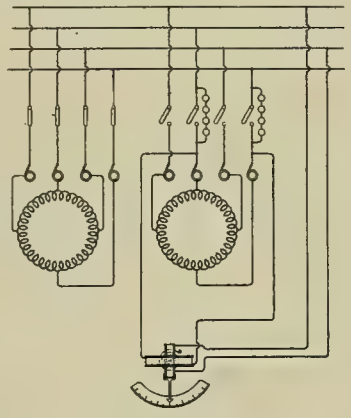
Combined with a trolley pole are a head rotatable about an axis in line with the pole and having a rigid rearwardly extended upper portion, and a trolley carried by the rearwardly extended portion of the head.

722,411. Electric Furnace. Albert A. Shade, Chicago, Ill., assignor of one-half to Eugene Howard Moore, Chicago, Ill. Application filed May 15, 1902.

See page 224.

722,435. Distance Meter or Range Finder. Johan P. Sörensen, Copenhagen, Denmark. Application filed August 30, 1902.

See page 223.



NO. 722,345.—SYNCHRONISM INDICATOR.

722,446. Electrically Operating Door. Joseph Chambers, Jr., Dallas, Texas. Application filed August 12, 1902.

Parts of the invention are a moving member carrying means for operating a door, a power device for moving the member, an electrical circuit for actuating the door-operating means upon the moving member, a movable controller for intermittently making and breaking the circuit, and means connecting the controller and the power device for the moving member to effect a movement thereof in unison.

722,453. Electric Current Controller. James J. Murphy, Jersey City, N. J. Application filed August 25, 1902.

In the controller are a body portion composed of insulating material and provided near one edge thereof with a longitudinal bore or passage, the body portion being provided in each side thereof with contact devices which are arranged in pairs therein and which project into the bore or passage, and wires connect with the contact devices at each side and passed out through the edge opposite the bore or passage, all the wires of each side being connected in a cable.

722,502. Means for Handling Cable-drawn Cars on Inclines. Thomas A. Edison, Orange, N. J. Application filed January 9, 1903.

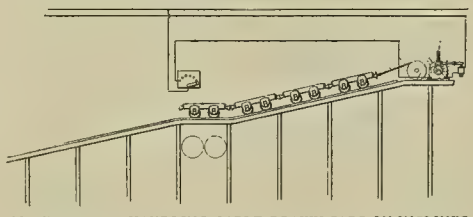
The apparatus combines a main incline, a horizontal extension at the top thereof, an auxiliary incline, a cable and electric means for operating the same. (See cut.)

722,527. Electric Controller. Frank A. Merrick, Johnstown, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed October 14, 1902.

An electric controller for motors has contacts and connections so arranged relatively to one another as to place two motors in series with each other, then shunt a portion of each field-winding, then place one motor in parallel with a part only of the other motor, the remaining part of the last-mentioned motor being in series with the parallel circuits, and then place the two motors in parallel.

722,532. Speed Indicator for Vehicles. Alden L. McMurtry, New York, N. Y. Application filed October 3, 1902.

The indicator comprises the combination of a part actuated relatively to the speed at which the vehicle is traveling an indicating device associated therewith showing a definite distance traversed, and a stop watch or time piece, automatically and electrically set into operation and automatically arrested by the speed-indicator-actuating mechanism and having the usual indicating devices and which shows the time occupied in traversing such definite distance.



NO. 722,502.—HANDLING CABLE-DRAWN CARS ON INCLINES.

722,535. Automatic Regulator for Constant-current Dynamos. Felix B. O'Hanlon, Portadown, Ireland. Application filed April 22, 1902.

In combination with a regulator for a constant-current dynamo is a relay device adapted automatically to reduce the current passing through the field of the dynamo against the action of the regulator when a "flash over" occurs.

722,563. System of Regulation for Electric Motors. Patrick J. Collins, Scranton, Pa., assignor to Richard J. Bourke, trustee, Scranton, Pa. Original application filed December 18, 1899. Divided and this application filed July 21, 1900. Renewed August 20, 1902.

Combined with a pair of independent armatures and separate sectional field-windings for each armature, are a graduated resistance arranged in shunt to each field-winding, a switch and connections leading therefrom to successive points in the windings and resistances, the switch and connections being so arranged that when the switcharm is turned in either direction from the neutral point, the resistance in shunt to one field-winding will be decreased and the resistance of the other field-winding will be decreased.

722,581. Filter. George F. Hodkinson, Chicago, Ill., assignor to the New York Continental Jewell Filtration Company. Application filed May 11, 1900.

A series of water filters having side walls that extend from one end of the series to the other and tracks extending throughout the walls are combined with a rake, a carriage by which it is supported and carried mounted on the tracks, an electric motor for propelling the carriage along the tracks, means for supplying a current to the motor, and devices through which the movement of the carriage may be controlled, whereby to carry the rake over any one of the filters of the series and there move it back and forth over its filter bed to furrow or agitate the material thereof.

722,583. Secondary Electrode for Electrolytic Apparatus. Paul Imhoff, Liverpool, England, assignor to the United Alkali Company, Limited, Liverpool, England. Application filed December 17, 1902.

The electrode consists of an anode of platinum wires or strips, and a cathode of iron, carbon or other conducting material of a less expensive character than platinum, in the form of wires, rods, plates, bars, strips, or gauze, and an intervening supporting plate, or body, of non-conducting material.

722,594. Electrical Instrument for Surgical or Similar Purposes. Myron D. Law, New York, N. Y. Application filed June 25, 1900.

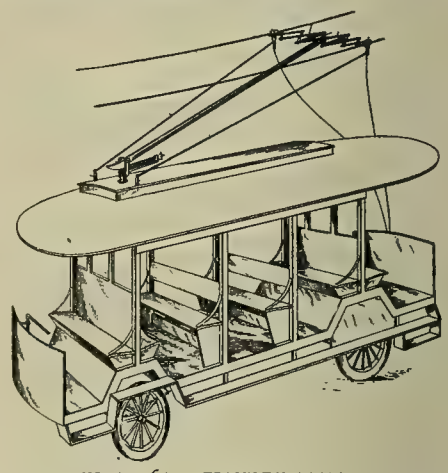
One terminal of a speculum is fixed in connection with one terminal of an electric battery, and a conducting piece is adapted to connect with the other terminal.

722,597. Apparatus for Raising or Lowering the Scenery of Theaters. Edward Lytton, Bedford Park, England. Application filed June 19, 1902.

Electric motors equipped with electric clutches are used.

722,598. Electrical Generator and Distributer for Medical Use. Edwin L. Madden, Kanawha, Iowa. Application filed February 3, 1902.

The device has a battery consisting of a cell or casing, generating plates removably fitted therein, and filling strips adapted to occupy any vacancies in the cell, and press the plates together.



NO. 722,654.—TRACKLESS TROLLEY.

722,606. Electrical Contact Brush and Method of Producing Same. Homer N. Motsinger, Pendleton, Ind., assignor to the Motsinger Device Manufacturing Company, Pendleton, Ind. Application filed August 25, 1902.

The brush consists of a central core of carbon, and an external wrapping of metallic gauze, the edges of which are brought together and connected by solder.

722,608. Trolley for Electric Railways. Robert L. McCartney, Ottumwa, Iowa. Application filed December 12, 1902.

The trolley comprises a yoke fixed to the end of the trolley pole, a trolley wheel journaled between the ends of the yoke, two spring jaws pivoted to the opposite sides of the yoke and connected together at their lower ends, and laterally extending wings on the yoke adapted when the spring jaws are pulled down to spread the jaws apart.

722,654. Trackless Trolley. Artemas B. Upham, Boston, Mass., assignor of one-half to Fred G. Tilton, Lowell, Mass. Application filed April 25, 1901.

Combined with two parallel positive and negative conductors fixed above a roadway, of a conveyance freely running on any part of such roadway, are horizontal trolley wheels elastically pressed in opposite directions against lateral faces of the conductors, and connections between the wheels and conveyance. (See cut.)

REISSUES.

12,098. Electric Brake for Vehicles. Joseph N. Mahoney, New York, N. Y., assignor to Price, Darling Co., New York, N. Y., a firm composed of John R. Price, William H. Darling, William C. Lombard and Joseph N. Mahoney. Application filed January 14, 1903. Original No. 665,450, dated January 8, 1901.

A controller or switch cuts off from the motor the current that actuates it for the movement of the vehicle, effects the excitation of the motor-field by current from the source and includes the winding of the brake-operating apparatus in the circuit of the source. An electrically operated relay in the circuit of the motor then operates as a generator that acts to transfer the winding of the brake-operating apparatus to the circuit of the motor.

12,099. Lamp Socket. Duny A. Schutt, Peru, Ind. Application filed January 23, 1902. Original No. 681,268, dated August 27, 1901.

An improved incandescent-lamp socket is described.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, MARCH 28, 1903. No. 13

Largest Automatic Telephone Exchange in the World.

Widespread interest has been manifested by telephone men and others in the large automatic telephone system that is now in course of installation in Chicago. The readers of the Western Electrician have been kept well informed of the progress of this enterprise—how the Illinois Telephone and Telegraph Company first secured its ordinance four years ago and was later reorganized by eastern capitalists to install the system; how the Illinois Telephone Construction Company was created as a subsidiary company to construct the large and deep tunnels under the streets for the purpose of carrying the cables; how the Automatic Electric Company was organized to purchase the factory of the Strowger Automatic Telephone Exchange and to manufacture automatic telephone apparatus in the United States under the Strowger patents, and, finally, how orders were placed with the Automatic Electric Company by the Illinois Telephone and Telegraph Company for a large exchange in the business district of the city. Descriptions of the tunnels appeared in the Western Electrician of March 17, 1900, April 5, 1902, and September 27, 1902, and to them the reader is referred for a conception of the underground work. The Strowger automatic telephone apparatus was described in the issue of September 6, 1902. The present article is devoted chiefly to the Chicago exchange, now nearing completion. As it is the first automatic exchange in Chicago and the largest one in the world, it is of much interest.

Exchange Building.

The exchange building is located at 177 to 181 Fifth Avenue, between Adams and Monroe Streets. It is a four-story and basement brick structure and was formerly used for mercantile purposes. It was secured on a five-year lease by the Illinois Telephone and Telegraph Company, which obtained possession on January 1st last. Since that time the building has been completely remodeled to meet the requirements of the company. The walls were strengthened, a cement floor put in the basement, elevator shaft tiled, new floors laid, the stairways shifted to suit the conditions and walls properly finished and decorated. Fig. 2 on the next page illustrates the present exterior appearance of the building.

In general the different floors will be put to the following uses: Basement, cabling and storage battery; first floor, offices and supplies; second floor, cable distribution and automatic switches; third floor, automatic switches; fourth floor, automatic switches and power apparatus. The cross-section of the building shown in Fig. 3 indicates these different uses, while Figs. 4 and 5 are, respectively, floor plans of the second and fourth floors. Each of the floors in the building is about 48 by 58 feet in size, with an average height of 13 feet.

Automatic Switches.

There is at present installed in the exchange building an equipment of automatic switches to provide for 8,000 subscribers. These are located on the fourth and third floors, and an additional 2,000-subscriber equipment, which is now being made, will be placed on the second floor and will complete the capacity of the exchange, viz., 10,000 subscribers. The switchboards are in reality sets of racks or shelves, as shown in several of the accompanying illustrations, and they are arranged in rows, with 11 boards in each row. On each of the fourth and third floors there are four of these rows and on the second floor there will be two rows. Each row of 11 boards contains apparatus for 1,000 subscribers' lines, and the different rows are identical in equipment, so that in the following description a single row will be treated as a unit.

Fig. 1 is a general view on the fourth floor of the exchange in its present condition and shows the three rows of switchboards, the third row jutting past the other two on account of the elevator shaft, which is on that side of the room. The arrangement of boards may be better understood by reference to the plan (Fig. 5). A detail view on the fourth floor (Fig. 6) shows one of the aisles between rows of boards, looking toward the front of the building. A view of the third-floor equipment of switchboards, which is not so far advanced, is shown in Fig. 7. All of these pictures and also the plans show how closely the switchboards can be placed, practically all the available floor space being utilized.

Each row of boards, as already stated, supplies service to 1,000 subscribers, and the equipment consists of 1,000 subscribers' or first-selector switches, which select the first figure or the thousand of the number called, 280 second-selector switches, which select the particular hundred in that thousand, and 160 connector switches, which select the last two digits in the number, and are really the switches that connect the calling subscriber to the called instrument. Thus there are a total of 1,440 switches in each row, the second-selector and connector switches differing but slightly in their construction from the first-selector or subscriber's switch. There being eight rows now in place, makes a total of

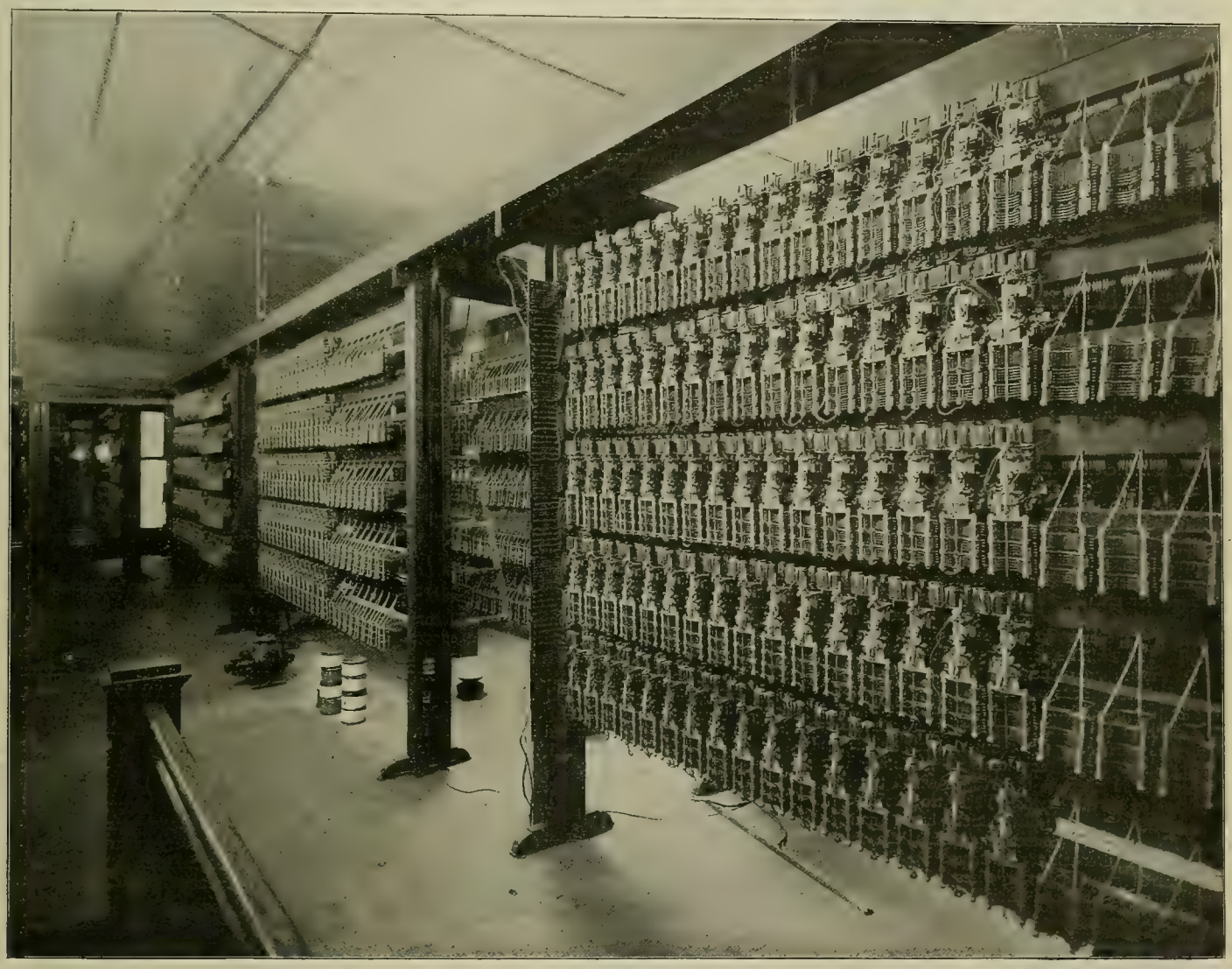


FIG. 1. LARGEST AUTOMATIC TELEPHONE EXCHANGE IN THE WORLD.—GENERAL VIEW OF AUTOMATIC SWITCHES IN ILLINOIS TELEPHONE COMPANY'S PLANT.

11,520 switches installed, while the ultimate equipment of 10 rows will necessitate a total of 14,400 switches for the operation of 10,000 subscribers' lines.

The different switches on each row are distributed as follows: The first six boards, counting from the front of the building, have 150 first-selector switches each, arranged on six shelves, 25 switches to a shelf. On the seventh board are 100 first-selector switches, arranged on the four lower shelves, and on the two top shelves

FIG. 2. ILLINOIS TELEPHONE COMPANY'S EXCHANGE BUILDING.

are 40 second-selector switches, 20 to a shelf. There are 14 shelves of the second-selector switches in all, the other 12 being on the eighth and ninth boards. The connector switches are arranged in 10 groups, one group for each 10 hundreds in that row. They are mounted on the tenth and eleventh boards, each board having five shelves with 16 switches to a shelf. It is these connector switches which are seen in the foreground in Figs. 1, 6 and 7.

Each switchboard is 11 feet six inches long, seven feet six inches high and 10 inches wide. The boards are set with three-foot centers, the floor space allowed for each board being 39 square feet. Each shelf consists of two pieces of well-seasoned oak placed 4½ inches apart and fastened by heavy end strips. The switches are mounted on the shelves at the factory and 90 per cent. of the necessary contacts and connections are made there. The switches are bolted to the bars and the wires banked below the switches are bolted to the switches themselves and then carried to the terminal head at the end of the shelf. From these terminal heads the wires are carried in cables to the troughs which run along the tops of all the boards. These troughs carry all the cables from the distribution board and the cables between the connector switches, the second-selector and first-selector switches. At one end of the boards are the power wires which run along the ceiling of the floor below and are connected to a power board located at the rear of the fourth floor, as indicated in Fig. 5.

There are 300 wires which lead to the three banks of contacts of each switch, and nine wires that lead to the magnets and relays, two of which are the line wires, three normal wires that go to the particular connector group on which that subscriber has his number, and four wires for the battery connections. There would seem to be an apparent multiplicity of wires, but most of them are confined only to that board. Of the 300 wires, 100 pairs are connected to the "vertical" and "rotary" or talking banks of contacts and lead to the 10 different groups of second-selector switches. The other 100 single wires connect with the "busy" or uppermost bank of contacts and lead along the group of 75 switches so as to prevent any two calls coming in on the same trunk line. The wires from the banks of the second-selector switches lead to the connector switches and from there to the first-selector switches, tapping then on to the lines leading to the subscribers' instruments. The lines from the first-selector switches to the distribution board are carried in 25-pair cables, one cable running from each shelf of 25 switches.

Distribution and Cabling.

The distribution board on the second floor was made by Frank B. Cook, and has a capacity for 12,000 lines or pairs of wires. It is equipped with a lightning arrester and heat coil for each line. The 25-pair cables from the automatic switches are carried to the distribution board and there distributed and combined again into 25-pair cables. These are potheaded under the platform on which the board stands, eight 25-pair cables being combined into a 200-pair lead-covered underground cable. There will be 60 of these large cables, and they will be carried down to the basement along the north wall of the first story in a cable shaft, as shown in Fig. 3. From the basement the cables will be carried through two vertical drifts, each about three feet in diameter, down to the level of the telephone tunnels, with which they will connect by means of laterals. The cables will be supported on the roof of the tunnel by means of special iron brackets and they will be unreeled directly from the cable reels, which, in turn, will be mounted on specially constructed cars so as to travel along the tunnel. The reels will be mounted on these cars in the basement of the exchange and then lowered to the tunnel by means of an electric elevator in a shaft that has already been constructed.

Tunnels and Building Connections.

These tunnels, as has already been described in the Western Electrician, are of horseshoe shape, seven feet six inches high and six feet wide in the widest part. They extend under all the streets of the business section of the city, as indicated on the map, Fig. 8, running under the Chicago River on Fifth Avenue and Van Buren Street and connecting with the Illinois Central Depot on Twelfth Street on the south. The total length of tunnels at present constructed is about 18 miles.

Small laterals will be taken off from the tunnels at the different buildings for the individual telephones. One method of constructing such a lateral is shown in Fig. 9, which indicates a cross-section of a street with the water, sewer, gas, electric-light, telephone and other public-utility services near the surface. The lateral is three feet in diameter, and is run horizontally to the building and then four-inch wrought-iron pipes are driven to meet the lateral, this pipe being placed under the sidewalk or within the building walls, as desired. Should a street-railway subway be constructed in the city, the

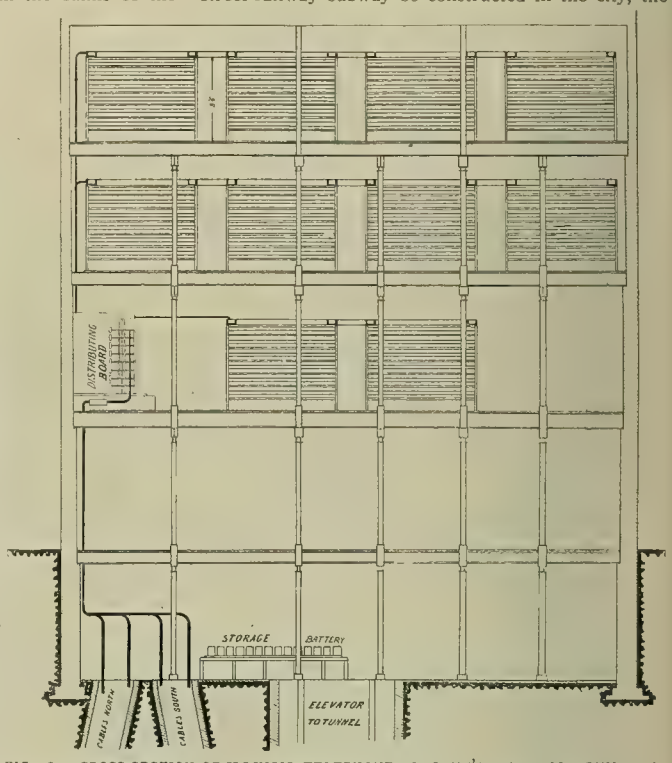


FIG. 3. CROSS-SECTION OF ILLINOIS TELEPHONE COMPANY'S EXCHANGE BUILDING.

pipes can be altered to meet the conditions, if necessary. This method of bringing the telephone cables into a building without breaking the surface of the street has many advantages when contrasted with the old method of conduits by which from two to four manholes, eight by 10 by 12 feet in size, are required for nearly every block.

The buildings are being wired with lead-covered cables and the company already has one or two buildings completed. It is the intention to wire every building in the downtown district which is completed and apt to be permanent. According to the company's plan, every room in the building will be wired and equipped with a telephone, all at no expense to the tenant or owner, except when the in-

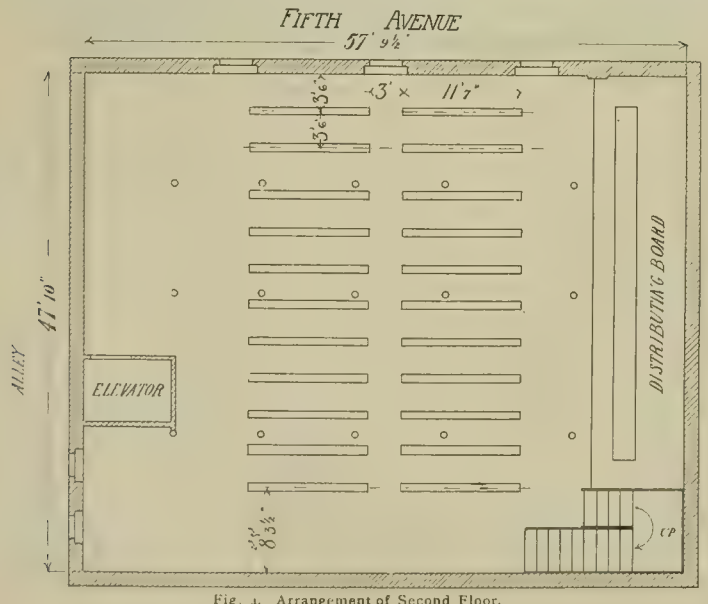


Fig. 4. Arrangement of Second Floor.

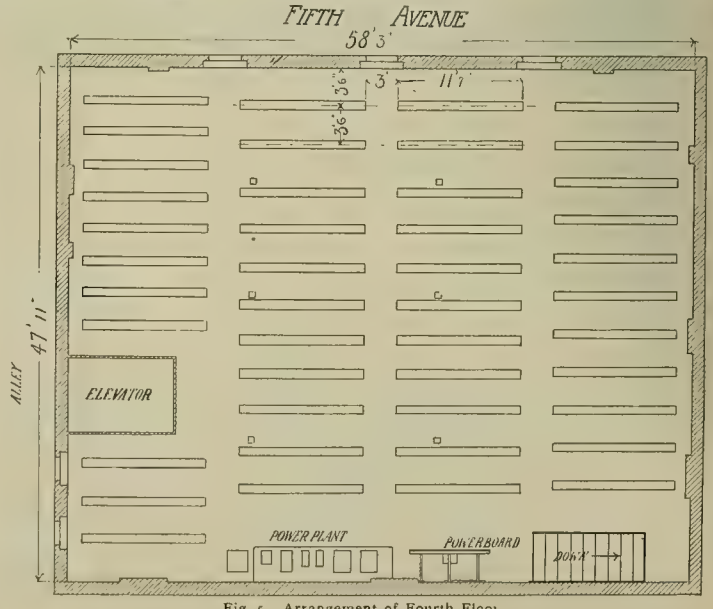


Fig. 5. Arrangement of Fourth Floor.

LARGEST AUTOMATIC TELEPHONE EXCHANGE IN THE WORLD.—FLOOR PLANS OF ILLINOIS TELEPHONE BUILDING.

strument is actually used for telephone service; then the subscriber will be charged at the rate of five cents a call, all calls above $85 being free, while the maximum charge for residence instruments will be $50. Besides installing wires for every room, an excess of 25 per cent. of the total number will be placed in each building, so as to provide for extra private telephones, additions to the building, etc.

As stated above, the company is now engaged in wiring the buildings, and about May 1st will begin the installation of cables in the tunnels. The exchange will probably be completed by that time and the whole system will be placed in operative condition as soon thereafter as possible. While the present exchange will provide for but 10,000 subscribers, the company has already planned to erect a new exchange building in a central location which will provide for an equipment of 25,000 telephones. Then as the system is extended to the North, West and South Sides, the present 10,000 equipment will be used for a branch exchange and others constructed of equal capacity.

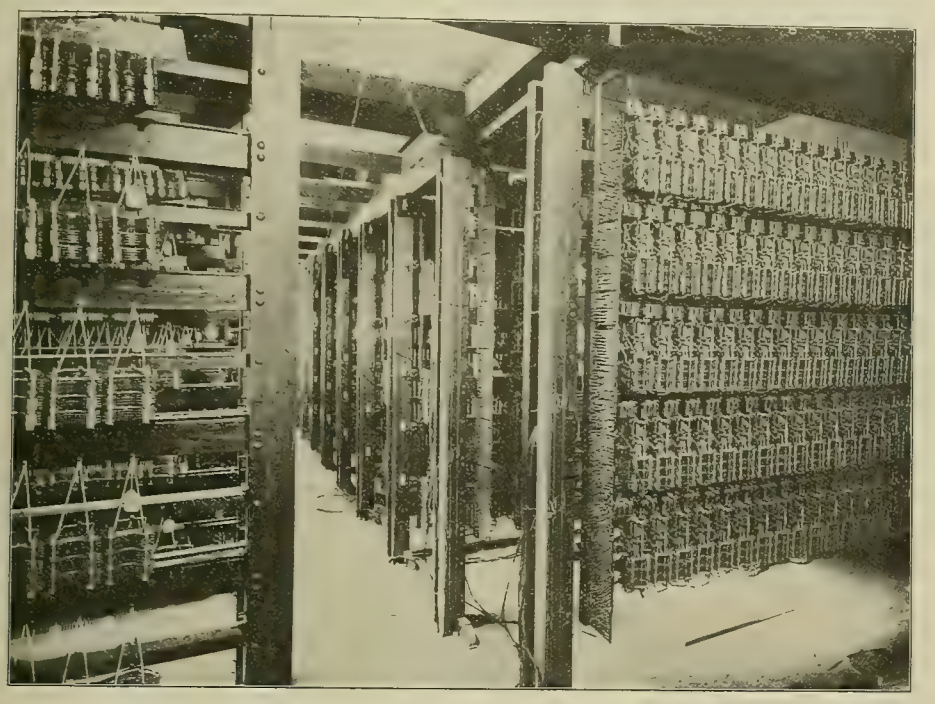


FIG. 6. LARGEST AUTOMATIC TELEPHONE EXCHANGE.—VIEW ON FOURTH FLOOR.

Power Plant.

Reverting to the exchange building, there are some additional details which are of interest. The power used for the operation of the entire plant and also for the lighting is obtained from the Chicago Edison Company. The service is brought to the power board on the fourth floor and thence distributed. The board will be of marble, six feet six inches high and seven feet six inches wide, and will contain three panels. On the center panel will be mounted an ammeter and voltmeter and their switches. The right-hand panel will contain the Edison power connections and also switches for starting the charging machines, motor-generators, circuit-breaker and air-blower motor. Switches for connecting the storage batteries to the board are provided on the left-hand panel.

To the right of the power board, mounted on a platform, will be two 2.8-kilowatt Sprague charging machines for the batteries, receiving current at 220 volts and generating at 75 volts. Two Holtzer-Cabot motor-generators will be provided for ringing the subscribers' bells and two small motors will operate circuit-breakers which supply current to the rotary magnets of the first and second-selector switches. All these machines are provided in duplicate. The air-blower spoken of will be located on the third floor, and iron pipes will be run from it along the ceiling, with taps in that floor and through the floor above for each aisle of the switchboards. Connection can be made with these taps with a hose, so that the dust may be blown off the switches, this operation being necessary once or twice a month, according to the season of the year.

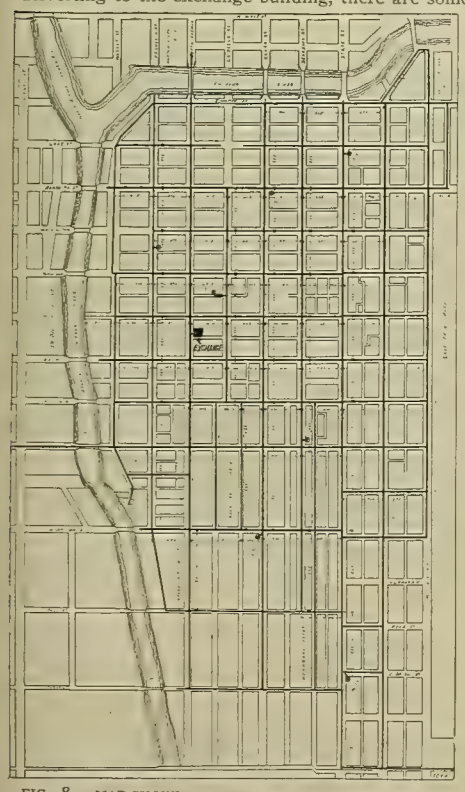


FIG. 8. MAP SHOWING TUNNELS AND EXCHANGE OF ILLINOIS TELEPHONE COMPANY.

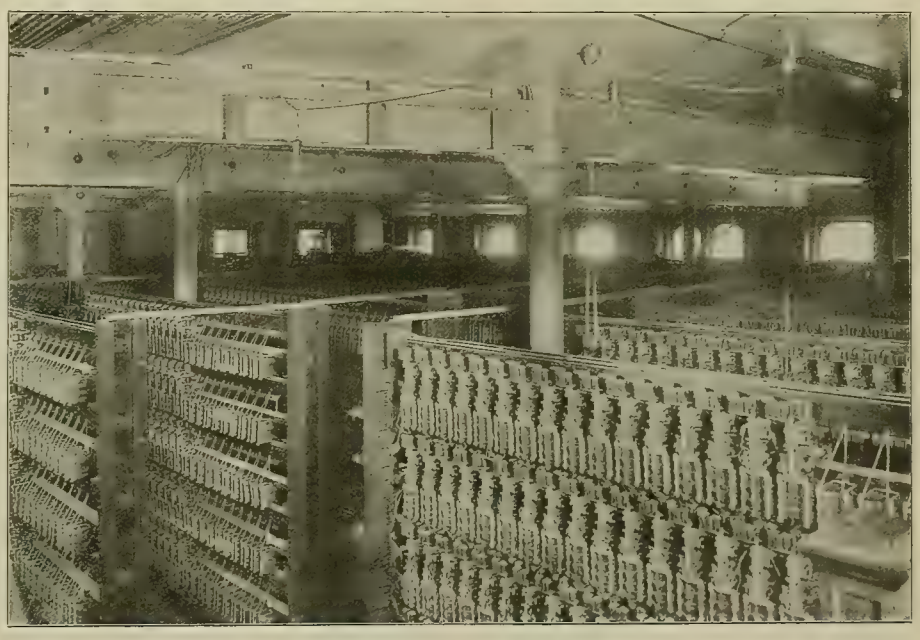


FIG. 7. LARGEST AUTOMATIC TELEPHONE EXCHANGE.—SWITCHES ON THIRD FLOOR.

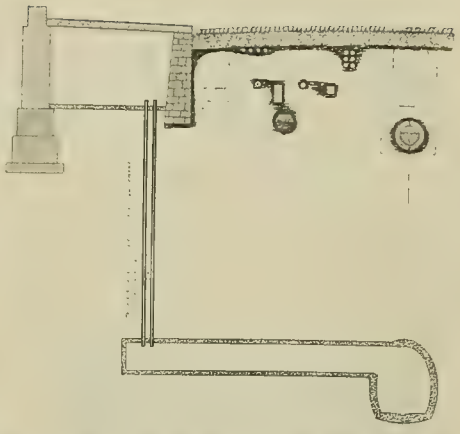


FIG. 9. STREET CONNECTION WITH ILLINOIS TELEPHONE TUNNEL.

Tell-tale Board.

At the northeast corner of the fourth floor back of the stairway is located a tell-tale lamp board with rows of eight-candlepower incandescent lamps divided into two sections. The upper section consists of 10 rows of lamps, with 11 lamps in each row, corresponding to the switchboards in the building, each lamp indicating, when lighted, a blown heat coil on that particular board. The operator can then go immediately to that board, and the lighting of a small two or four-candlepower lamp on the particular shelf of that board indicates at once where the blown coil is to be found. These heat coils are mounted on the back of the switch shelves and consist of small wire coiled around hard-rubber tubes. When a ground occurs the wire is heated and the tube expands, releasing a spring, thus breaking the circuit to the automatic switch. The spring when released makes another contact which lights the signal lamp on that shelf and also the lamp for that board in the tell-tale. Fig. 10 is a view in the rear of some of the boards, the heat coils being easily distinguishable.

The lower part of the tell-tale board consists of 200 lamps, two for each of the 100 groups of connector switches. The alternating-current circuit which operates the bells at the subscribers' instruments is completed through these lamps, and if a short-circuit occurs in one group it will not cut out the rest of the groups. The lamps thus act as tell-tales, and serve as resistance.

Operation and Trouble Tests.

At the busiest time of operation it is estimated that one man will be required to tend to 1,000 switches, replace heat coils, trace out trouble, etc. The manager of the exchange and also the trouble clerk will be stationed on the fourth floor. It is stated that grounds and short-circuits can be de-

tected much quicker on the automatic than on the manually operated switchboard. When a ground occurs the heat coil is blown and the tell-tale lamp lights. If there is a short-circuit on the line it is known the instant the subscriber attempts to make a call, as the switch, by not operating properly, makes a sound unlike the regular sound but one with which the attendant is familiar, so that he can locate the trouble immediately.

Each first-selector switch is provided with a small meter, similar to a cycle meter, which registers the number of calls, the register being operated only on the completion of the call, so that no "busy" signals are recorded.

The "busy" test is made by an interrupted direct

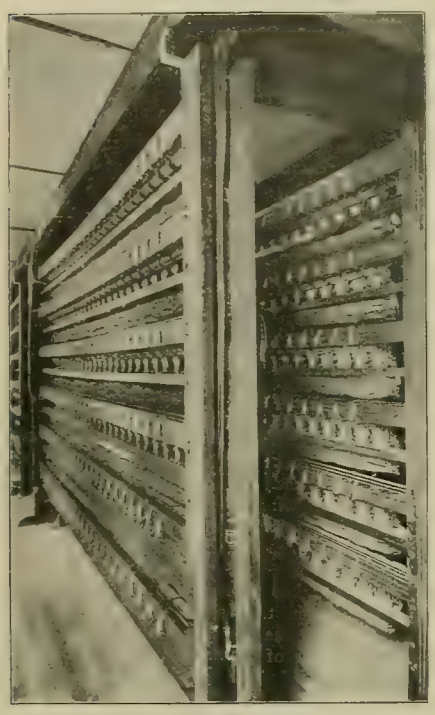


FIG. 10. LARGEST AUTOMATIC TELEPHONE EXCHANGE.—REAR VIEW OF SWITCHBOARDS.

current sent through a condenser by the same circuit-breaker machine that operates the rotary magnets. A busy-indicating lamp is provided on each shelf to indicate whether a line is off normal, tests being made with these lamps each morning, noon and evening. When a subscriber leaves his receiver off the hook, no busy signal is made should another person attempt to call that telephone. Upon getting no response the matter is reported, and then with a "howler" device the diaphragm of the hanging receiver is vibrated rapidly to attract the subscriber's attention. The howler device is located on the same shaft as the circuit-breaker and connection is made with it or a test telephone through a plug at the distribution board.

STORAGE BATTERY.

The storage battery is located in the northeast corner of the basement in a room built especially for that purpose, with air-tight walls, to prevent the fumes from getting into the building. Connection is made with the outer air for ventilating. The battery consists of two series of 26 cells, each series having a capacity of 350 ampere-hours. The cells are of glass and contain 11 plates each. The battery was installed by the American Battery Company of Chicago. One series of cells is used at a time, the other being charged. The battery furnishes current for operating the magnets on the switches, the signal lamps and the small motors on the circuit-breakers.

It is estimated that in this 10,000-line exchange, a high average for the number of switches to be in operation at one time will be 100. This number of switches would require 10 amperes of current to operate the relays, 50 amperes for the other motor magnets and two amperes for the circuit-breaker motor, making a total average consumption of current of 62 amperes.

A. G. Wheeler is president of the Illinois Telephone and Telegraph Company and George W. Jackson is chief engineer of the Illinois Telephone Construction Company. Their work is everywhere shown in the enterprise.

The exchange is being installed under the immediate supervision of T. E. Meyer, who had charge of installing the automatic telephone exchanges at New Bedford and Fall River, Mass. The types of telephones to be installed on subscribers' premises are illustrated on page 250.

Tesla Double-circuit Selective Space-telegraph System.

Nikola Tesla has found that, notwithstanding all constructive advantages and experimental resources, the method of selective signaling in space telegraphy, as commonly practiced, is in many cases inadequate. Thus, while he has succeeded in so operating selectively under certain favorable conditions more than 100 receivers, in most cases it is practicable to work successfully but a few, the number rapidly diminishing as, either owing to great distance or other causes, the energy available in the tuned circuits becomes smaller and the receivers necessarily more delicate. Evidently, a circuit however well constructed and adjusted to respond exclusively to vibrations of one period is apt to be affected by higher harmonics, and still more so by lower ones. When the oscillations are of a very high frequency, the number of the effective harmonics may be large and the receiver consequently easily disturbed by extraneous influences to such an extent that when very short waves, such as those produced by Hertzian spark apparatus, are used little advantage in this respect is to be derived from tuning the circuits.

"It being an imperative requirement in most practical applications of such systems of signaling or intelligence transmission," says Mr. Tesla, "that the signals or messages should be exclusive or private, it is highly desirable to do away with the above limitations, especially in view of the fact which I have observed, that the influence of powerful electrical disturbances upon sensitive receivers extends even

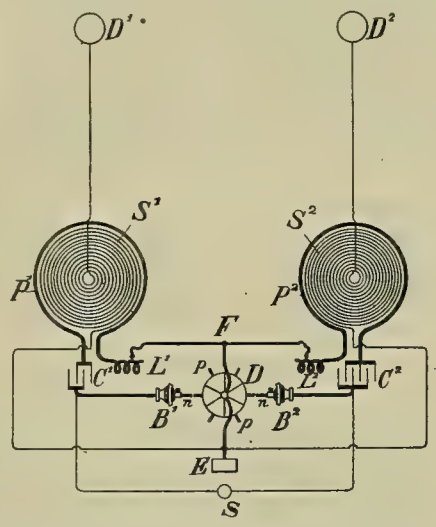


FIG. 1. TESLA DOUBLE-CIRCUIT SELECTIVE SPACE-TELEGRAPH SYSTEM.—SENDING STATION.

on land to distances of many hundreds of miles, and consequently, in accordance with theory, still farther on sea." To overcome these drawbacks and to enable a great number of transmitting and receiving stations to be operated selectively and exclusively and without any danger of the signals or messages being disturbed, intercepted, or interfered with in any way is the object of an invention recently patented by Mr. Tesla.

Broadly stated, this invention consists in generating two or more kinds or classes of disturbances or impulses of distinctive character with respect to their effect upon a receiving circuit and operating thereby a distant receiver which comprises two or more circuits, each of which is tuned to respond exclusively to the disturbances or impulses of one kind or class and so arranged that the operation of the receiver is dependent upon their conjoint or resultant action.

By employing only two kinds of disturbances or series of impulses instead of one, as has heretofore been done, to operate a receiver of this kind, he has found that safety against the disturbing influences of other sources is increased to such an extent that he believes this number to be amply sufficient in most cases for rendering the exchange of signals or messages reliable and exclusive; but in exceptional instances a greater number may be used and a degree of safety against mutual and extraneous interference attained, such as is comparable to that afforded by a combination lock. The liability of a receiver being affected by disturbances emanating from other sources, as well as that of the signals or messages being received by instruments for which they are not intended, may, however, be reduced not only by an increased number of the co-operative disturbances or series of impulses, but also by judicious choice of the same and order in which they are made to act upon the receiver.

Figs. 1 and 2 represent diagrammatically an apparatus and circuit connections employed at the sending and receiving stations, respectively, for the practice of Mr. Tesla's invention.

In Fig. 1, (S') (S²) are two spirally wound coils or conductors connected with their inner ends, to preferably elevated terminals (D') and (D²), respectively, and with their outer ends to an earth plate (E). These two coils, conductors, or systems, (D') (S') (E) and (D²) (S²) (E) have different and suitably chosen periods of vibration, and, as pointed out in other patents relating to his system of energy and intelligence transmission, their lengths should be such that the points of maximum pressure developed therein coincide with the elevated terminals (D') (D²). The two systems may have electrical oscillations impressed upon them in any desired manner conveniently by energizing them through primaries (P') and (P²), placed in proximity to them. Adjustable inductances (L') and (L²) are preferably included in the primary circuits chiefly for the purpose of regulating the rates of the primary oscillations. In the drawings these primaries (P') and (P²) surround the coils (S') (S²), and are joined in series through the inductances (L') (L²), conductor (F), condensers (C') and (C²), brush-holders (B') and (B²), and a toothed disk (D), which is connected to the conductor (F), and, if desired, also to the ground plate (E), as shown, two independent primary circuits being thus formed.

The condensers (C') and (C²) are of such capacity and the inductances (L') (L²) are so adjusted that each primary is in close resonance with its secondary system, as explained in other Tesla patents. The brush-holders (B') and (B²) are capable independently of angular and, if necessary, also of lateral adjustment, so that any desired order of succession or any difference of time interval between the discharges occurring in the two primary circuits may be obtained. The condensers being energized from a suitable source (S), preferably of high potential, and the disk (D) being rotated, its projections or teeth (p p) coming at periodically recurring intervals in very close proximity to or, as the case may be, in contact with conducting rods or brushes (n n), cause the condensers to be discharged in rapid succession through their respective circuits. In this manner the two secondary systems (D') (S') (E) and (D²) (S²) (E) are set in vibration and oscillate freely, each at its proper rate for a certain period of time at every discharge. The two vibrations are impressed upon the ground through

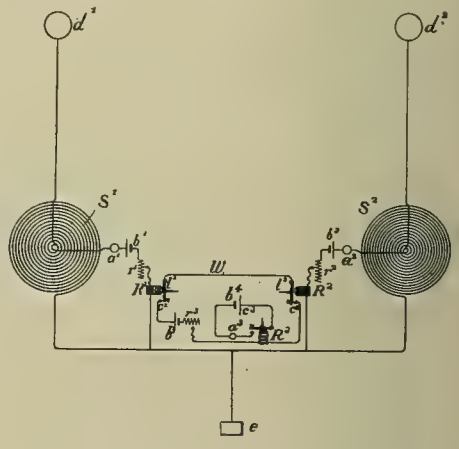


FIG. 2. TESLA DOUBLE-CIRCUIT SELECTIVE SPACE-TELEGRAPH SYSTEM.—RECEIVING STATION.

the plate (E) and spread to a distance reaching the receiving station, which has two similar circuits or systems (e) (s') (d') and (e) (s²) (d²), arranged and connected in the same manner and tuned to the systems at the sending station, so that each responds exclusively to one of the two vibrations produced by the transmitting apparatus.

The same rules of adjustment are observed with respect to the receiving circuits, care being furthermore taken that the tuning is effected when all the apparatus is connected to the circuits and placed in position, as any change may more or less modify the vibration. Each of the receiving coils (s') and (s²) is shunted by a local circuit containing, respectively, sensitive devices (a') (a²), batteries (b') (b²), adjustable resistances (r') (r²), and sensitive relays (R') (R²), all joined in series, as shown. The relays (R') (R²) have armatures (l') (l²), which are connected by a wire (w), and when attracted establish electrical contacts at (c') and (c²), thus closing a circuit containing a battery (b³) and adjustable resistance (r³) and a relay (R³). From the above description it will be readily seen that the

relay (R^3) will be operated only when both contacts (c') and (c^2) are closed.

The apparatus at the sending station may be controlled in any suitable manner—as, for instance, by momentarily closing the circuit of the source (S), two different electrical vibrations being emitted simultaneously or in rapid succession, as may be desired, at each closure of the circuit. The two receiving circuits at the distant station, each tuned to respond to the vibrations produced by one of the elements of the transmitter, affect the sensitive devices (a') and (a^2) and cause the relays (R') and (R^2) to be operated and contacts (c') and (c^2) to be closed, thus actuating the receiver or relay (R^3), which in turn establishes a contact (c^3) and brings into action a device (a^3), by means of a battery (d^4), included in a local circuit, as shown. But evidently if through any extraneous disturbance only one of the circuits at the receiving station is affected the relay (R^3) will fail to respond. In this way a communication may be carried on with greatly increased safety against interference, and privacy of the messages may be secured.

The receiving station shown in Fig. 2 is supposed to be one requiring no return message; but if the use of the system is such that this is necessary, then the two stations will be similarly equipped, and any well-known means may be resorted to for enabling the apparatus at each station to be used in turn as transmitter and receiver. In like manner the operation of a receiver, as (R^3), may be made dependent, instead of upon two, upon more than two such transmitting systems or circuits, and thus any desired degree of exclusiveness or privacy and safety against extraneous disturbances may be attained. The apparatus, as illustrated in Figs. 1 and 2, permits, however, special results to be secured by the adjustment of the order of succession of the discharges of the primary circuits (P') and (P^2), or of the time intervals between such discharges.

"Whatever the nature of the specific devices employed," says Mr. Tesla, "it will be seen that the fundamental idea in my invention is the operation of a receiver by the conjoint or resultant effect of two or more circuits, each attuned to respond exclusively to waves, impulses, or vibrations of a certain kind or class, produced either simultaneously or successively, by a suitable transmitter."

Pole Dealers Seek Legislative Protection.

Senator E. J. Swedback of Bemidji, Minn., has offered a bill in the Minnesota Senate to protect shippers of cedar poles against fraud on the part of consignees. The surveyor-general of logs and lumber is required to inspect cedar posts, electric-light, telegraph and telephone poles on the request of the owner or the sheriff or constable, in case of replevin, attachment or tax assessment. A certificate of inspection issued by the surveyor-general and be prima facie evidence of the measurement, number of pieces and grade of posts. The author of the bill states that cedar posts are shipped in large numbers from Northern Minnesota to Wisconsin, Illinois, Iowa and the Dakotas, and often the consignees take advantage of the shipper and cull out a large part of the shipment or fraudulently cut down the measurement.

The Skagit Improvement Company has asked for a franchise to install an electric-light plant at Woolley, Wash.

Frontier Telephone Exchange in Buffalo.

"No 'gingerbread work,' but everything of the best," seems to have been the motto of the Frontier Telephone Company in building the recently completed Independent exchange in Buffalo, which is one of the very best examples of modern telephone installation in the country. The office building and exchange (Fig. 1) is at 332 Ellicott Street. The main switchboard and electrical equipment of the exchange are located on the second floor, the first floor being given up to offices and storerooms in the rear.

Current for operating the exchange is obtained from the Buffalo General Electric Company, but an independent gas-engine plant has been provided for use in case of failure of the Niagara power. The

FIG. 1. FRONTIER TELEPHONE EXCHANGE IN BUFFALO.

electrical generators and motor-generator sets (Fig. 2) were supplied by the Holtzer-Cabot Electric Company, the gas-engine equipment by the Westinghouse company, the telephones and switchboards by the Kellogg Switchboard and Supply Company of Chicago, while the storage-battery plant was installed by the National Storage Battery Company of Buffalo.

The storage-battery room is equipped with two sets of accumulators, consisting of 11 cells each, the present capacity of the four positive and five negative plates being 800 ampere-hours, while the output can be doubled when desired by increasing the number of positives to eight plates and adding five more negative plates. These cells are 33 inches long, 23 inches wide and 19¾ inches deep.

The power switchboard (shown in Fig. 2) consists of three panels, the first of which is equipped with Weston instruments, the voltmeter reading from 0 to three volts for testing the individual storage cells. The second panel is equipped with the distribution switches and a Weston voltmeter reading from 0 to 50 volts. The third or charging panel is supplied with two circuit-breakers, one for each battery, together with Weston ammeter, reading up to 250 amperes, and the usual switches.

The batteries are charged by two motor-generator sets of 10-horsepower capacity each, one being held in reserve in case of emergency. These groups, shown as the larger machines in Fig. 2, operate at 1,000 revolutions per minute. The motor receives its current from the General Electric service at 220 volts, taking 10 amperes, while the dynamo supplies a direct current of 175 amperes and 30 volts, the latter being raised as the cells become charged. In case it is necessary the batteries may be charged from a gas-engine plant adjacent to the group shown in Fig. 2 but not shown in the picture. This installation includes a Westinghouse twin-cylinder vertical gas engine of 15-horsepower capacity, the cylinders being six by eight inches and the speed 350 revolutions per minute. The engine is connected to a four-pole Holtzer-Cabot dynamo by a chain drive. This direct-current auxiliary generator has a capacity of 5¼ kilowatts, supplying a current of 175 amperes at a pressure of from 30 to 80 volts. This outfit may be utilized for charging the accumulators or operating lights, as desired.

Among the interesting apparatus in the exchange are the direct-alternating-current ringing motor-generator sets seen in the foreground in Fig. 2. These ringing machines are for the four-party lines and consist of two groups with five machines in each group connected by a common shaft. One set is held in reserve and may be operated from the storage battery, the motor in the center of the group being wound for 24 volts, while the other set is driven by Niagara current from the 220-volt power service of the Buffalo General Electric Company. These ringing machines and the wiring are arranged for supplying the current for the selective or individual ringing. The direct-current motor in the center of each group drives the alternating-current ringing generators at a speed of 1,050 revolutions per minute and is a one-horsepower, four-pole machine. The ringing buttons for the four-party lines are connected with each of the small ringing alternators. The one-bell subscriber receives current from alternator No. 1, which is a bipolar machine supplying a current of 1.5 amperes at a pressure of 100 volts, and a frequency of 17.5 cycles per second, while the bell of the two-bell subscriber receives its current from ringing alternator No. 2, supplying a current of 1.5 amperes at a pressure of 100 volts and a frequency of 35 cycles per second. In the same manner the bell of the three-bell subscriber is rung by alternator No. 3, having the same voltage and current, but supplied with six poles, while the No. 2 machine only has four poles, the periodicity being in this case 52.5 cycles, instead of 35 cycles per second. Similarly alternator No. 4 rings the four-bell line bells having the same voltage and current, but a current of 70 periods per second, the number of poles of this machine being eight. Each bell on the line is thus adjusted to ring only with the number of alternations which corresponds to the proper alternator and button of the operator. These buttons are colored red, green, black and blue, and the selective ringing is thus easily manipulated by the operators at the main telephone switchboard.

The telephone switchboard of the Frontier Telephone Company is of the latest improved type of the Kellogg company, as will be noted by the accompanying view (Fig. 3), which shows a large part of the 23 sections already installed. The complete switchboard on both floors will consist of 56 sections, with three operators for each section. The board is finished in mahogany, and each section is five feet 7½ inches long and seven feet high. The total capacity of the board when completed will be 18,000 lines, which, including the four-party lines, will accommodate 36,000 subscribers.

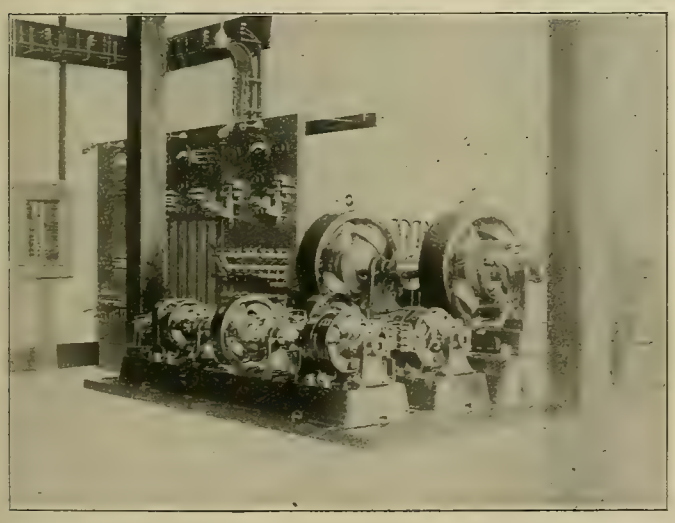


Fig. 2. Power Plant and Switchboard.

Fig. 3. Exchange Switchboard.

FRONTIER TELEPHONE EXCHANGE IN BUFFALO.

The board is very compact and is already equipped for 8,000 lines. It is stated that this exchange starts out with as large or larger list of patrons as that of any company installing a completely new plant. The general working of this board and exchange is similar to other modern common-battery systems. A subscriber taking his receiver from the hook of his instrument operates a line relay in the terminal room. This line relay in turn lights a miniature lamp in front of the operator at the switchboard proper. The girl inserts an answering plug in the jack associated with this plug, which in turn operates another relay, called a cut-off relay, which extinguishes the line lamp. At the same time it cuts the operator's switchboard line in on to the subscriber's line. After the lines are connected the operator asks the number, and, having received it from the subscriber, connects this subscriber by inserting another plug, called the calling plug, to the desired number.

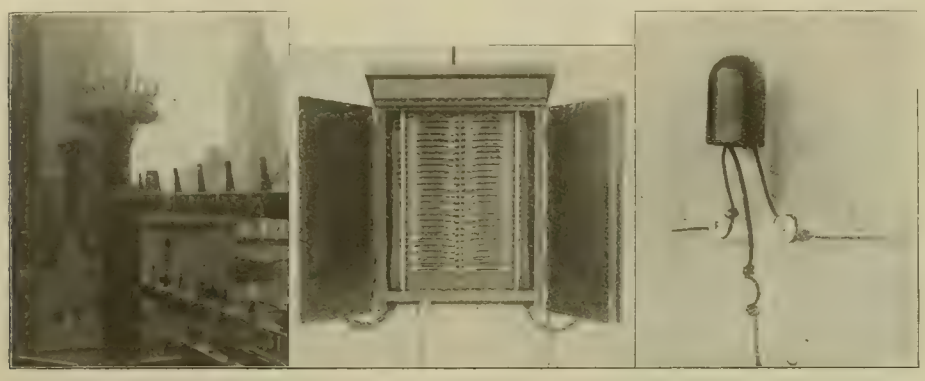


Fig. 4. Distributing Pole. Fig. 5. Pole-box with Lightning Arresters. Fig. 6. Individual Lightning Arrester.

FRONTIER TELEPHONE EXCHANGE IN BUFFALO.

The switchboard cords are equipped with a double supervisory system, whereby an operator, by means of the supervisory lamps associated with each plug, can tell whether a subscriber does not answer, is talking over the line, or is through talking. The switchboard is also supplied with the usual busy test, whereby an operator, before making a connection, first touches one side of the line wanted with the tip of her plug. If she hears a click, she knows that some party is talking over that line, or, in other words, the line is busy. If she finds the line is quiet, there being an entire absence of the click, she knows the line is not busy, and proceeds to make the necessary connection.

Fig. 4 shows a distributing pole with ring top and pole box, while Fig. 5 depicts a 25-pair pole box with fuses and lightning arresters. Fig. 6 illustrates the latest type of individual lightning arresters, as installed outside of the subscriber's window or entrance.

Arrangements for the comfort of the operators include a rest room, comfortably furnished, and a dining room, where meals are supplied to the girls at actual cost. There is also a small but well-equipped hospital. A "practice room," where the necessary instruction is given to new employes, has been provided.

Tariff rates of the Frontier Telephone Company for unlimited service are as follows: For business telephones on direct lines the charge is $48 a year, while for private service on direct lines the charge is $36. On the party lines, the rates for business purposes vary according to the number of subscribers upon the same line. The two-party business telephones cost $40 a year, three-party $32, and four-party $24. In a similar manner the charges are arranged for residence service at $24, $20 and $15 a year for two, three or four-party lines, respectively. The total number of subscribers already under contract is said to be more than 10,000, and several thousand are already connected and are receiving excellent service. As soon as the party-line instruments arrive, several thousand more will be connected up.

As stated in the Western Electrician of March 14th, the formal opening of the exchange took place on March 10th. It was a great success, the building being thronged from 2 to 10 p. m. Music, flowers and refreshments added to the pleasure of the occasion. Visitors were received by Vice-president William A. Douglass, Assistant General Manager Wilbur H. Johnston and others. The president of the Frontier Telephone Company is E. C. Lufkin, the secretary and treasurer, Charles B. Hill, and the general manager, Samuel E. Wayland.

Telephone Affairs in Missouri and Kansas.

Some rather interesting (although evidently slightly inaccurate) statements are given in the following extract from a news article in the St. Joseph (Mo.) News of recent date: "James F. Land of Detroit, Mich., is to succeed Alonzo Burt as president and general manager of the Missouri and Kansas (Bell) Telephone Company. The headquarters will remain at Kansas City. It is stated on good authority that the Bell people are preparing to wage a fierce war against Independent telephone companies, the most vigorous fight to be made against the new Home Telephone Company of Kansas City. It is not yet known whether the change in the executive head of the company will make any changes in the force of St. Joseph, but it is not thought so by local officials. James F. Land is what is known in telephone circles as a 'buster,' this title being given him because of his success in driving out so many Independent companies started in opposition to the Bell company. He was formerly state superintendent of the Michigan Telephone Company, but he resigned that position to accept that of general manager of the Missouri and Kansas Telephone Company in this district, which embraces Missouri, with the exception of St. Louis, Kansas, Oklahoma and the Indian Territory. It is possible that the proposed war by the Bell people will be extended to St. Joseph, where the Citizens (Independent) company is strongly entrenched, and gradually spreading out. Just what method of warfare is to be adopted has not been announced. Advices from Kansas City are to the effect that Mr. Burt will continue as president and general manager of the Missouri and Kansas company and that Mr. Land will assume the duties of assistant general manager on April 1st. In an interview with a reporter for a Kansas City paper, Mr. Burt is quoted as saying in answer to a question: 'Does the Bell company propose to make an aggressive fight on the Home Telephone Company?' 'Not especially. We do not expect to drive that company out. It will simply mean that Kansas City business men will have two telephones in their place of business, just as they do in St. Joseph, St. Louis, Leavenworth and other towns where there are competing telephone companies.'"

Kansas City Contract Awarded.

No doubt, many telephone men, especially in the territory surrounding Kansas City, will be pleased to learn that the contract for the central-office equipment for the Home Telephone Company, Kansas City, Mo., and Kansas City, Kan., has been awarded. The successful competitor is the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., and Chicago. The contract comprises four exchanges. The main exchange, having a capacity for 12,000 lines, will be equipped for the immediate operation of 4,500 lines, and capacity for 360 trunk lines, with present equipment of 120 lines. The East Branch exchange will have an ultimate capacity of 7,200 lines, equipped for the immediate operation of 1,200 lines, with capacity for 360 trunk lines and a present equipment of 75 lines. The South branch exchange will have a capacity for 7,200 lines and a present equipment of 700 lines, with capacity for 360 trunk lines, with a present equipment of 75 lines. The Kansas City (Kan.) exchange will have a capacity for 7,200 lines and will have a present equipment of 800 lines and capacity for 360 trunk lines, with a present equipment of 80. All of the above boards are to be of the bridged multiple relay, lamp-signal central-energy type. The contract also calls for the necessary wire chief's, monitor's and chief operator's desks, distributing frames, lightning arresters, power plant, storage batteries and a complete central-office equipment. This is probably one of the most important contracts that has been awarded for a considerable time. It is stated that the company has been for some months closing the deal, during which time it has made a thorough investigation of the telephone apparatus manufactured by the leading telephone companies. The main exchange is to be in operation on September 20th and the sub-exchanges October -, October 15 and November 1, 1903.

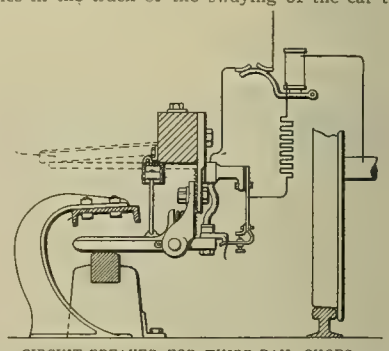
Cost of Bell Service.

The city of Kansas City, Mo., is investigating the question of telephone charges. Edward P. Moxey, an expert accountant, testified at the hearing that he had examined the books of the local Bell company (Missouri and Kansas Telephone Company) and that the cost to the company of the service was $28.81 per telephone in 1902, counting in a royalty of $1.96 to the parent company. The number of subscribers (in all the company's territory, apparently) was 25,794. In 1900, with 15,510 subscribers, the cost was stated to be $31.21 per instrument, including $3.66 royalty, and in 1901 it was placed at $32.22, including a royalty of $3.24. When asked how he had arrived at these estimates Mr. Moxey said: "I took the total amount of actual expense and divided it by the average number of telephones in use during the year. In figuring the expense I eliminated amounts aggregating $510,000, which had been improperly charged up as expense." Mr. Moxey said that the books showed many improper entries.

Circuit-breaker for Third-rail Shoes.

At crossings, switches and drawbridges of third-rail electric railways the third rail is necessarily interrupted, and in order to prevent breaking the power circuit when one of the shoes leaves the third rail at such a point it is customary to connect all the shoes in multiple, so that current will always be supplied through the shoe or shoes remaining on the rail. If two or more motor cars are coupled into a train, all of the shoes are connected for the same reason; but it often happens that at the places where the third rail is interrupted there are metal structures, such as switch stands or bridge girders or other grounded metalwork, which may come into close proximity to the shoe as it passes, so that there is danger that the shoe which is out of contact with the third rail may establish a short-circuit from the other shoes to ground, which short-circuit would injure whatever lay in the path of the heavy current which would instantly flow through the short-circuit, besides interfering with the service. Moreover, the shoes on the opposite side of the car from the third rail are "alive," and as they are protected only by a short wooden guard, which stands some little distance above them, there is great danger that someone may accidentally come in contact with one of them and receive a serious or even fatal shock.

A patented invention of Montraville M. Wood of Schenectady, N. Y., aims to prevent this dangerous possibility by so constructing each shoe and its connections that unless it is resting in contact with the third rail it will be dead. This is accomplished by utilizing the play of the shoe in a vertical direction in excess of that required to allow for irregularities in the track or the swaying of the car truck,



CIRCUIT-BREAKER FOR THIRD-RAIL SHOES.

so that when the shoe runs off the third rail and drops below the normal limit of oscillation it opens a switch which may be either in the power lead itself or in an auxiliary circuit containing an electromagnetic switch controlling the power lead. In either case the dropping of any shoe below the lowest normal position it occupies while in contact with the rail breaks the connection between that shoe and the others after the circuit is broken between the shoe and the rail, so that the shoe is de-energized so long as it remains in this abnormally low position and out of contact with the third rail. By breaking the power circuit at the shoe and then opening the power lead all danger of an arc at the switch in the power lead is avoided. The accompanying drawing is a sectional end elevation of a third rail and contact shoe, the latter being provided with a switch controlling an electromagnetic switch in the power circuit.

The Middlesex and Elgin International Electric Railway Company has been granted a 50-year franchise to operate a railway in Vancouver, B. C., and vicinity.

Lightning Arresters for High-potential Lines.

To protect lines carrying high-tension currents, certain essential conditions are requisite. The protective devices should at all times be capable of permitting the escape to earth of all atmospheric discharges, and under normal conditions absorb only the minutest fraction of the initial energy developed by the dynamos. The disconnections and the swinging arresters, do not fulfill these conditions, writes A. Bainville in L'Electricien, because in both of these the ground wire is opened either permanently or intermittently. The liquid rheostat does not fulfill the second requirement. The "horned" arrester and the "comb," formed of a series of points from the line wire in close proximity to similar projections from the ground line, and the condenser arresters, formed of alternate disks of metal and mica, made up in sections and used in sets of a greater or less number, according to tension requirements, with the first and last of the plates metallic, one being connected to

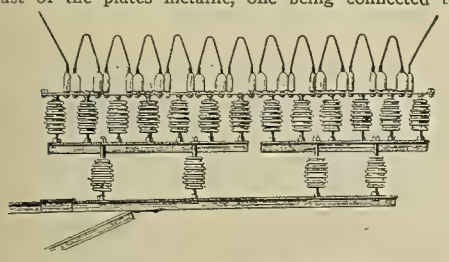


FIG. 1. LIGHTNING ARRESTERS FOR HIGH-POTENTIAL LINES.—ARRANGEMENT FOR 5,000 VOLTS.

line and the other to earth—none of these satisfy all the requirements and conditions.

With all these forms of arresters a portion of the discharge still passes over the line, and it is necessary to intercalate a self-induction coil, especially in systems where the insulation is weak or the generators are not thus protected.

Now any of the above forms of arrester may be used to advantage on high-tension systems, but the number and position of these devices should be carefully chosen; it is necessary to proportion the number to the length or surface of the aerial conductor and never to depend on the ordinary "comb" protection principle.

In all cases the ground wire should be without angles, lead as directly to the ground as possible, and be kept carefully away from metallic surfaces and points, and the ground plate should be carefully placed well down in good conducting soil. Circumstances in each individual case must settle these particulars.

Those forms of arresters in which the discharge is permitted from points across an air space to a ground connection—either a plate or a comb, are unsafe when enclosed, because of the arcing, and they constantly deteriorate with age, rendering renewals necessary and constant; and where these are placed outside, subject to atmospheric influences, other objectionable results follow.

It is the aim of the apparatus described by Mr. Bainville to surmount these difficulties.

The apparatus consists of a series of elements, each formed of two metallic pieces, mounted on a support, and connected by a copper conductor in

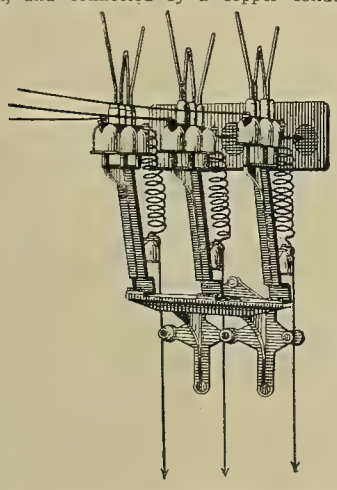


FIG. 2. LIGHTNING ARRESTERS FOR HIGH-POTENTIAL LINES.—ARRANGEMENT FOR THREE-PHASE SYSTEM.

the form of an inverted V. These elements are not identical. Half of them are hollow, cylindrical, and cone-shaped at the top, while the others have each a semi-circular recess on each of four sides, and are capable of being adjusted as to distance from the elements of the other type. The pairs are each mounted on the cross-arm, and are movable about a vertical axis for adjustment. The space between the surfaces of the two types of elements—a flash space—can be adjusted to a fraction of a millimeter.

The number of elements is proportioned to the electromotive force of the current.

The extremities of each of the parts or halves of the elements are continued upward by a copper rod connection, constituting the extremes or horns of the arrester. The several elements are mounted on porcelain insulators, which are held in position by the aid of a spring, fixed on the cross-arm.

For potentials higher than 5,000 volts the insulation is doubled, as shown in Fig. 1.

Each element has two terminals. One of these is connected direct to earth or through a rheostat; the other communicates with the line and with the switchboard, through a self-induction coil. This coil is so placed as to stop atmospheric discharges which are high, while the alternating current is comparatively feeble, and passes this "potential bridge" without appreciable fall of potential.

The multiplicity of elements permits of reducing the potential by dissipating the arc, which in its tendency to rise, finally extinguishes itself—becoming feebler as it lengthens. The temperature is not materially raised as a consequence, and the many elements afford so many occasions for extinguishing the arc, that a single ground connection is sufficient for the series.

The extinguishing of the arc is automatic, as suggested above; but it should be noted that the masses between which the sparks pass are of such magnitude as to prevent undue heating—and this space can be graduated as circumstances require.

The apparatus, as arranged for three-phase currents, is shown in Fig. 2.

New Telephone Companies in Indiana.

During the last week a number of new telephone companies were incorporated in Indiana. These companies will operate in various parts of the state and may be noted as follows:

Stout's Creek Telephone Company, which proposes to build and operate lines and exchanges in Monroe County. Samuel M. Hunter and John A. Parks of Bloomington are the incorporators.

The Garrett Telephone Company, to construct an exchange and lines in Garrett and throughout DeKalb County. This company has a capital stock of $15,000. S. A. Beekner, E. E. Grant and R. L. Mason are incorporators.

The Landessville Rural Telephone Company, capital stock $42,000, which proposes to establish exchanges, construct and operate lines in Grant and Huntington Counties. S. H. Shilholtz and Henry Wine of Marion and Rudy Freeman, L. D. Johnson and Wade Robinson of Landessville are the directors.

The Amboy Home Telephone Company, capital stock $5,000, will construct and operate a telephone system and exchanges in the town of Amboy and in Miami County. W. P. Miller, W. H. Houck, Robert Ridgeway and E. E. Cox are directors.

The Orange Mutual Telephone Company of Orange, Fayette County, with a capital stock of $35,000. This company proposes to construct and operate telephone lines and exchanges in Fayette, Franklin and Rush Counties. The company will also deal in telephone supplies. The directors are William F. Schrontz, W. P. Sipe, W. R. Conway, George A. Looney and John McKee, all of Orange.

The Farmers' Accommodation Telephone Company of Green Township, Hancock County. This company will construct a neighborhood system. Its officials may be reached through the Greenfield postoffice.

Word has been received from Trenton, N. J., that the Illinois and Indiana Telephone Company that filed articles of incorporation there on the 17th inst., with a capital stock of $2,000,000, would soon file a copy thereof with the secretary of state of Indiana. It is understood that this is an Illinois movement to build long-distance Independent lines in that state and that the company has been organized for that purpose. The lines would naturally have some connection along the Indiana border or possibly branch into the state, and thus Indiana is included. Louis P. Bailey, Joseph H. Mitchell and J. J. McLarren of Jersey City are the incorporators' names, but it is understood a number of Illinois men are back of the enterprise.

The Sulphur Springs Co-operative Telephone Company of Henry County has been organized by uniting 12 neighborhood lines which extend into three or four townships. The purpose of the company is to secure connections with surrounding towns. The united company has nearly 500 patrons. S. Hayes, D. F. Hoover and Adam Fadley are directors.

The Columbia Electric Company of Indianapolis has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture and sell telephones and other electrical appliances, build and install telephone or other electric plants, and may also construct and operate such plants, own and lease property and machinery for that purpose. The company's plant and offices will be in Indianapolis. Seymour Mason, F. N. Martindale and Luther R. Frost are the incorporators.

Chicago Electrical Association.

A regular meeting of the Chicago Electrical Association was held on March 20th at the association rooms, about 60 members and visitors being in attendance. The paper of the evening, on "Telephone Service," was delivered by S. J. Larned, general superintendent of the Chicago Telephone Company, and may be found elsewhere in this issue, with an abstract of the discussion, which was participated in by Messrs. Larned, Almert, Hale, Dimick, Tanner and others. The meeting was presided over by P. Junkersfeld, vice-president of the association, owing to the absence of President Woodworth. The next meeting of the association will be the second of the semi-social evenings planned for this year, and will be held at the Albion Cofe in the Pullman Building on April 3d. Dinner will be served at six, to be followed by a paper on "Effects Produced by Grounding the Neutral on an Alternating-current System," by G. M. Eastman, in charge testing laboratory of the Chicago Edison Company.

Military Telegraphy and Telephony in the German Army.

The German army is paying especial attention at present to the question of military telegraphy, and has a specially equipped corps of officers and aids for this purpose. An improvement in the telegraph service has been introduced by the law of 1899, which resulted in the formation of a special corps under the orders of the inspector of troops. The telegraph operations are now carried on by a body composed of three Prussian battalions, a Saxon and a Bavarian corps and a Wurtemberg detachment, making a total of 50 officers, 160 under-officers and 1,353 men. The telegraph regiment is commanded by the inspector, who is the chief officer of the army telegraph department, and his authority extends over all questions relating to military telegraphy and carrier pigeons, having his headquarters at Berlin and overseeing the military and telegraphic instruction of the corps. The troops composing the telegraph corps are at present divided into three battalions, of which the first is located at Berlin. Here is also situated the Telegraph School of the Cavalry. The second battalion has its headquarters at Frankfort-on-the-Oder,

GERMAN SOLDIERS TESTING MILITARY TELEPHONE LINE.

and the third at Coblentz. At Munich is the center of the Bavarian telegraph corps, as well as the Bavarian military telegraph school. In time of peace telegraph troops do not employ the regular army horses, but are provided with horses used especially for this employ, these being kept in the barracks of the telegraph corps at Berlin, Spandau and Ehrenbreitstein. The total equipment of a telegraph battalion comprises a lieutenant, an under-officer, 32 men and 48 horses.

In the illustration the troops are shown running a telephone line through the woods, and are testing it by the apparatus placed against a tree. The formation of the communication troops, and especially of the telegraph corps, has led to the transformation of the old Military Telegraph School. The latter, which is situated at Berlin, has served since 1901 to give instruction to the officers and under-officers of the cavalry. The course for the officers lasts five months, from the 4th of January to the 31st of May, and is followed each year by 34 lieutenants of the cavalry, chosen among those who show a special aptitude for such work. The under-officers' course lasts nine months and has 83 in attendance, one for each regiment of cavalry. The technical instruction which is given in the school, as well as in the field work, includes all the details of military telegraphy, electricity, optics and telephony, commencing with the manipulation of apparatus, placing of telegraph and telephone lines, and is completed by exercises in erection of lines and testing. The telegraph corps also carries out field work during the annual grand maneuvers of the German army. At Berlin the corps has constructed a permanent system of telegraph and telephone lines, which serve to connect all the principal barracks and other buildings of the army, and includes no less than 46 different stations.

Temporary World's Fair Power House Completed.

The temporary power house in which will be located the generating machinery for use on the World's Fair grounds during the pre-exposition period, has been completed, and the work of installation is now well advanced. The building is but a wooden shell, covered with corrugated iron, and will be replaced by the $100,000 steel structure, the contract for which has been let to the American Bridge Company, as soon as the steel can be obtained. However, this temporary building is, in reality, a government bonded warehouse, as the Durr boiler to be installed therein entered the United States under bond, as will most of the machinery that will be exhibited by foreign manufacturers. The steam generating machinery is, with the exception of the Durr boiler, of American manufacture, and consists of one 250-horsepower Morrin-Climax water-tube boiler and one 300-horsepower boiler of the same type, both furnished by the Clonbrock Steam Boiler Company of Brooklyn; one 700-horsepower Durr marine-type water-tube boiler, manufactured by the Duesseldorf-Ratinger Rohrenkesselfabrik of Duesseldorf, Germany; one Sorge-Cochrane feed-water heater and purifier, with a normal rating of 1,500 horsepower, furnished by the Harrison Safety Boiler Works of Philadelphia, and also Cochrane steam separators and Reliance steam traps; one 10-inch exhaust head, built by the Pittsburg Gage and Supply Company, Pittsburg; one 300-horsepower, high-speed, automatic tandem-compound engine, supplied by the Buffalo Forge Company, Buffalo, N. Y.; one 240-horsepower high-speed automatic simple engine, furnished by the Skinner Engine Company of Erie, Pa.; one 200-kilowatt, revolving-field, 60-cycle Stanley generator, built by the Stanley Electric Manufacturing Company of Pittsfield, Mass.; one 150-kilowatt, 60-cycle Warren generator, supplied by the Warren Electric Company of Sandusky, Ohio; two duplex steam boiler-feed pumps, with a capacity of 100 gallons per minute against a boiler pressure of 150 pounds, furnished by the National Steam Pump Company of Upper Sandusky, Ohio.

The Stanley generator will be direct-connected to the Buffalo engine, and the Warren generator to the Skinner engine, the two units having a capacity of 7,000 incandescent lamps, which will be used for lighting the grounds during the pre-exposition period, and especially for lighting the Liberal Arts Building for the dedicatory exercises, to be held therein on April 30th and May 1st.

The Loomis-Pettibone Company of New York is considering the installation of a 3,000-horsepower gas-generating plant, in connection with the exhibitors' power plant in the Machinery Building. The plant will be installed as an exhibit, and will be chiefly interesting from the fact that it is the only system in the world that successfully uses bituminous coal for the manufacture of producer and water gas.

Nearly all the cables for the lighting circuits of the Education Building have been strung, and the Electricity Building will next receive the attention of Chief Rustin. As these two buildings are almost identical in size and shape, occupying positions on each side of the Grand Basin, the wiring will not differ materially, except for the fact that in the Electricity Building current will be available at seven voltages, while the needs of the exhibitors in the Education Building will require but one, or, at most, two. The cables of the 6,600-volt lines will enter the transformer house, located in the court of the building, where they will serve three sets of transformers—three 250-kilowatt, three 200-kilowatt and three 50-kilowatt. The largest set will supply current for the decorative circuit, that is to say, the 20,000 incandescent lamps on the exterior of the building. This load will be carried by four feeders, each side of the building being fed by an independent line, controlled from the transformer house. In the same manner, the grounds surrounding the building will be supplied through four feeders, while the interior lighting will require two lines. The decorative circuits will be equipped with dimmers, so that the lights on the exterior of the building may be varied from zero to full candlepower as gradually as desired. The 200-kilowatt transformers will be used in connection with motor-generators or rotaries, to supply the building with direct current at 110 volts. The cables are strung on insulators mounted on the lower chords of the roof trusses, about 70 feet from the ground, and are of the usual stranded rubber-covered type.

New Telephone-system Patents.

Among recent telephone systems brought out by American inventors is a lock-out party-line system, the invention of Charles Lane Goodrum and Jacob William Lattig of Philadelphia. The invention has for its object the production of a party-line system such that when the line is in use by one party the other parties whose telephone sets are in connection therewith can neither "listen in" nor call central or each other until the line be again idle. In the operation of the system the inventors provide for an exception when it is desired to permit two subscribers on the same line to converse. In such case a specific action on the part of an operator at the central office or its equivalent is required, and in every case a call must first be made to the central office before communication can be had over the line. Such systems are usually designated "lock-out" party-line systems, and this apparatus is designed to work with centralized or common battery. However, it can be adapted to other than common-battery systems, and it will work equally well where selective or non-selective signaling is employed.

The invention consists, essentially, in the employment at each subscriber's station of a mechanical lock for the switch, a polarized controlling-magnet therefor having a biased armature normally set to locking position, together with means to connect this magnet to one side of the line in initiating a call, so that it will thereupon unlock the switch if the line is idle, but retain it locked if the line is busy. A source of energy is connected across the line and divided in such fashion that normally the side of line above referred to will be at such a potential and receive such a polarity as to insure the proper operation of the first locking device brought into connection with the line by a calling subscriber; but after such subscriber shall have secured possession of the line the bridging of his telephone set thereacross will cause a reversal of the polarity, so that any locking devices thereafter brought into connection with the line will remain in locking position. When one party has called and thus obtained exclusive control of the line, if it is desired to permit another party to come in means are provided whereby the polarity of current on the line may be momentarily reversed by the operator.

As an incident to the operation of the locking apparatus a visual indicator is actuated at each station to display the alternative indications of "Busy" or "O. K." Any other desired legends may be substituted for these, or the indicator may be dispensed with. The accompanying drawing (Fig. 1) is a diagram of a subscriber's line having three stations upon it, together with portions of the apparatus at the central station and the line-terminal and signaling devices.

The same two inventors are the patentees of an improved telephone system, the exchange functions of which are "more perfectly performed by simpler apparatus than heretofore." They assert that they avoid the disadvantages of the cut-off relay with its three-conductor cord and also the method of cutting off in the jack, by using shunts, closed when the plugs are inserted. In most common-battery systems the supervisory signals are controlled by ordinary neutral magnets, which when brought into connection with the lines respond to the flow of current therein to conceal their signals and when de-energized cause the display of their signals. Obviously when the cord circuits are disconnected and out of use some provision must be made to prevent the continued display of the signals. This is usually accomplished either by switches in the plug seats or by extra relays. The inventors avoid all complication in this respect by providing polarized relays connected to conceal their signals when disused or in the absence of current in the lines and to display their signals under the single other condition only.

The signals they describe as supervisory signals might very well have other functions—for instance, replacing line signals or trunk signals. "We desire it to be expressly understood," they state, "that we consider ourselves to be the originators of this type of signal controlled by the differential action of divisions of a single battery or generator or of separate units employed in the relations pointed out with the regard to the supervisory signals herein. As it would not require more than the skill of a trained electrician or telephone engineer to make the changes required, we consider that all such changes are well within the scope of our invention." The system is shown in Fig. 2.

The object of an invention for a subscriber's telephone circuit of William W. Dean of Chicago, the patent for which is assigned to the Kellogg Switchboard and Supply Company, is to remove the receiver entirely from the influence of the energizing current traversing the microphone, whereby several objections are obviated. The receiver is included in a path which is opaque to the passage of the energizing current, which is usually continuous, while a parallel path is provided around the receiver which is opaque to the passage of the talking currents, while permitting the energizing current to pass freely therethrough. In practice a condenser is usually included in the path containing the receiver and an impedance or choking coil in the path which is parallel thereto. Fig. 3 is a diagram illustrating a system embodying Mr. Dean's invention.

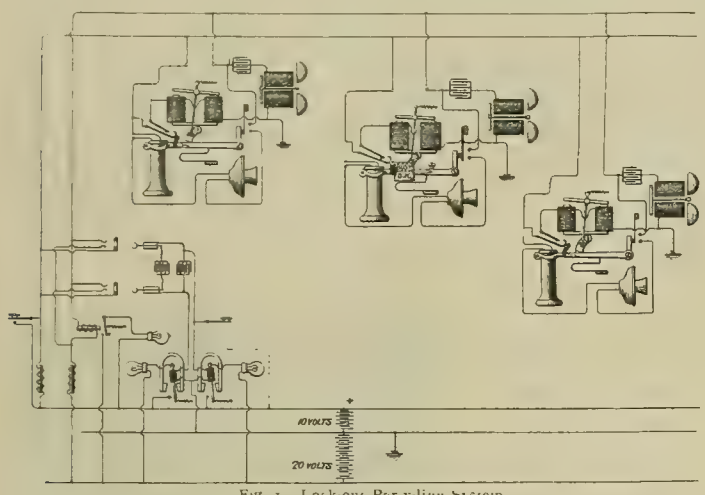


Fig. 1. Lock-out Par y-line System.

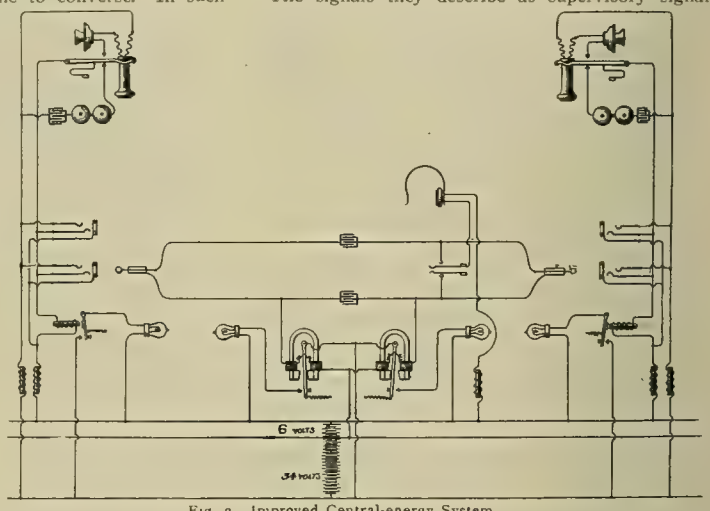


Fig. 2. Improved Central-energy System.

NEW TELEPHONE-SYSTEM PATENTS.

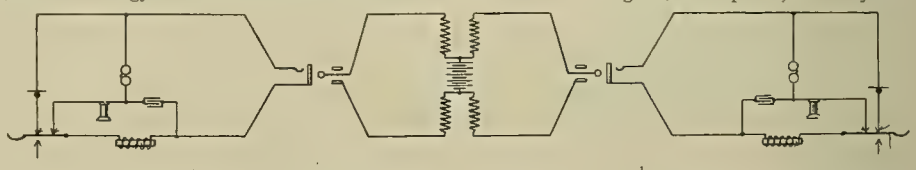


FIG. 3. NEW TELEPHONE-SYSTEM PATENTS.—SUBSCRIBER'S CIRCUIT.

Prospect of War in Los Angeles.

The Home Telephone Company of Los Angeles, Cal., is just about ready to give service to subscribers. A California correspondent writes that a war in telephone rates is predicted for that city. An insider says that the Bell people backing the Sunset will be willing to make any effort necessary to overcome competition of the Home Telephone Company. The Home officials say that they will start with 500 subscribers and that no charge will be made for service until 3,000 instruments are in use. They also state that they expect soon to enter San Francisco.

Traction and Municipal-ownership Issues in Chicago Mayoralty Campaign.

Chicago is in the throes of its biennial campaign preceding the election of a mayor and other city officers. So much attention has been attracted by the street-railway situation, municipal electric-light plant and general municipal-ownership question as issues in the campaign, that the following extracts from the platforms of the two political parties may be of general interest:

REPUBLICAN.

Chicago is great in all things except its municipal government. The enterprise, patriotism and devotion of its citizens have achieved marvels. Its government of itself of late has failed. Its citizenship at the present time has the admiration of the world; its government the respect of none.

The Democratic party, through Mayor Harrison, has been in control of th ecity for well nigh six years. At the expiration of Mayor Harrison's first term he sought re-election upon the ground that he alone could settle the traction-franchise question upon a basis satisfactory to the people. We then charged that Mayor Harrison would never settle the franchise question, but he was re-elected. At the end of his second term the Democratic platform reiterated its claim and demanded "an early settlement of the street-railway franchise question" within the next two years. These last two years, so big with promise, have also failed to bring results, but have verified our repeated and earnest statement that Mayor Harrison did not desire to settle the franchise question.

The only progress which has been made in this whole matter is to be credited to the local-transportation committee of the City Council. A majority of this committee are Republicans, whose records upon the franchise question in some cases antedate, and in all cases surpass in zeal, courage and honesty the record of Mayor Harrison. This committee has the entire confidence of the community. Its labors, however, have neither been encouraged nor aided by Mayor Harrison. This committee, despite the mayor, has presented an able and comprehensive report—a report which would solve the problem to the satisfaction of our people. This report will never be expressed in law as long as the Democratic party is in control of the City Hall. The promises of two years ago will be repeated by the Democratic party in this campaign.

Can the people of Chicago longer doubt that the settlement of the franchise question is conditioned absolutely upon the return of the Republican party to power in this city? That party proposes the following terms of a settlement of this question:

There shall be an immediate settlement of the traction question on the lines laid down in the report of the committee on local transportation of the City Council of the city of Chicago, to the end that the best street-car service attainable shall at once be secured for the people of the city of Chicago.

Enabling legislation should be passed at once by the General Assembly which will give to the city of Chicago the power and authority to own and operate street railways and other public utilities.

The question of municipal ownership or operation of street railways shall, upon petition, be submitted to the people before adoption.

No renewal of the expiring franchises shall be made unless the claimants under the so-called 99-year act shall specifically waive any and all alleged rights thereunder.

No grant shall be for more than 20 years, and the city shall reserve the right to take over such lines at such times as may be fixed in the ordinance prior to the expiration of the period of the grant, upon paying equitable compensation therefor.

One city, one fare, whether the streets are occupied by one or more companies.

In any ordinance that may be granted the city shall retain such control and supervision of the service as shall assure the best service for the entire period of the grant.

The compensation to be exacted by the city shall be based upon the gross receipts and shall be either in cash, in lower fares or in such other form as shall be found best for the interests of the whole people of Chicago.

In the development of our city the congestion of traffic in the business district becomes more apparent every day, and to relieve this situation a system of subways must of necessity be constructed in the near future, and these subways should be owned or controlled by the city of Chicago.

The merit system adopted by an overwhelming majority of the people, has been made to serve but one purpose, to protect incompetent employes, and we reaffirm our faith in the principle of the merit system and pledge ourselves to employ it for the purpose it was intended—the elevation of the public service.

DEMOCRATIC.

In 1897 the present city administration, on coming into office, found the then existing municipal conditions disheartening and deplorable. * * * The municipal electric-light plant, installed under a previous Democratic administration, was at a standstill, if, indeed, not actually retrograding from lack of interest and attention; the street-railway service, bad enough now, was worse then, the cars being too few in number, without vestibules, fenders or adequate heating, and, owing to the companies' refusal to issue transfers, in many localities passengers were compelled to pay two and even three fares for a single ride.

The application of business methods to the electrical department of the city has roundly diminished the cost per annum of each lamp one-half and increased the number of lamps fourfold, making this the largest electric-light plant owned by any municipality in the world.

The traction companies have been compelled to furnish more cars, to equip them with vestibules, fenders and proper heating apparatus, and, as the result of hard-fought litigation, to give transfers good for a single ride anywhere in the city upon their respective lines and to carry children at half fare.

The platform clamor of the recent Republican city convention for an immediate settlement of the traction question comes burdened with suspicion when citizens reflect that this clamor is raised by the same political machine which less than six years ago was urging upon the State Legislature the infamous Humphrey and Allen bills. We insist that it is more important that the traction question be settled right than that it be settled speedily. In his message to the City Council in 1899 Mayor Harrison closed the discussion of the street-railway question with the following words:

"One hears occasional criticism of the failure of the present city administration to pass constructive street-railway legislation. Whenever the traction companies are ready to take up a settlement of the question upon the foregoing lines, constructive legislation may readily be had. Until they express a willingness to approach the question with due regard for the rights of the citizens no honest-minded critic can find fault with the city administration for its neglect to pass constructive legislation."

The terms then proposed by Mayor Harrison, and of which we now approve as necessary to a proper settlement of the traction question, are as follows:

The passage by the Legislature of a municipal ownership enabling act; this to be an absolute prerequisite to any consideration of the traction question.

The reference of all proposed extension ordinances to a vote of the people for their sanction and indorsement.

An improvement of accommodation which will do away with the present uncomfortable, unwholesome and indecent overcrowding of cars.

Adequate compensation in the form either of a percentage of gross receipts paid into the treasury as a trust fund, to be expended solely on the public streets, or a reduction of fares, or a combination of both forms.

An express waiver of all alleged rights under the 99-year act.

Provisions for municipal ownership at the earliest possible date.

The simultaneous expiration of all franchises on or before 20 years from the date of grant and the express prohibition of the transfer of a franchise to a foreign corporation.

The use of the underground trolley within certain boundaries; the realignment of terminals that transportation may be rapid and street congestion avoided; the use of the modern grooved rails in all paved streets and the paving of rights-of-way by the traction companies with asphalt or dressed granite block.

A universal system of transfers.

Full publicity of accounts.

A system of arbitration for the settlement of disputes arising between traction companies and their employes.

A single-car service instead of the present train service.

Proposed Reforms.—We favor the municipal ownership and operation of gas and electric-light plants, telephone systems and other public utilities at the earliest date possible and demand enabling legislation therefor.

We favor the speedy construction of a downtown system of subways, to be owned and perpetually controlled by the city.

We favor the principles of the initiative and referendum upon all important municipal questions, and demand enabling legislation to that end.

We insist that the use of the waterpower of the drainage canal should not be granted to private persons or corporations, but preserved for the general purposes of the municipality.

We favor a strict and impartial enforcement of the civil-service law and demand its extension to the county and the state.

Graeme Stewart is the Republican candidate for mayor and Mayor Carter H. Harrison the Democratic.

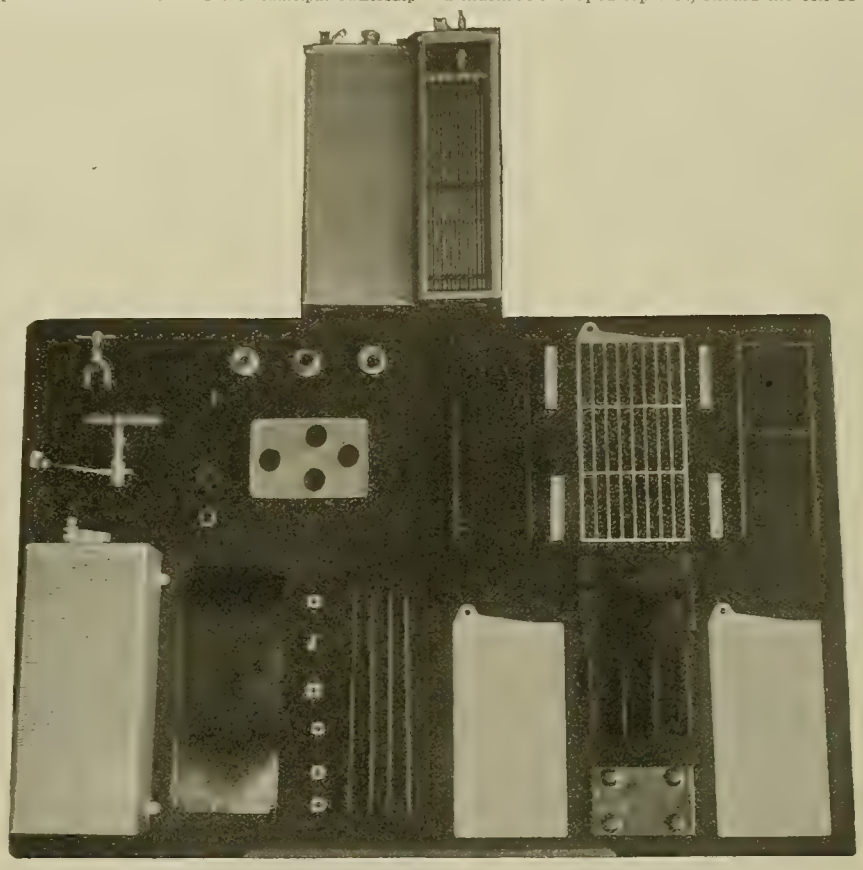
Edison Storage Battery Exhibited in Chicago.

The first public exhibition in Chicago of the new Edison storage battery took place last week. The battery was shown as one of the exhibits at the Auditorium Hotel prepared for the inspection of the delegates and visitors to the fourth annual meeting of the American Railway Engineering and Maintenance of Way Association, held on March 17th, 18th and 19th. The exhibit was in charge of W. G. Bee of the Edison Manufacturing Company, which also showed a line of Edison-Lalande primary batteries. A view of the exhibit is given in the accompanying illustration. On the board are shown a complete cell and all the different mechanical parts which enter into its construction. Above are seen a complete cell and one with a portion of the side broken away to show the construction of the plates.

Although the Edison battery has been described in general in previous issues of the Western Electrician, some facts concerning its construction and operation may be of interest. The jar used for the cell is of sheet steel, corrugated to strengthen it for about two-thirds of its height. The plates fit tightly in the jar, with their vertical edges pressing against hard-rubber side frames that have properly spaced grooves to receive them. They rest on four suitably grooved hard-rubber wedges, and are separated by hard-rubber strips.

The plates themselves consist of very thin sheet-steel frames, into the "windows" or slits of which are hydraulically pressed briquettes of iron and graphite or nickel and graphite (according to whether the plate is a positive or a negative), covered with perforated steel retaining lids. The positive plates are all connected together within the cell and fastened to the positive terminal, which is brought out through a rubber bushing in the cell cover. A nut, held from unscrewing by a cotter key, clamps the connecting wire to the terminal, outside the cell. The negative terminal is brought through the outer side of the cover in the same manner, and connected outside to the positive one of the adjoining cell.

There are two other openings in the cover of the cell—one for filling it, and one for allowing gas to escape. The former has a hinged spring cap that opens upon releasing the catch. The gas valve has a mushroom-shaped top that, should the cell be overturned, closes the two small gas passages in the gauze-fitted cap over it, and effectually prevents any liquid from escaping. The fine wire gauze, operating on the principle of the Davy miner's lamp, keeps the gas from firing back and blowing up the cell, should any of that which escapes become ignited. The cell cover fits sufficiently close upon the top of the jar to make a fluid and gas-tight joint.



EDISON STORAGE BATTERY EXHIBIT IN CHICAGO.

The cells exhibited were of 200 watt-hours capacity, they being capable of furnishing 160 ampere-hours at an average discharge voltage of 1.3 per cell. They can be run down to 0 without damage, but ordinarily are not discharged below 0.75 volt per cell. Each cell has 24 plates 9⅝ by 4¾ inches in size and 0.1 inch thick. These plates are capable of discharging at as high a discharge rate as 200 amperes without damage. The cells weigh 18 pounds each.

Bell Telephone Output.

The American Telephone and Telegraph Company reports its output of instruments for the month ended February 20th as follows:

	1903.	1902.	1901.	1900.
February:				
Gross output	91,844	95,584	73,310	58,272
Returned	35,188	36,855	26,144	23,414
Net output	56,656	58,729	47,166	34,858
Since December 1:				
Gross output	221,681	182,996	139,358	117,125
Returned	78,474	71,651	51,910	42,380
Net output	143,207	111,345	87,448	74,745
Outstanding February 20	3,293,527	2,637,355	2,040,264	1,655,250

The commissioner of patents has denied the petition of Edward D. Priest in which he made application for a rectification of a mistake made by him in connection with the reissuing of a patent covering a means for insulating electrical apparatus.

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

American Electrochemical Society, Chemists' Club, 108 West One-hundred-and-fifty-fifth Street, New York city, April 16th to 18th

National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Detroit, Mich., July 15th to 17th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

OUR esteemed contemporary, Feilden's Magazine of London, is no longer "militantly British," apparently, but simply a plain "engineering review." Perhaps the task of setting aright all the industrial enterprises of the British Empire was too great for its strength or perhaps it realized that its asseverations were just a trifle extravagant and ridiculous. At any rate, the dropping of the highfalutin is a change for the better.

PERIODICALLY, the rumor of the consolidation of the Western Union and Postal Telegraph Companies and the American Telephone and Telegraph Company is revived. The story is again going the rounds of the financial columns in the daily papers. It is asserted that the recent resignation of General Eckert as president of the Western Union and the death of John W. Mackay of the Postal-Commercial Cable interests have removed formidable obstacles to the amalgamation. Then, again, the gossips declare that the imminent increase to $250,000,000 of the stock of the Bell company, which is now spoken of as a certainty, has a confirmatory look. It is true that circumstances seem now more favorable to the merger than before, but many of the old difficulties are still in existence also, and it may be found impossible to secure the assent of a majority of the large number of stockholders in the companies, even if the step is strongly urged.

ONE of the most interesting of telephone installations—that of the Illinois Telephone and Telegraph Company in Chicago—is described at length in an illustrated article in this issue. The interest attaching to this exchange lies in the fact that an equipment for 10,000 subscribers is designed entirely for automatic switching operation, dispensing altogether with the operators who make the connections at "Central" in the existing types of exchanges, with which all are familiar. Automatic exchanges having working capacity up to 1,200 subscribers' lines or thereabouts are in operation, but Chicago will furnish the first example of a test of the system on a large scale. Opinions differ radically as to the practicability of the automatic system when put to the exacting test of daily commercial service in a large city. Advocates of the well-tried system of manual operation of telephone switchboards declare that the automatic people do not realize fully the difficulties they will encounter in maintaining efficient service through the multitude of contacts and magnets that are necessary. Still it would be difficult to find a telephone engineer of prominence who would be willing to make the flat prediction that an automatic exchange of 10,000-line capacity is surely foredoomed to failure. He would rather be inclined to say: "I doubt the practicability of the plan very much, but in electrical development only the inexperienced and the unwise are given to dogmatizing; let us wait and see." In the meantime the backers and designers of the automatic system are certainly showing their faith by their works. They have gone ahead building factories and equipping exchanges, without saying very much about their plans, and in a few months' time will have a system of such extent ready for operation in Chicago that their enterprise must, apparently, stand or fall by the issue. One cannot help but admire such enterprise, courage and pertinacity. Of course, if the Chicago exchange proves to be as successful as its builders confidently expect, the effect on the telephone industry will be profound. The automatic system insures secret communication and relies on mechanism rather than human fallibility. In small towns it will preclude the subscriber from calling up the exchange and finding out where the fire is when the fire alarm is sounded, and in cases where the telephone company may wish to undertake a general dissemination of news, as on election night, it would appear to be at a disadvantage. The subscriber will find it necessary, also, to become accustomed to the finger-hole calling switch at each station. On no occasion will a soft voice assure him "I've called them several times, and they don't answer." But, on the whole, telephone users will probably welcome the change if convinced that the new system is practicable. Exchange companies will be impressed with the great saving in operators' wages if it shall be proved that this item may be dispensed with. As to the telephone girl herself, she has reason to regard the future with some apprehension. But before these possibilities can become actualities some time must still elapse. Manufacturers of telephone switchboards designed for manual operation can hardly keep up with their orders, and if they are in any way alarmed at the prospect of automatic competition they give no sign. The Chicago automatic exchange is not yet in operation, although, as the article in this week's issue shows, the enterprise is now so far advanced toward completion, and so much money has been spent on it, that it would seem that in a very short time—a matter of a couple of months, perhaps—the automatic switches must be clicking with the messages of subscribers. We believe that the company has no subscribers pledged as yet, but under the plan which it has evolved, and which is outlined in the descriptive article, the question of getting customers will probably present no great difficulty. But a great deal of building wiring and many underground connections remain to be accomplished, although this part of the work should present no insuperable difficulty. Of course, one drawback to the new company's service will be the comparatively limited area to which it will be confined at first. But all of these considerations are comparatively insignificant in comparison with the question, "Will an automatic exchange of 10,000 capacity work satisfactorily?" It is the answer to that inquiry which the telephone world is awaiting with eagerness.

PATIENCE is an excellent virtue, but, with a full realization of the difficulties in the way, one still wishes that greater progress were making in the practical development of space telegraphy. Tests, experiments, patents and financial prospectuses there are in plenty, but where is the station where one may go with his message and his fee and send a wireless message over a distance of a hundred miles or even 50 miles? It is now five years or more since the sending of the first aerial message was heralded to the world, and it does seem that something more definite in the way of practical accomplishment should have been shown by this time. When one contrasts the present state of the art of space telegraphy with what had been done in telephony five years after the invention of the telephone the advantage in favor of the latter is very marked. True, wireless messages have been sent across the Atlantic, while a similar feat by telephone is still far in the distance; but five years after the advent of the telephone there was no doubt as to its great usefulness, while there are still many skeptics in relation to the commercial utility of the wireless system. Here is Mr. Willis L. Moore, chief of the United States Weather Bureau, for instance, who, in his recent annual report, briefly enumerates the results of 2½ years' experimentation: "While much valuable information has been secured and a fairly satisfactory experimental system has been devised, I am not able to report such progress in the investigation as would justify the department in dispensing with its coast telegraph lines or the cables that connect certain islands with the mainland. * * * * It has so far been found impossible to send messages any appreciable distance over land or fresh water or to attune the transmitter to the receiver so as to overcome the difficulties of interference should a second transmitter generate electric waves within the same field. I am of the opinion that the use of wireless telegraphy in its present state is limited to the transmission of messages between moving ships and between ships and the land, and that wherever permanent communication is required the cable or the land wire is the more reliable means of communication and probably the more economical. Our experiments during the past year were conducted over a course between Manteo and Cape Hatteras, N. C., a distance of about 50 miles."

If the field of space telegraphy is limited as Mr. Moore apprehends that it will be, the inventors and investors who are interested in the various systems will be greatly disappointed. Mr. Marconi is a great inventor and there are many other worthy workers in the field; but it is now about time to take one of two courses—either to establish a permanent system of communication working day after day under commercial conditions over a considerable distance or to admit that space telegraphy, while still a wonderful invention, is of limited practical value. This is said in no unfriendly spirit to the wireless method or lack of appreciation of the work done, but rather in the hope that the art may speedily show a decided improvement in things accomplished that make for usefulness.

Telephone Service.[1]

By S. J. Larned.

If we classify all telephones as to the nature of the places in which they are located, the group of residence telephones will be the biggest. In Chicago over 20,000 families find a telephone at home worth while. With the men of the house, its principal value is to establish a link between house and office, putting the business man within reach in case of accident or emergency and often enabling him to stay at home, when without such a connection he would have to be on duty. In sickness he is not isolated and telephones are often placed at a bedside to allow some unfortunate to still conduct his business, though he may be on his back.

But to the real head of the home, the connection with the grocer and the butcher is the all-important one, and to the market men this business is so important that they have sometimes paid for telephones in the houses of their customers for the sake of getting it. In some cities, notably San Francisco, an extremely cheap service known as kitchen service has been established, and is much used. It is primarily intended for marketing, and the stipulation is made that the telephone must be located in the kitchen. It is a one-way party-line service, there being no bells placed on the instrument, and, as its name implies, is devoted to the stocking of the household larder. Emergency calls for fire or police protection, or for the doctor, are not as frequent as the market and social calls, but perhaps count for about as much in importance. Probably more than half of the fires in most large cities are reported by telephone.

Ingenious householders have found innumerable other uses for the telephone never originally thought of. The operator many times gets the request, "Please ring my bell at 6 o'clock to-morrow morning;" 5,000 times every day in Chicago she is asked for the time of day; election and prize-fight results, football and baseball scores are asked for and reported.

Many attempts have been made to allow telephone patrons to listen to operas, concerts and church services, but without any permanent success. I have heard of people taking French and German lessons over the telephone.

In no other class of service are the demands and uses as varied as in the residence service. In exchanges where they predominate, the load line is very different from the more purely business exchanges, and it indicates in a way the habits of the inhabitants. The load comes on earlier and the maximum demand comes at marketing time about 9 a. m., and then falls off and continues at a pretty uniform rate till late in the evening. A little spurt is noticeable at about 5 p. m., when the man of the house calls up from the office to explain why he cannot come home to dinner, or to announce that he is bringing four or five friends with him.

The majority of residence telephones are connected up on party-lines, their light traffic hardly requiring the exclusive use of a pair of wires for each one.

Closely allied to the residence service is the system now becoming popular in most of the large hotels. A private switchboard is set up in the hotel with a telephone connection to every room and trunks to the city exchanges. The newly arrived guest in his very bedroom at once becomes a part of the great telephone community, one of the get-at-able people of the city, and is presented with the keys of the city more really and effectually than were ever old-time heroes who were honored by that interesting old ceremony.

To the merchants, big and little, the telephone is the doorway through which a large portion of their customers enter; with some by far the biggest part of their trade comes to them over the wire. Gradually they have all come to appreciate the importance of this bond of union with the outside world. Many who, a few years ago, allowed their customers to crowd and push one another in their efforts to get into them over one overcrowded telephone line now advertise with great prominence the special facilities they have provided for such business. with clerks who devote their entire time to telephone orders. Those who carry small stocks depend upon it entirely for replenishing in case of sudden calls.

In the offices of the various professional men, lawyers, physicians, etc., the use and dependence upon the telephone is nearly as great. The doctors, of course, are slaves of the telephone, being always at the beck and call of their patients. For their special behoof a form of portable telephone has been devised that can be carried from room to room, so that eating, sleeping or in his office, the doctor may always have his telephone at hand.

The big corporations would hardly be a possibility without the telephone systems, which bring all their multitudinous heads and branches within talking distance of one another. Were they to be made dependent once more on old-time methods of intercommunication, they must break up into smaller, simpler parts.

One of the vital organs of their being is the private telephone exchange; designed primarily to afford quick intercourse between the individuals within the organization, it has become also a clearing house for most of their transactions with the outer world.

In construction, a private exchange is simply a general exchange in miniature, though when one considers the private exchanges that serve the large railroads and packers, or a store like Marshall Field's, the term miniature is perhaps inappropriate.

The relations of a private operator to the people she looks after are direct and personal. She must know each man's name and part in the organization, and be able to connect inquiring strangers to the proper person. She must know who is to be allowed to speak to the august head of the establishment and who must be satisfied with the ear of someone lower in the line.

She must know the office habits of all her people, where they are to be found at any hour of the day. She gets to know their voices, their dispositions, the numbers they generally call; she is a confidential telephone clerk to the entire establishment, and a calamity overwhelms the place when she marries the bookkeeper, and a new operator has to slowly learn the ropes.

Private exchanges and private operators are by no means confined to the giants in business. Wherever a business gets beyond the one-man state, there is a field for the private operator, and that form of service is rapidly growing in popularity. In New York city the number of private operators by far exceeds the operators employed in the central exchanges.

Most telephone men feel that the general tendency of the demand to-day is for a more personal service, rather than for a self-operated mechanical device, however well designed. The busy man prefers to have a professional attendant to operate for him the machinery that he uses, whether it be a typewriter, an elevator, a street-car or a telephone switchboard. Conductorless street cars have never been popular, and I doubt whether operatorless switchboards will ever be more so. I do not mean that I disbelieve in mechanical appliances, calculated to increase the working range of any individual. We can say with certainty that in the future operators will do more and more of their work through the use of just such appliances, but ideal service will still require the interposition of a trained operator between the general user and the wonderful, intricate machinery of a telephone exchange.

Ideal service, though it can never be quite attained, is the ambition of the operating department of a telephone company. People may differ as to the essentials of good service, but I will venture to set down the following points as, in my opinion, most vital from the users' point of view.

The exchange should include as patrons every one with whom one might wish to converse.

Calls should receive uniformly prompt response from the operator.

Connection with the person or telephone called for should be made rapidly and accurately and should not be interrupted.

Communication should not be prevented by busy lines.

Communication should not be interfered with by the apparatus getting out of order, or if such trouble does occur, it should be promptly remedied.

And last, but not least, the treatment of patrons by employes should be courteous. The converse of this is true, but is not so easily controlled by the telephone management.

The requirements are ideal and service is good if it only approximates them closely.

It is sometimes stated that the installation in Chicago of a vast number of telephones at low rates on party lines has been unfair to the larger users of the service; that it has, perhaps, been a boon to the small users who could not afford a better service, but that the others suffered, drowned as it were in the ocean to which their little pool had suddenly grown.

But this is not an age in which people, business people at least, care to limit their intercourse to a small and select circle. The telephone aristocracy, if I may call it such, has suffered in the way a newspaper would suffer if its readers were doubled; or as a retail store would suffer if increased multitudes were brought to its doors each day.

The service is most often gauged by the way in which calls are answered by the operator, by the promptness with which she responds and by her general bearing and attention and courtesy.

The standard of service generally set requires that the time of answering, i. e., the interval between the picking up of the telephone and the response of the operator, should not average more than six or seven seconds. But a good average alone is not sufficient. A user may have been answered in three seconds on 20 consecutive calls, but he is apt to forget that part if on the 21st call he has to wait a minute.

The answering must then be uniform. The generally accepted standard on this point is that from 90 to 95 per cent. of all the calls must be answered in less than 10 seconds. The uniformity of the service is affected principally by the nature of the operator's work. The two factors determining the load upon her are the number of calls she has to answer and the operations or talking required to dispose of each call. The service is bettered very much more by decreasing the second factor than the first. As a matter of fact, every one of us is more alert and active, and accomplishes things with less effort when he is busy and pushed than when things are not coming his way rapidly, and if we decrease the number of calls that an operator has to answer, and give her time to lean back and fold her hands between calls, her attention is sure to lag. But by paring down unnecessary phrases that she uses by machinery to cut out certain manual operations, by providing easily read signals to keep her posted on various phases of the connection, the amount of time that she must give to each call is so reduced that even though she receives simultaneous calls from three or four patrons, each one can be answered with reasonable promptness.

The work of an operator is not easy, and the requirements of a good operator are many. She must have a good voice and a quick ear; she must be alert, active, even-tempered and adaptable, for though one moment she may be hearing the improvocations of a man to whom she has just had to report a line busy for the fifth or sixth time, she must turn instantly, perhaps, to answer a lady to whom her voice must show no trace of impatience.

Her first learned and most often reiterated rule must be one of patience and courtesy. The most rigid discipline, of course, must be insisted upon, for inattention follows the least appearance of a free and easy spirit. Plenty of calls to answer is the greatest aid to good discipline, for the old saw that couples up Satan and mischief and idle hands, is as true of telephone operators as of the rest of mankind. Besides this, a military system of responsibility is carried out, the operators being divided into small groups of nine or 10, each captained by a supervisor, who, in turn, is responsible to a chief operator.

Though an operator is required to concentrate her whole attention on her work while on duty, she is given frequent resting spells throughout the day in comfortable rooms provided for that purpose in each office, so that the work is not, on the whole, trying.

The applicants for positions are always in excess of the needs, and the successful ones are selected by examinations. This provides the raw material for an operating force, composed for the most, the best part generally, of young Irish-American girls. Weeks and months of patient teaching and practice are needed to round them into form, and after a couple of years' service, matrimony claims them, and new recruits must be trained for their places.

Courteous treatment of patrons by employes, and vice versa, are, without question, things of which the exchange management must take cognizance; but perhaps the treatment of patrons by patrons is nearly always their own affair. Nevertheless, I want to voice a protest against a growing habit which is, I think, the grossest kind of an imposition upon the victim of it.

Mr. Brown wishing to talk to Mr. Jones, tells his office boy to get Mr. Jones on the telephone. Mr. Jones is called, perhaps taken away from important work, and when he gets to the telephone, instead of finding Mr. Brown ready to talk, is told to wait a minute—Mr. Brown wishes to speak to him. My own practice on receiving such a call is promptly to hang up my telephone, instead of waiting, and get what little satisfaction I can out of the knowledge that Mr. Brown is also wasting a little of his time. If I ring my neighbor's door-bell I expect to be considerate enough of his convenience to be at his door when he opens it, and do not send a small boy to ring it a minute or two in advance of my arrival.

The most often complained of, least often deserved fault that the exchange manager bears, is that of false busy reports. While too frequent busy reports are a decided defect in service, it is one only in a small measure controllable by the telephone management. The only remedy is a campaign of education among those insufficiently provided with telephones. But they can never be eliminated. In Chicago, about one call in five is unsuccessful because of a busy line.

Telephone men have adopted the railroad use of the word "traffic," to describe the amount of business, the number of telephone calls or conversations carried on in a fixed time. Traffic counts are made at frequent intervals on particular lines or in total, to point out overloaded or underloaded lines, or operators, or exchanges. These counts show in Chicago a total of more than two-thirds of a million conversations per day.

Faults in the service, due to defects in the apparatus and lines, are, unfortunately, always numerous, and the maintenance force of an exchange is always a large and busy one. Of the millions upon millions of parts comprising the machinery of the Chicago exchange, it is small wonder that a thousand or more go wrong in the course of every day.

In various ways the knowledge of the mishap filters through to the repair department; some cases are discovered by the operators, others reported by the subscribers. They must first be diagnosed by the tester, whose work in many respects is analogous to that of the family physician. He first inquires as to the symptoms, thumps the patient two or three times with positive or negative or alternating current, listens to his voice and decides, too often perhaps, that the ills complained of are imaginary.

1. Abstract of paper read before the Chicago Electrical Association on March 20, 1903. Mr. Larned is general superintendent of the Chicago Telephone Company.

But having discovered an actual trouble, he turns it over to the proper specialist—the switchboard man, the underground man, or the line and instrument repairman. The work of these men must be checked and carefully tested after the trouble is cleared. Accurate reports as to the nature of the trouble are made and tabulated, so as to indicate prevailing difficulties and point out unreliable types of apparatus. The interval of time between the reporting and the clearing of the trouble is also noted and tabulated.

The value of all such data, of course, is in pointing out definite lines along which improvement may be made and preventing a self-satisfied assurance that conditions are good enough as they are.

Every business house must keep posted as to the quality of the stuff it is selling to the public, and a telephone company must go to particular pains to discover the real facts as to the kind of service it is rendering. It might be supposed that its patrons could be depended upon for such information, but, as a matter of fact, about 98 per cent. of them take everything for granted, and make absolutely no expression of satisfaction or dissatisfaction. Of the remainder, a few report such difficulties as they may encounter from time to time; another few apparently never encounter anything but abuse or lack of attention from the incompetent and idle employes of the company. Another very much smaller lot will occasionally give a word of commendation.

In order, therefore, that the record shall not be entirely blank or black, the telephone company is obliged to learn for itself what is being served out to the public. So a considerable force of men and girls is constantly at work making hundreds of test calls of every description daily, or standing, stop-watch in hand, beside patrons who are making calls, timing the answering, noting errors, busy reports, etc., and the thousand and one details of the service.

These results regularly tabulated are a fair index of the general trend of things. A relaxation of the discipline in any office, due perhaps to an inefficient manager or chief operator, is very soon indicated by the tabulated tests.

To the telephone man it sometimes seems as if all the pent-up impatience of humanity finds outlet at the telephone.

This is due, I think, to the impossibility of seeing and knowing all the attendant circumstances. We send a call out over the wires for a friend, and cannot follow it through all the intricacies of wire, cable, switchboard, etc. It is easy to imagine if anything goes astray, that some malevolent power at Central is thwarting us. It is no unusual thing for a man to work himself into a passion over an inanimate piece of wire that has unfortunately broken, and attribute all of his troubles to the spiteful operator.

Perfect telephone service, that is, service in which each one always gets what he wants and gets it quick, is as impossible as in any other field of human effort, for we are dealing with a machine more complicated and with a greater number of parts than any other in existence. Moreover, the parts are distributed all over the land, tied together by mere threads of copper, exposed to the disturbing influences of mankind and the elements, and dependent for good working upon the proper co-operation of everyone concerned, from you who originate a call down to the irresponsible office boy or ignorant domestic who may answer it.

Discussion.

In discussing Mr. Larned's paper, Harold Almert drew attention to the universal use and dependence on the telephones by asking the audience to try and realize what would happen if all the telephones in the United States were put out of business. He also spoke of the varied duties, of a personal as well as a business nature, which devolved upon the private operator, citing some of the many questions which come to an operator in a large department store.

D. W. C. Tanner asked if any study had been made of the psychological effect upon the subscriber of the different methods of calling him to the telephone, such as the machine ring, the operator's personal ring or the use of a buzzer. Mr. Larned replied that the position of psychological tester of his company had not been filled as yet, and said that the machine ring had proved of great value, as it had decreased the time of answering the call by about one-half.

Others taking part in the discussion were W. B. Hale, H. S. Dimick and A. M. Blumenthal, one of the points brought out being that the average number of calls per line per day in the Chicago telephone system was between 17 and 18. Other points touched upon were the installation of telephones on railroad trains, the use of the phonograph to answer "Line busy—call again" when the line called was in use, and the subscribers' fault in leaving the receiver hanging.

The Insular Railway Company, which was incorporated recently in New Jersey, with a capital of $2,500,000, has undertaken the construction of an extensive electric-railroad system in Cuba. The company is controlled by American capitalists affiliated with the Havana Electric Railway Company, which concern operates a 36-mile traction system within the limits of the Cuban capital. The new lines will comprise four sections, making a total length of over 100 miles radiating from Havana.

Moore Improved Transmitter for Space Telegraphy.

The art of sending electrical oscillations through space is now well covered by patents, and inventors are turning their attention to the perfection of details and designing of new features. Such an improvement has recently been patented by Daniel McFarlan Moore of Newark, N. J., the object of the invention being to improve the generating system by producing waves or oscillations of greater penetration or carrying power, thus enabling the control to be effected over longer distances than is possible with the apparatus and methods heretofore employed.

In previous apparatus the source of the waves has been a pair of metallic terminals or electrodes, across which a disruptive spark is maintained by electricity obtained from any suitable source—as, for instance, the secondary of an induction coil. Mr. Moore has discovered that superior results may be obtained by using as the emitter or producer of the oscillations the electrodes or terminals of a circuit-interrupter operating in a vacuum to produce interruptions of a circuit of induction. For the best results the vacuum should be very high, so as to produce very abrupt changes of resistance in the circuit. A vacuum which is as nearly as may be an absolute vacuum is best suited to the practice of the invention. By "circuit of induction" is meant any circuit through which electric current flows from any suitable source of continuous, intermittent, pulsating, or alternating currents, and which is adapted by its self-induction or by its induction upon a parallel circuit to generate electromotive forces at the point of separation.

By employing circuit-interrupters of a character whereby an exceedingly high speed or rate of circuit interruption is obtained, one is enabled to secure very greatly improved results with electromotive forces or potentials of comparatively small amount, whereas heretofore in the art where a mechanical interrupter is employed the aim has been to secure a comparatively high potential by slowing down or retarding the rate of interruption of the circuit-interrupter in the primary of the induction coil.

In the invention induction waves or oscillations are produced at the electrodes of a circuit-interrupter, and in this respect the invention differs materially from devices heretofore employed for the purpose, which involve the use of ball electrodes or surfaces or "capacity areas;" nor does the inventor employ induction coils and interrupters operating in the primary circuit while the secondary is connected to the electrodes of the emitter to maintain a spark.

At the receiving point any proper or usual means for rendering the oscillations or waves sensible and for utilizing them to control an electric circuit may be employed. Mr. Moore says he may use the Branly coherer or any modification thereof or the form of instrument employed by Hertz for rendering such oscillations sensible and properly included in the electric circuit whose varying electric condition produces the desired operation directly or indirectly upon any translating device or device whose action is to be controlled.

Any circuit-interrupter of the character described in his patent No. 548,127, dated October 15, 1895, may be used for the purposes of the invention, it being understood that in every case the interrupter contacts are in a high vacuum and will operate to make and break a circuit of induction.

Water Storage in New York State.

The bill to place the control of the watercourses of the state of New York in a water-storage commission for purposes of preventing floods and utilizing the power on an extensive scale is meeting opposition in the Legislature of that state, particularly from the Board of Trade and Transportation of New York city. It is stated that the corporate interests, which have for years been attempting to get control of the various water supplies of the state are indirectly seeking to accomplish through this measure what they have been unable to accomplish directly. Financial objections to the bill are urged, and it is also stated that the state would be subject to the danger of a repetition of the Johnstown horror.

The commission promises a development of 57,000 horsepower on the Genesee River, 120,000 horsepower on the Black River, and 260,000 horsepower on the Hudson River above Troy, and over 1,000,000 horsepower more in other parts of the state. Senator Lewis, who introduced the bill, spoke in its favor. He presented resolutions from the Chamber of Commerce of Rochester indorsing it. Its whole purpose, he said, was to prevent an annual loss of hundreds of thousands of dollars to the people of the state, and at the same time develop in the state a water-storage power which would be a source of great revenue. "The time will come," said Senator Lewis, "when the coal supply of this country will be insufficient for the demands of the people. If a source of power can be developed in this state, which will lessen to an enormous extent the consumption of coal, it would seem that such development would be most desirable. The bill is a big bill. If there are any provisions in it which seem unwise they can be amended, but it seems to me that the purposes which it seeks to achieve are not open to the assaults which have been made on them."

Municipal versus Private Lighting in St. Joseph, Mich.

St. Joseph, Mich., has a municipal electric-lighting plant. In a recent report the lighting committee of the City Council stated the condition of the plant at the end of the year 1902. The committee's report shows the expenditures, including building, fixtures and appliances, to be $7,103.93; bonded indebtedness, $12,000; total investment, $19,103.93. The total cost of maintenance, including four per cent. of total cost of plant for depreciation, insurance and taxes, and deducting $450, the amount of supplies on hand at end of year, is placed at $4,495.52. Thus, as the city has 123 arc lights, the cost per year for each light is placed at the low rate of $35.85.

But, Mr. W. Worth Bean, the president of the Benton Harbor and St. Joseph Electric Railway and Light Company, is not disposed to let these figures go unchallenged. In an elaborate analysis of the report, filling 14 columns in a local paper, Mr. Bean undertakes to prove by actual figures and, apparently, with success, that the committee's report is incorrect and misleading.

"The total investment," says Mr. Bean, "stated to be $19,103.93, should be $19,955.95, as shown hereafter [by items and figures at the City Hall open to anyone interested, but not given in the present summary]. A proper construction account for the enlightenment of the general public should itemize the articles entering into it, rather than conceal them under an ambush of glittering generalities. Such words as 'supplies,' 'sundries,' etc., except for trivial odds and ends, should not appear in a public statement at all. It is under such cover that accounts are juggled.

"In the effort to keep the apparent cost of lighting down to a point somewhere near the estimate, the Board of Public Works has entirely omitted a number of items; nothing appears for depreciation, nothing for taxation, nothing for insurance, and nothing for interest upon the floating or unbonded debt except in an item, 'four per cent. on total cost of plant.' The item of taxation alone includes a cost to the city of more than $1.50 per lamp. If a private corporation owned the plant, its assessed value would be practically $9,000, and the taxes upon that amount would exceed $180; but as the city owns the plant, it is not taxable, and the citizens consequently are required to bear their share of the burden. The depreciation on such property is an element that should by no means be ignored. The rapid growth of ideas in electrical and mechanical science renders the up-to-date machine obsolete long before it wears out. The gasoline engine of five years ago has no market value, and the dynamo of 10 years ago is antiquated and cannot produce lights economically. The progress of the inventor along these lines is no less rapid now than it has been during the past 10 years; and aside from the ordinary wear of machinery of this character (which, beyond question, averages seven to 10 per cent. per annum), the depreciation which results from new improvements is a very important factor. The report is entirely silent with regard to it. Insurance will add more than a dollar to each light, besides increasing the rate on the pumping plant, and this, too, is omitted.

"Herewith is submitted the cost of lights, including operating expenses, $4,829.28, plus the interest $930.96, placing the depreciation at 10 per cent., $1,955.59, amounts to total $7,715.83, or divided by 123 lights, $62.72 per light per annum, figuring in every case 123 lamps as stated in the board's report. Now, a depreciation of seven per cent. will be calculated, plus the cost of operation, $4,829.28, and interest as above, $930.96 and depreciation $1,368.92 will be $57.96 per light per annum. In order to meet the $12,000 of bonds when due, it will be necessary to create a sinking fund of five per cent. per annum, amounting to $600 per annum. If 123 lights are divided into this amount, it will show conclusively that the lights for this item will cost $4.87 each per annum, until the bonds are paid, which, added to the cost of operating the plant each year, will give the grand total per annum per light for the period, which is really the true cost."

Mr. Bean's company offers to supply street arc lights at these rates per lamp per annum: Direct-current lamps of 1,200 candlepower, $45 to $58.14, depending on the number taken; alternating-current lamps of 2,000 candlepower, $53.60 to $56.45, depending on the number taken.

James Watt's House in Birmingham.

Heathfield Hall, near Birmingham, in which James Watt died on August 19, 1818, is now occupied by Mr. George Tangye, the younger brother of Sir Richard Tangye. One of the rooms was used by the great inventor in his later years as a private workshop, and this room—as is pointed out in Sir Richard Tangye's autobiography—has been "reverently preserved exactly as it was left by its owner" over 80 years ago. There still are Watt's tools, methodically arranged; also a stove, with a coal-scuttle and fire-irons, as well as a Dutch oven, in which he could cook his own meals without being disturbed. There, likewise, stands his lathe, with his lamp and tools left untouched as he himself placed them, and with the stool on which he sat, while his old leather apron remains on the back of the chair over which he had thrown it when he took it off for the last time.

Bell Telephone Company and Its Licensees.

The following statistics are reproduced from the Commercial and Financial Chronicle of New York of March 14th last:

Under date of October 31, 1902, this company [the American Telephone and Telegraph Company] made a statement to the New York Stock Exchange, showing the outstanding capital stock of each of its licensee companies, and the amount thereof in its own treasury. We have revised these figures to date, assuming in each case that the parent company has subscribed to its full pro rata share of the new stock issued. We have also supplied the data regarding dividends, outstanding bonds and telephones, and give the whole in tabular form as follows:

CAPITALIZATION OF BELL LICENSEE COMPANIES.

Name of Company and Stock (unless otherwise stated).	Stock and Bonds. Total Issued.	Stock and Bonds. Owned by American T. & T. Company.	Dividends and Interest. Period Paid.	Per Cent. Years. 1901.	Per Cent. Years. 1902	Principal Due or Last Dividend.
Bell Telephone Company of Buffalo.....a	*$5,500,000	$2,762,650	Q.-J.	6	6	January, 1903, 1½%
Bell Telephone Company of Canada.....b	*5,600,000	2,333,200	Q.-J.	8	8	January 15, 1903, 2%
Debentures of 1895	2,000,000	302,500	A.-O.	5	5	April 1, 1925.
Bell Telephone Company of Missouri....c	*2,639,100	1,752,020	Q.-J.	8	8	January, 1903, 2%.
Bell Telephone Company of Phila. ....d	‡11,976 600	9,688,140	Q.-J.	8	8	January, 1903, 2%.
Central District and Printing Telephone Company of Pittsburg.....e	*8,510,520	5,689,840	Q.-J.	8	8	January, 1903, 2%.
Central N. Y. T. & T. Co	*961,500	527,500	.....	3¾	1	February, 1902, 1%.
Debentures of 1898	100 000	.....	J.-D.	5	5	1903-1918.
Central Union Telephone Company.....	*5,437,902	3,727,655	.....	.....	.....	In 1896, 1%.
1st of 1896, gold	2,500,000	.....	J.-J.	6 gold	6 gold	u 1906-1916.
Consol. of 1899, gold	3,500,000	1,000,000	J.-J.	5 gold	5 gold	u 1909-1919.
New Har. bds. V. 74, p. 632	100,000	.....	.....	.....	.....	.....
Ches. & Potomac Telephone Co	*2,650,000	1,512,100	Q.-J.	4	2	July, 1902, 1%.
Consol. M. '99, $1,500,000 gold	1,500,000	.....	J.-J.	5 gold	5 gold	s July, 1909-1929.
Chicago Telephone Company	*11,993,400	6,240,000	Q.-J.	12	10½	January, 1903, 2½%.
City and Suburban Telegraph Association of Cincinnati	‡3,564,850	1,091,450	Q.-J.	6	6	January, 1903, 1½%.
Cleveland Telephone Company (See Western Telephone and Telegraph Company below.)						
Colorado Telephone Company.....ee	‡3,400,000	1,744,250	Q.-J.	6	6	January 15, 1903, 1½%.
Cumberland Telephone & Telegraph.....f	*9,675,125	4,919,082	Q.-J.	7	7	January, 1903, 1¾%.
1st Mortgage, 1898, gold	910,000	.....	J.-J.	5 gold	5 gold	January 1, 1918.
Debenture of 1900, red. at par	239,000	.....	A.-O.	5	5	February 1, 1920.
East Tenn. Tel. 1st mortgage 1898	150,000	.....	J.-J.	6 gold	6 gold	v 1903-1918.
Ohio Valley Telephone Co. bonds	16,000	.....	J.-J.	6 gold	6 gold	January 1, 1908.
Delaware & Atl. T. & T. Co.....g	*397,945	150,667	.....	.....	.....	.....
Duluth Telephone Company	100,000	56,650	.....	.....	.....	.....
First and second mortgage	180,000	180,000	(?)	6	6	(?)
Empire State T. & T. Company	200,000	131,880	.....	(?)	(?)	.....
Hudson River Telephone Company.....h	*4,000,000	2,028,000	Q.-F.	6	6	February 1, 1903, 1½%.
Iowa Telephone Company.....i	1,423,225	471,570	(?)	(?)	(?)	(?)
First mortgage, 1897, $500,000	750,000	350,000	J.-J.	6 gold	6 gold	w 1907-1922.
Michigan Telephone Company (See Western Telephone and Telegraph Company below.)						
Missouri & Kansas Telephone.....l	*3,062,000	1,553,200	Q.-F.	6	6	February, 1903, 1½%.
First mortgage, 1899, $1,250,000	495,000	.....	A.-O.	5	5	t October, 1909-1929.
Nebraska Telephone Company.....q	1,800,000	918,517	Q.-J.	6	6	January, 1903, 1½%.
New England T. & T. Company.....m	*21,628,200	12,587,500	Q.-F.	6	6	February 15, '03, 1½%.
Bonds, see Inv. Supplement, p. 165	4,000,000	581,000	A.-O	various	various	various.
New York and New Jersey T. Co.....n	*10,625,000	1,044,240	Q.-J.	7	7	Rate 7% in 1903.
First mortgage 1890, $1,500,000	1,324,000	.....	M.-N.	5 gold	5 gold	May 1, 1920.
New York and Pennsylvania T. & T. Co..	*1,000,000	492,900	Q.-J.	3½	0	July, 1901, 1%.
First mortgage 1896, $300,000 s. f.	291,500	.....	F.-A.	5 gold	5 gold	February 1, 1926.
Gen. M. 1899, $1,000,000 gold	470,000	.....	M.-N.	4 gold	4 gold	November 1, 1929.
New York Telephone Company.....o	*30,000,000	19,329,400	Q.-J.	6	6	January 15, '03, 1½%.
Met. T. & T. Co., first mortgage, 1888	1,843,000	.....	M.-N.	5 gold	5 gold	May 1, 1918.
Northwestern Telephone Exchange (see Western Telephone and Telegraph Company below.)						
Pacific States T. & T. Co.....y	*12,000,000	6,021,300	Q.-J.	6	7	January 15, '03, 1½%.
Sunset T. & T. Co., first mortgage, '93	750,000	.....	J.-J.	6 gold	6 gold	July 1, 1913.
Con. M. 1899, $2,250,000	2,250,000	.....	A.-O.	5 gold	5 gold	u 1913-1929.
Pennsylvania Telephone Company	‡2,130,867	1,162,350	Q.-J.	5	6	January, 1903, 1½%.
First mortgage 1898	482,500	.....	A.-O.	5 gold	5 gold	x April 1, 1918.
Cent. Pa. Tel. and Sup., first mortgage	168,500	.....	A.-O.	6	6	1925.
Providence Telephone Company	‡1,600,000	480,000	Q.-J.	8	8	January, 1903, 2%.
Rocky Mountain Bell Telephone .....z	*2,097,500	1,021,100	Q.-J.	6	6	January 10, 1903, 1½%.
Southern Bell T. & T. Co	1,000,000	922,500	.....	.....	.....	.....
Southern New England Telephone Co....	*2,990,000	995,400	Q.-J.	6	6	January, 1903, 1½%.
First mortgage 1898, $1,000,000	790,500	.....	J.-D.	5 gold	5 gold	December, 1948.
Southwestern T. & T. Co (see Western Telephone and Telegraph Company below.)						
Western Electric (Manufacturing) Co...r	*12,000,000	7,210,080	Q.-F.	8	8	February, 1903, 2%.
Western Telephone and Telegraph Co....	16,000,000	21,440,200	.....	.....	.....	.....
Pref. 6 per cent. cumulative after 2 yrs.	16,000,000		F.-A.	.....	2	February, 1903, 2%.
Collateral trust $10,000,000	9,834,000	.....	J.-J.	.....	5 gold	January 1, 1932.
Cleveland Telephone Company.....j	*3,100,000	700,000	various	6	2½	January 16, 1903. zz.
Michigan Telephone Company.....kk	*5,000,000	110,400	Q.-J.	1¼	.....	January, 1901, 1¼%.
First mortgage, gold, 1897, s. f.	285,000	.....	J.-J.	5 gold	5 gold	July 3, 1917.
Con. M. 1899, $5,000,000 gold	4,715,000	.....	J.-J.	5 gold	2½	January 1, 1929.
Detroit Telephone Co., 1st mort., guar.	600,000	.....	F.-A.	6 gold	3	February 1, 1922.
Northwestern Telephone Exchange.....j	4,354,300	780,000	various	11	8	January 17, 1903. zz
Postal Telegraph Cable, Texas.....j	1,200,000	.....	.....	.....	.....	.....
First mortgage $2,000,000.....p	1,189,000	.....	J.-J.	5 gold	5 gold	January 1, 1928.
Southwestern T. & T. Co.....j	7,316,000	1,200,000	various	8	5½	January 17, 1903. zz
Wisconsin Telephone Company.....k	3,011,100	505,100	various	3	6.7	January, 1903. zz

*Par value of share $100. ‡Par value $50. **a** Stock authorized $10,000,000, see v. 75, p. 1205, 1033. **b** Stockholders in 1902, subscribed to $1,000,000, new stock at $125, payable in instalments to July 2, 1903, making total issue $6,000,000; v. 74, p. 1309. **c** Outstanding stock to be increased in 1903, from $2,639,100 to $3,339,100. **d** Authorized stock issue increased in May, 1902, from $8,000,000 to $12,000,000; v. 74, p. 886, 990; v. 75, p. 396, 668. **e** Increase to $10,000,000 was authorized in February, 1903; v. 76, p. 437. **ee** Outstanding stock to be increased in 1903 from $3,400,000 to $4,400,000. **f** Authorized issue increased in January, 1903, from $10,000,000 to $20,000,000; v. 75, p. 1356; v. 76, p. 50, 161. **g** Control understood to be held by Bell Telephone Company of Philadelphia, and the American T. & T. Co. together. **h** Increase of stock to $4,000,000 authorized in 1901; v. 76, p. 105. **i** Control held by Central Union Telephone Company and American T. & T. Co. together. **j** Western Telephone and Telegraph Company owns all the stock not owned by the American T. & T. Co. **k** A controlling interest in stock owned by Western Telephone and Telegraph Company; v. 74, p. 893. **kk** The Michigan Telephone Company is in receiver's hands; 70 per cent. of stock owned by Western and other Bell companies; v. 75, p. 33; v. 76, p. 482. **l** Authorized issue increased in February, 1902, from $2,500,000 to $5,000,000; v. 74, p. 429, 1199. **m** Authorized issue of stock $30,000,000; amount outstanding increased in 1902 to $21,628,200; v. 74, p. 838, 1312. **n** Authorized issue of stock increased in 1901 from $8,000,000 to $15,000,000; amount outstanding is to be increased by August, 1903, to $12,500,000; v. 75, p. 669. A controlling interest in stock is held by New York Telephone Company and American T. & T. Co. **o** Western Union Telegraph Company on July 1, 1902, owned $6,164,300 of the stock; limit of stock issue was raised in January, 1903, from $30,000,000 to $50,000,000. **p** V. 74, p. 430; v. 76, p. 334. **q** Increase to $2,400,000 authorized; v. 76, p. 438. **r** See v. 76, p. 439. **s, f, n, v** Subject to call on (or after) date first named, viz.; **s** at 103; **t** at (?); **u** at 105; **v** all at 102½, also sinking fund $3,000 yearly, beginning in 1900. **w** Redeemable after January 1, 1907, at 102 and interest. **x** Redeemable after April 1, 1908, at 102 and interest. **y** Stock increased to $12,000,000 on March 1, 1903; see Chronicle of March 6, 1903. **z** To be increased to $2,397,500; v. 76, p. 438. **zz** The dividends shown for this company in 1901 and 1902 are those paid for the years named (instead of merely those paid during the year as is our custom) and therefore in the case of 1902 include the dividend paid in January, 1903.

Number of telephones of leading companies on January 1st was:

	Telephones. 1903.	Telephones. 1902.
Bell of Buffalo	23,566	18,603
Bell of Canada	49,081	42,856
Bell of Missouri, about	12,000	8,300
Bell of Philadelphia	39,807	24,525
Central District, Pittsburg	46,859	40,136
Central New York	6,594	5,339
Central Union	111,427	101,575
Chesapeake & Potomac	19,404	14,215
Chicago	79,043	53,511
City & Suburban	16,636	12,251
Colorado	23,473	16,443
Cumberland	92,425	76,532
Delaware & Atlantic	18,160	11,346
Hudson River	18,992	14,866
Missouri & Kansas	29,932	21,402
Nebraska	18,858	15,169
New England	111,774	93,822
New York & New Jersey	53,184	42,130
New York & Pennsylvania	11,054	10,390
New York	96,364	72,159
Pacific	115,462	114,311
Pennsylvania	24,500	19,700
Providence	10,562	8,731
Rocky Mountain	13,711	9,165
Southern New England	21,110	17,564
Western—		
Cleveland	16,700	13,978
Northwest	25,418	21,616
Southwest	42,400	33,038
Wisconsin	26,800	22,672
Michigan	49,500	50,964

Postal, Texas. Purely telegraph company (no telephones); total messages for 1902 were 3,149,893; in 1901, 2,597,648.

Increase in Bell Stock.

The report that the American Telephone and Telegraph Company will hold a special meeting on March 31st to vote on the proposition to increase the capital stock from $150,000,000 to $250,000,000, as mentioned in the Western Electrician last week, seems to be confirmed. President Fish, in speaking of the proposal, is reported as saying that the company is taking this step because it has theoretically reached the limit of its present power to issue stock. This does not mean, however, that there is now $150,000,000 stock outstanding. It is figured that at present there is outstanding in the hands of the public $109,685,000 stock. Besides this, about $27,100,000 is held in the treasury of the old Bell company, leaving about $13,200,000 of authorized stock still unissued. In a circular dated January, 1902, Mr. Fish stated that the capital stock of American Telephone and Telegraph was $114,858,400, of which there was outstanding in the hands of the public $82,748,000. The remainder was held in the Bell treasury. Since that date there has been sold to stockholders at par $21,937,000 new stock, making the total issue $136,795,400, of which $104,685,000 was outstanding. It is also asserted that $5,000,000 of the stock in the Bell treasury was sold privately to New York men now represented in the directory. This would make the total stock outstanding in the hands of the public at present $109,685,000. The statement that the company is theoretically limited in its stock issue may be taken to mean that the treasury stock is regarded as issued. As there is only $13,200,000 stock still unissued, it is clear that if the company intends to issue as much stock for construction this year as it did last year, i. e., almost $22,000,000, it must either sell the stock in the Bell treasury or increase the amount of capital stock authorized.

Ohio Telephone Notes.

The Farmers' Independent Telephone Company of Smithfield, Jefferson County, has been incorporated with a capital stock of $10,000. M. B. Cole, J. M. Copeland and others are interested.

It is said that the American Telegraph and Telephone Company has inaugurated a hot fight against the United States Telephone Company in Ohio, and that there are a lot of solicitors out in every city doing work for it. There are about 10 men working in Cleveland. H. H. Robinson, general manager of the United States Telephone Company, does not go into details in regard to the matter, but expresses no fear that his company will experience any great reduction in business through its competitor's efforts.

The Farmers' Mutual Telephone Company of Attica has been incorporated with a capital stock of $3,000 to build lines through the country about that town. J. W. Walker and others are interested.

The Medina Telephone Company, Medina, has increased its capital stock from $20,000 to $30,000.

The Willshire Telephone Company, Willshire, has been incorporated with a capital stock of $20,000 by I. D. Johnson, Alex Beal and others.

The Muskingum Valley Telephone Company of Marietta will build a line from McConnellsville to Marietta at a cost of about $12,000.

The reported statement of Manager Charles E. Wilson of the Keystone Telephone Company of Philadelphia, that the Elkins-Widener syndicate had secured large holdings in Federal telephone properties in this state, has created some curiosity among people interested in the business. The officials of the Federal say they know nothing about the holdings of that syndicate in their company, and it is, therefore, probable that if the Philadelphia syndicate does hold stock in the Federal, it has been picked up on 'change the last few months. There is now a pool of the Federal stockholders, with an agreement to sell no more stock until the debts of the company are paid. The plan for doing this was spoken of some weeks ago by the Western Electrician, and it is probable that it will be carried out. Nothing will be done, however, until the electric-railway matter is out of the way. O. M. C.

Telephone News from the Northwest.

The council of Crookston, Minn., is considering an ordinance requiring all telephone wires to be placed underground. The Iron Range Telephone Company states that it will fight the proposition to the end. The company built its exchange about two years ago, and does not feel that it can endure the expense of rebuilding it on an underground system so soon. The city asserts that it has the power to order the wires underground.

The Waseca (Minn.) Telephone Company has increased its capital stock from $10,000 to $40,000.

The Hecla Telephone Company has been formed at Hecla, S. D., with $50,000 capital.

C. N. Smith has bought a controlling interest in the Farmers' Telephone Exchange at Richland Center, Wis.

C. M. McFatridge of Moravia, Iowa, asks a franchise at Mystic, Iowa, for a local exchange.

G. T. Newman of Bonaparte, Iowa, has patented a telephone, and it is rumored that he will engage in their manufacture there.

The Jackson Telephone Company of Preston, Iowa, has been incorporated with $25,000 capital stock.

The Commonwealth Telephone Company of Chicago expects to equip the local exchange at Waterloo, Iowa, with automatic instruments at once. It will be the first city west of Chicago which the company will so equip. When that city is finished Cedar Falls will probably be taken up.

A representative of the Wisconsin Telephone Company appeared before a legislative committee at Madison to speak against a bill to prevent telephone companies from changing rates to meet local conditions and classifying cities with rates for each class. The representative of the Wisconsin company is reported as saying that his company made war on Independents and did what it could to freeze them out; that they were a nuisance and a needless expense. R.

LATEST TYPES OF TELEPHONE INSTRUMENTS.

In common with other parts of the telephone system, although not, perhaps, to so great an extent, the transmitter and receiver have been improved and developed. From the fact that so great a proportion of the attention of the telephone engineer is taken up with switching and construction problems, there is some danger that the ingenuity displayed in the betterment of the instrument itself and in adapting it to the present-day requirements of the telephone exchange will be overlooked. Of course, when all is said, it is the telephone that is the one indispensable piece of apparatus in the whole system. Comparing the instruments of to-day with the type in existence, say 20 years ago, it will be observed that the talking qualities have been greatly improved, especially for long-distance work, and that the user has now a variety of types to select from—types not only of different makers but designed for different classes of service. In appearance the receiver of to-day does not differ greatly from its progenitor, but the common-battery transmitter has been evolved, and the apparatus at the subscriber's station, considered as a whole, has been made much more efficient and more attractive in appearance. That there is an instructive and interesting diversity of telephone instruments, and that improvement has been the order of the day in this branch of electrical design, as in every other, is shown by the descriptions and illustrations in the present article.

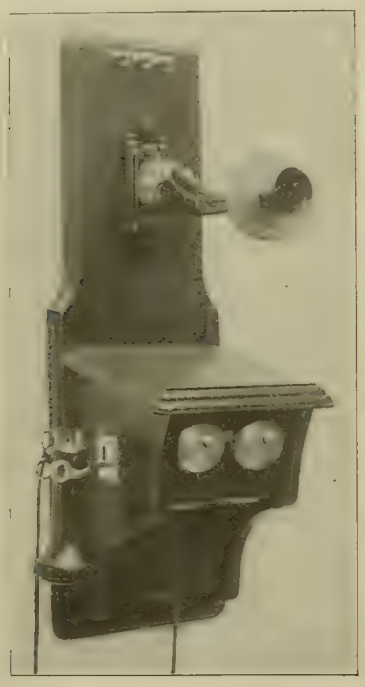


Fig. 1. Bell Long-distance Wall Set.

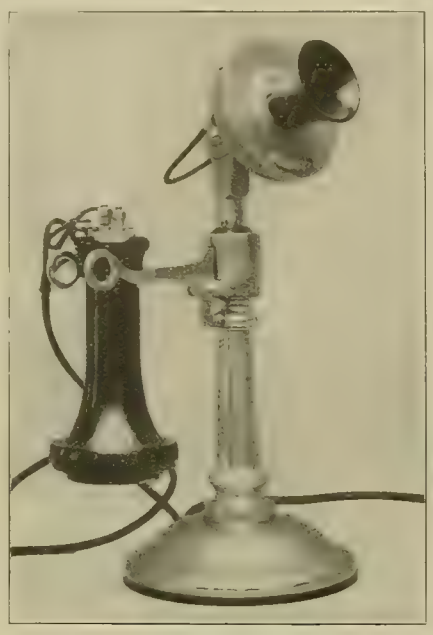


Fig. 2. Bell Desk Set.

Fig. 3. Desk Set (Disassembled) of American Electric Telephone Company.

Fig. 5. Automatic Desk Set.

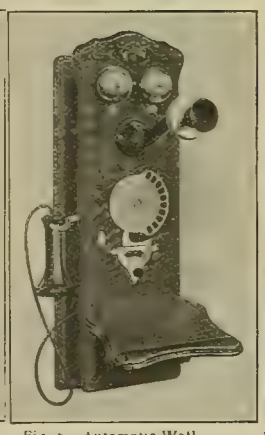


Fig. 6. Automatic Wall Instrument.

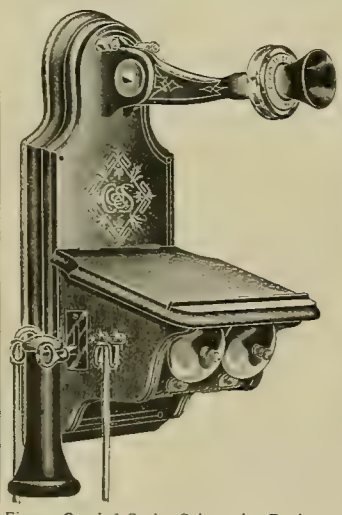


Fig. 7. Couch & Seeley Sub-station Equipment.

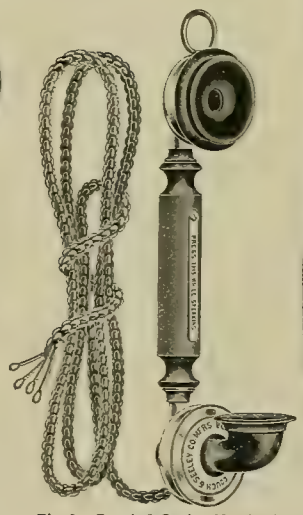


Fig. 8. Couch & Seeley Hand Micro-telephone.

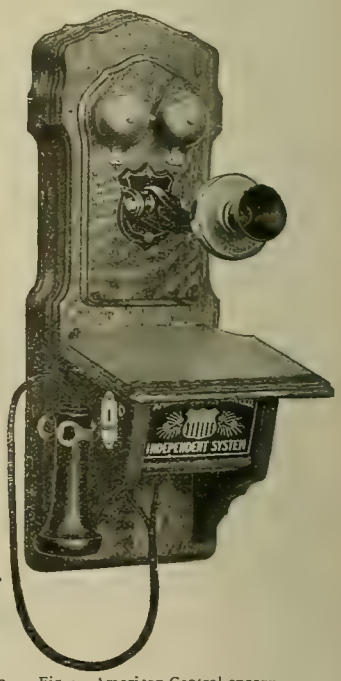


Fig. 4. American Central-energy Instrument.

LATEST TYPES OF TELEPHONE INSTRUMENTS.

Bell Telephones.

Of course, taking the people of the country as a whole, more telephone users are familiar with the standard Bell apparatus than with instruments of any other make. As is well known, the Western Electric Company of Chicago is the manufacturer of the instruments and switchboards used by the American Telephone and Telegraph Company and its licensees. This company's standard long-distance wall set (Fig. 1) is the type of subscriber's set used in exchanges fitted with central-battery equipment. The portable stand illustrated in Fig. 2 is the corresponding instrument for use on desks, etc. In both instruments the circuits are designed to insure the highest possible certainty of signaling and volume of transmission.

American Electric Telephone Company.

The desk set shown taken apart in Fig. 3 is made by the American Electric Telephone Company of Chicago, and is put forth as the only self-contained article of the kind on the market to-day. The hook is substantially mounted with hard-rubber insulation on a steel frame, and the loosening of the screw in the base permits this steel frame to be removed without unsoldering a single connection or disturbing any screw connection. The set is equipped with a stamped hook, "American Beauty" transmitter, which is self-contained, and a Bell-style receiver, which is also self-contained. A dustproof plate covers the bottom in a new and substantial manner. Round leather is driven into the base and securely fastened, acting as a cushion. Patent on this article has been duly applied for. The central-energy telephone, shown in Fig. 4, is a patented design, so constructed as to make it readily accessible for inspection. It is equipped with the "American Beauty" transmitter and Bell-style self-contained receiver. Its principal features are the neatness of design and the accessibility of every part. The front half of the backboard swings open, permitting inspection of the condenser, wiring and ringer coils. The connection between this part and the backboard wiring is made through spiral springs, which is thought to be a decided improvement over the connections made by hinges.

Automatic Apparatus.

Two types of telephones made by the Automatic Electric Company of Chicago are illustrated in Figs. 5 and 6. These instruments are designed for use with automatic switchboards, doing away with an operator at "Central." The distinguishing feature, as the pictures show, is a revolving dial underneath the transmitter. This dial controls the keyboard or calling device inside the box, which sends the selecting impulses over the line to the automatic switch at the exchange. The dial and keyboard are of the same type whether the number of subscribers to the exchange be 100 or 100,000. The dial, which is locked until the receiver is taken from the hook, revolves on a pivot as far as the finger-stop at the lower edge, and is restored to its normal position by a spring. The 10 finger-holes, numbered from 1 to 0, allow any combination of figures to form any desired number. A push-button is provided for ringing the desired subscriber. The method of making a call, say 124, is as follows: Remove receiver from hook; place finger in hole No. 1 and press down to the stop, allowing dial to return to its position; repeat with finger in No. 2, then in No. 4; press button, which rings the bell of the subscriber desired. When the conversation is finished, the hanging up of the receiver sends current over the wires to the switchboard and instantly clears the lines which were engaged. The Automatic Electric Company asserts that its automatic equipment affords the subscriber a service of greater privacy, promptness and precision than that given by any other telephone system.

Couch & Seeley Types.

The Couch & Seeley Company of Boston produces the interesting designs illustrated by Figs. 7 and 8. The former shows a sub-station equipment for operating on common-battery systems. The whole framework is a single iron casting, including a clamp for holding transmitter arm, making a very substantial construction. The iron casting is hollow, forming a space for the condenser, which is covered and protected by a light oak backboard. The desk in front is made of light oak, which forms a pleasing contrast to the highly finished black enameled iron. The oak desk contains the hook switch and ringer coils, and as both the upper lid and front are on hinges ready inspection of these parts can be obtained. The hand micro-telephone, shown in Fig. 8, is made with or without switch in

the handle, and the transmitter and receiver are relatively adjustable. Although the hand microtelephone has been very largely used in Europe it is only lately that this convenient form of instrument has been available to Independent telephone buyers in the United States. Its popularity, however, is said to be increasing.

Eureka Desk Set.

The desk set shown in Fig. 9 is manufactured by the Eureka Electric Company of Chicago. This instrument is efficient and is likewise of graceful design. The standard is made of solid cast engine lathe-turned metal, finished in either copper or nickel. The transmitter is the company's latest design. One of the principal claims set forth by the Eureka company is that this transmitter is the only absolutely non-packing and moisture-proof transmitter made. The receiver also possesses many points of merit.

Farr Instruments.

The Farr Telephone and Construction Supply Company of Chicago finds that the popularity of different patterns varies according to locality. Each of the Farr types illustrated in Figs. 10, 11 and 12 has its admirers. Fig. 10 shows a bridging telephone to be placed on heavily loaded country lines where there are 30 or 40 telephones in multiple on each line. These instruments, having 150,000-ohm generators, are able to ring with ease from one end to the other of such a line. The type shown in Fig. 11 is used perhaps more than any other of the Farr manufacture. It is usually supplied with a 50,000 or a 100,000-ohm generator and has solid-back transmitter, bipolar receiver and two carbon batteries. Ringer coils for bridging telephones of this kind are usually wound for from 1,000 to 1,600 ohms. The style illustrated by Fig. 12 is a favorite for installation in residences, as it is neat and compact, and, being provided with dry batteries, is absolutely clean.

Holtzer-Cabot Magnetos.

Figs. 13 and 14 illustrate two new magnetos recently placed on the market by the Holtzer-Cabot Electric Company of Boston. These instruments are constructed, apparently, along lines which modern telephone practice has proved to be most desirable for many classes of work. The boxes are substantially made with lock corners, the material being selected quartered oak. Partitions separate the box into three compartments. The upper section holds the hook, which is of the latest pattern. There is sufficient room also for an induction coil behind the hook. In the middle compartment is placed the standard "H.-C." nickel-plated generator, while the lower section is arranged to hold two cells of dry battery in the pattern shown in Fig. 13, and four cells of dry or two cells of liquid battery in the type represented by Fig. 14. The drop shelf provided on these magnetos is most convenient, especially in shipping, requiring much less room than in instruments where the stationary bracket is used. The striker is mounted upon the lid of the box. These instruments can be fitted for either series or bridging lines.

International Country Party-line Instrument.

The instrument illustrated by Figs. 15 and 16 is a new generator-call local-battery telephone made by the International Telephone Manufacturing Company of Chicago, and specially designed for village systems and country party lines, where small troubles are especially annoying and expensive. The transmitters and receivers are durable and especially designed for heavy, long-distance work. The transmitter circuit is entirely independent from the frame of the transmitter or transmitter arm, the circuit being taken from the front and back electrodes by substantial, insulated conductors. The receiver has all working parts self-contained, and has all metal parts enclosed in the hard-rubber shell and cap. The switch springs are all insulated with hard rubber and mica, and the hook forms no part of the circuit. The bell hammer is protected by a nickel-plated brass guard. The generator, normally, is not in the line. The transmitter arm is provided with a sub-base containing the wire terminals. These features—of having no exposed metal parts forming any part of the circuit, and having all terminal screws, binding posts and connecting wires completely concealed—are said to be entirely new in the telephone field and original with the International company.

Kellogg Common-battery Wall Set.

In Figs. 17 and 18 are shown two views of the latest type of common-battery wall set put on the market by the Kellogg Switchboard and Supply Company of Chicago. This instrument is of the kind furnished to the Home Telephone Company of Los Angeles, and the name plate of this latter company may be seen above the transmitter arm on the backboard. The salient feature of this instrument is the mounting of all apparatus, except the ringer, directly on the backboard, so that the opening of the box leaves all parts exposed for quick repair. By this construction all of the wiring of the instrument may be done before the enclosing box is put on, thus facilitating greatly the work of assembling the instrument in the factory. The transmitter arm forms no part of the circuit, there being two cords leading from the transmitter, these being at all times concealed within the arm. The hook-switch is a modified form of the type so long used by the Kellogg company, it being entirely self-contained and carrying a bank of german-silver springs, each of which is platinum pointed. The condenser is of two-microfarad capacity and plays an important part both in the ringing and in the talking circuit. No induction coil is used, but the retardation coil is so associated with the talking apparatus and with the condenser that very high talking efficiency is secured, there being no loss of efficiency caused by the transformation in the induction coil of the ordinary common-battery set. The receiver cord is led out through an insulated bushing in an escutcheon plate of the hook, thus preventing effectually the acci-

Fig. 9. Eureka Desk Set.

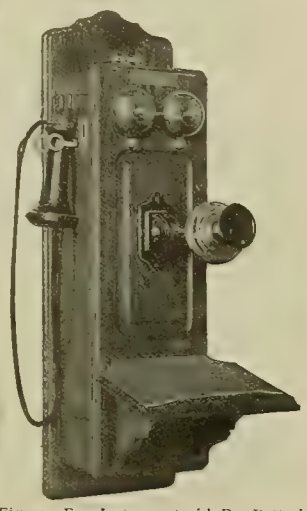


Fig. 12. Farr Instrument with Dry Batteries.

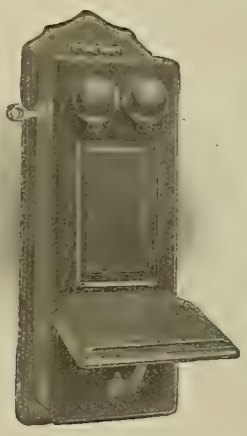


Fig. 13. Holtzer-Cabot Magneto.

Fig. 14. Holtzer-Cabot Magneto.

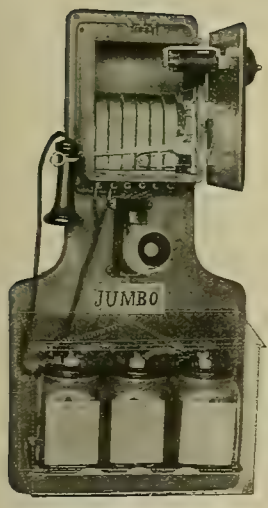


Fig. 10. Farr Bridging Instrument with Six-bar Magneto.

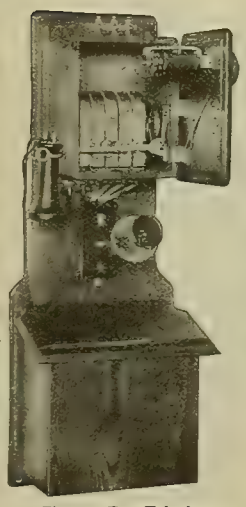


Fig. 11. Farr Telephone with Five-bar Magneto.

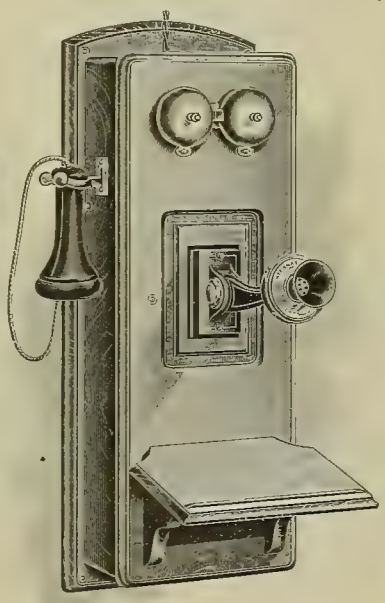


Fig. 15. International Party-line Instrument.

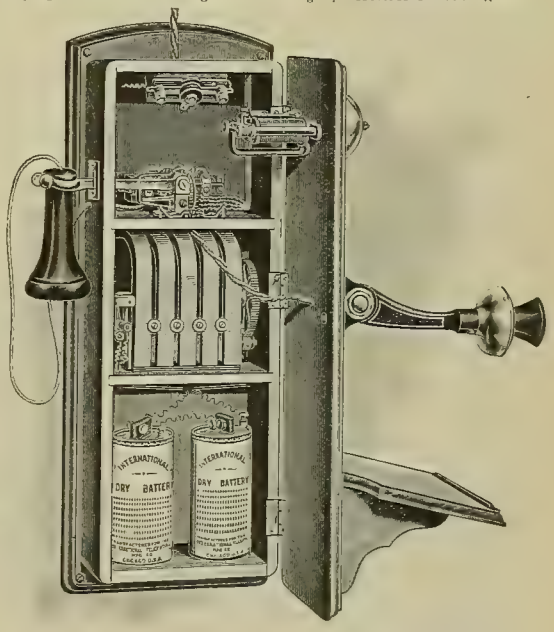


Fig. 16. International Party-line Instrument (Open).

LATEST TYPES OF TELEPHONE INSTRUMENTS.

dental pinching of the receiver cord in closing the box.

MONARCH WALL TELEPHONE.

In the instrument manufactured by the Monarch Telephone Manufacturing Company of Chicago (Fig. 19) one thing especially to be noted is the improved method of assembling the parts into the complete telephone, as shown in the illustration. All of the important working parts are mounted in a compact type of cabinet, but in such a way that they can be quickly removed for inspection or repairs without in any way disturbing the permanent wiring of the instrument. The generator, switch and induction coil are attached to shelves which occupy the usual position in the cabinet, but instead of being wired permanently through the back of the box, the connections are brought to lock-nut terminals, situated near the front edge of the shelves. These terminals, in turn, are clamped securely to the connecting plates in the cabinet, and serve the double purpose of making a positive electrical connection and at the same time locking the shelves firmly in place. To remove the parts it is necessary simply to loosen the lock-nuts and slide the shelves out. The instrument is made up entirely of Monarch parts. It is supplied with three, four or five-bar generators for either series or bridging work; also for direct-current divided circuits, or with pulsating-current generators and biased bells for party-line instruments.

STROMBERG-CARLSON TELEPHONES.

In Fig. 20 is shown a new portable desk telephone which the Stromberg-Carlson Telephone Manufacturing Company has recently placed on the market. The instrument consists of the company's standard desk-stand base and pedestal, upon which is mounted a forked hook-switch for supporting a hand micro-telephone. The hook-switch is operated by means of a stiff spring in the center of the pedestal, which moves the hook upward when the micro-telephone is removed. The hand micro-telephone contains several new and important features, one of which is the attaching of the receiver to the micro-telephone by means of a ball-and-socket joint. The distance between the receiver and mouthpiece of transmitter is adjustable, being made so by sliding the tube, which enters the rubber handle, in and out, according to the desired distance. Figs. 21 and 22 show open and closed views of this company's new type of central-energy telephone. New features are the arrangement and mounting of the apparatus in the set. The cabinet, which covers the condenser, ringer, hook-switch, induction coil, etc., is hinged to the backboard at the lower edge. The condenser is mounted directly against the backboard, being supported at the top and bottom by a brass clip and also held in place by being slid behind a frame, which supports the hook-switch and induction coil. The hook-switch is so arranged that no pressure is brought to bear upon the contact springs except when the receiver is removed from the hook. The ringer is mounted in the upper part of the cabinet, just beneath the writing shelf, as shown. The cabinet is fastened, when closed, by means of a brass rod, which extends parallel to the shelf through a brass clip, with nut, to keep it from dropping out when cabinet is opened. The end of the rod is threaded and designed to be screwed into the clip on the backboard, just above the condenser. The instrument is equipped with the company's standard long-distance transmitter, receiver and carbon-block lightning arrester.

VOUGHT-BERGER PENDENT TELEPHONE.

The pendent or hanging telephone has attracted considerable attention within the last two years. Figs. 23 and 24 show the device, as manufactured by the Vought-Berger Company of La Crosse, Wis., and its utilization at the business man's desk. Advantages of economy of room and convenience are obvious. The company asserts that this is the only telephone which satisfactorily combines durability, ease of operation and constant accessibility without occupying valuable space on the desk. "Always at arm's reach and yet out of the way," is the terse catchline adopted by the manufacturer. There is the same generator, ringer, transmitter and receiver as in the ordinary telephone, but a new arrangement of parts. In the place of a crank or other device at generator for signaling, there is attached a pulley that is operated by the cord.

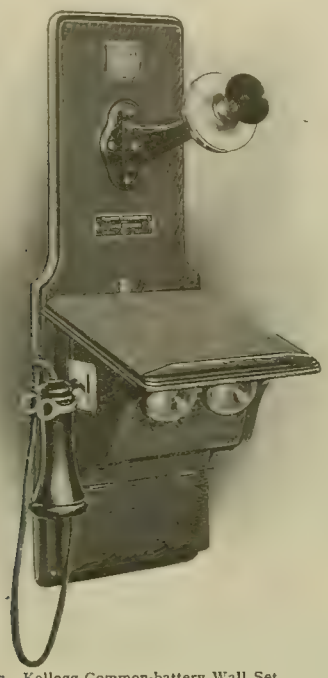


Fig 17. Kellogg Common-battery Wall Set.

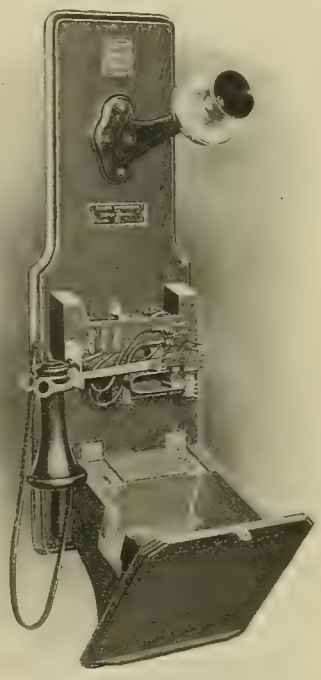


Fig. 18. Kellogg Common-battery Wall Set.

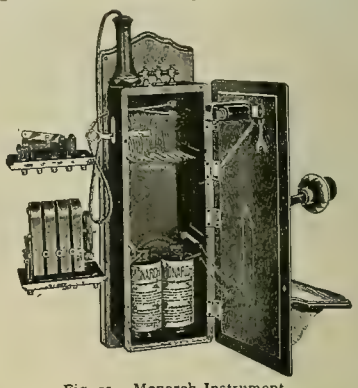


Fig. 19. Monarch Instrument.

Figs. 23 and 24. Vought-Berger Pendent Telephone.

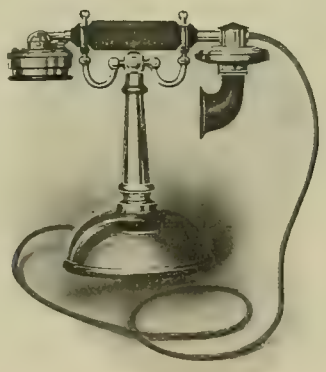


Fig. 20. Stromberg-Carlson Portable Desk Set.

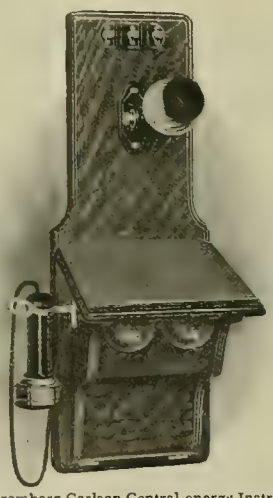


Fig. 21. Stromberg-Carlson Central-energy Instrument.

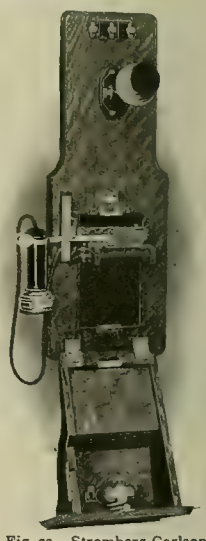


Fig. 22. Stromberg-Carlson Central-energy Instrument.

LATEST TYPES OF TELEPHONE INSTRUMENTS.

The Situation in Maine.

At a recent meeting of the Independent Telephone Association of Maine in West Paris the following-named officers were elected for the ensuing year: President, Lewis A. Goudy, Northeastern Telephone Company, Portland; first vice-president, R. L. Cummings, Citizens' Telephone Company, South Paris; second vice-president, P. C. Chandler, Pine Tree Telephone Company, New Gloucester; secretary, E. L. Durgan, Northeastern Telephone Company, Portland; treasurer, F. L. Wyman, West Paris and Curtis Hill Telephone Company, West Paris; executive committee, B. G. McIntire of Waterford, John H. True of New Gloucester, Dr. F. H. Packard of West Paris; E. W. Gross, Auburn; E. L. Tibbetts of Lewiston, George H. Jones of Oxford, H. C. Cook of Casco.

In a letter to the Western Electrician Mr. L. A. Goudy writes as follows: "The Northeastern company is building trunk lines and installing large exchanges in the principal cities in Maine, beginning with Portland, using the automatic system (Strowger patents) for its large exchanges, and the manual and selective party-line systems for its village exchanges and rural service. It will expend nearly half a million dollars on its new exchanges and installation of its system in Maine and New Hampshire during 1903. It is an aggressive representative of the rural Independent companies, which it is working in harmony with for the expansion of Independent telephony.

"The New England company (Bell) has been forced to join in the repeal of the so-called monopoly law of Maine, whereby any other company in the state is debarred from entering into competition with or paralleling the lines of the heretofore monopoly company. This piece of un-American legislation has been wiped out through the aggressive action of the Independents, supported by the Maine State Grange (which desires rural telephone connections). Immediately in connection with this action, however, the move was made by the Bell company to engraft seriously hampering legislation, whereby that company, its allies or representatives, could force suspension of construction of lines by appeals from the decisions of municipal officers of towns and cities granting rights to Independent companies, to the Supreme Court, which would cause long delays and discouraging results. This action is being sharply opposed by the Northeastern Telephone Company and others in harmony with its policy for broader expansion of the telephone business."

The Western Street Railway Company of Pittsburg is preparing to construct a double-track street-car line from Finleyville to Washington, Pa., a distance of 15 miles, and it is given out that later on the company will extend the line to Wheeling, W. Va. This line would join the company's Pittsburg and Charleroi line, which will be in operation by July 1st.

Bell Companies' Annual Reports.

New York and New Jersey Telephone Company.—In the report of President Charles F. Cutler for the year 1902 it is stated that the early part of 1902 was a season of unusually destructive storms, entailing heavy expenditures for repairs. The disastrous conflagration in Paterson, N. J., on February 9th, was followed on March 2d by an overflow of the Passaic River, a considerable amount of the company's plant in the streets being destroyed or seriously damaged. On the night of February 21st a destructive sleetstorm prostrated overhead lines, southern New Jersey and middle Long Island being completely cut off from telephone communication for from four to six weeks. At the same time substantially the whole force of linemen left the service of the company without a moment's notice. The actual cost of repairing and rebuilding the prostrated lines [$267,505] was charged against earnings, while the loss of revenue through the interruption of service is estimated at about $100,000. Otherwise the net earnings should have been at least $365,000 above the amount shown.

During the summer an experimental installation of the Pupin invention, the exclusive control of which was lately acquired by the American Telephone and Telegraph Company, was made upon this line with most encouraging results. The trunk-line conduit has been extended from Newark to Elizabeth, and further large extensions have been planned reaching Passaic and Paterson in New Jersey and east to Jamaica in the Long Island division. In co-operation with the New York Telephone Company, comprehensive plans have been worked out by which all the suburban points within a radius of 20 miles of New York will be connected through underground cables, thus protecting the entire suburban toll service against interruption. Prior to the Pupin invention it was not possible to communicate successfully through underground cables of such length.

The above-mentioned plans contemplate the equipment of all central offices within this radius with the common-battery switchboard of type similar to that now in use at the larger exchange centers. It is hoped that the principal part of the above work can be completed during 1903. Upon its completion it is expected that trunk connections within the above area can be established with the same promptness as now characterizes the local service in the best exchanges.

Among the important improvements completed in 1902 was the conversion of the exchange plant in Elizabeth, N. J., from overhead to a complete underground system.

An addition was made by the purchase of the plant and business of the Hudson River Telephone Company in Sussex County, N. J.

By authority of the board, under date of September 25, 1902, $3,125,000 of new stock was offered to the stockholders at par. About two-thirds of the amount was paid for on November 1st, leaving $1,069,900 to be issued during 1903. The company enters the year 1903 with a provision of $2,211,054 for construction purposes.

There was invested by the company during 1902 in extensions of plant and equipment, $1,712,502; real estate, $239,285. Of the amount invested in plant, $821,561 was expended in extension of the underground-conduit and cable system. Estimates for 1903 contemplate the expenditure of about $600,000 in real estate, $450,000 in improved central-office apparatus and $1,347,000 in underground-conduit and cable extension.

Regarding competition, President Cutler asserts that while the few unimportant systems heretofore established still keep up a struggling existence, there are no evidences of new life or further development. In fact, on the whole, he says, there are less stations connected to those systems than at the date of the last report.

The earnings for three years compare as follows:

EARNINGS, EXPENSES AND CHARGES.

	1902.	1901.	1900.
Number of stations December 31.	53,184	42,130	35,176
Earnings:			
Exchange service	$1,903,707	$1,633,319	$1,372,916
Pay stations	490,294	428,996	356,560
Tolls	1,365,854	1,162,279	965,341
Real estate	113,415	107,415	83,939
Other income	89,327	44,424	48,725
Total	$3,962,597	$3,376,433	$2,827,481
Expenses:			
General	646,240	536,665	504,613
Operating	594,730	522,071	460,840
Reconstruction and maintenance	1,330,172	997,828	847,649
Royalties	181,616	176,855	147,417
Real estate expenses	70,699	61,214	58,085
Total	$2,823,457	$2,294,633	$2,018,603
Net earnings	1,139,140	1,081,800	808,878
Deduct:			
Interest	70,350	71,486	72,272
Taxes	96,000	102,618	102,459
Dividends (7 per cent.)	707,628	616,286	490,650
Total	$ 873,978	$ 790,390	$ 665,381
Surplus	265,162	291,416	143,497

Of the total stations (53,184) on January 1, 1903, 28,158 were in New Jersey and 25,026 on Long Island.

The balance sheet shows total assets of $17,592,792 at the end of 1902. At that time the capital stock issued was $12,665,600 and the surplus $2,633,181.

Western Telephone and Telegraph Company.—This company is the successor of the old Erie company. In its report for the year ended January 31, 1903, are the following figures:

Gross earnings		$ 453,623
Dividends		850,586
Total net receipts		1,304,209
Interest and taxes	$519,343	
General expenses	24,537	
Depreciation (including $70,621 interest not now collectible)	86,478	
		620,360
Net reserve		973,849
Dividends		940,000
Surplus		33,849

The general balance sheet as of January 31, 1903, follows:

ASSETS.

Stocks, bonds and notes acquired at time of organization	$36,347,573
Property since acquired	219,910
Bills and accounts receivable	2,330,016
Supplies	48,422
Cash and deposits	3,548,157
Organization expenses	54,006
Total	$42,548,084

LIABILITIES.

Common stock	$16,000,000
Preferred stock	16,000,000
Surplus	33,849
Bonds	9,835,960
Reserve for retiring bonds of Erie Tel. and Tel. Company	164,034
Sundry reserves (including depreciation)	172,055
Bills and accounts payable (including $320,000 for dividends payable February, 1903)	342,780
Total	$42,548,684

President Fish says: "The earning property of your company consists chiefly in a controlling interest in the capital stock of the Northwestern Telephone Exchange Company, the Cleveland Telephone Company, the Wisconsin Telephone Company, the Southwestern Telephone and Telegraph Company and the Michigan Telephone Company. These four companies have expended during the last year in improvements and development $2,203,193. The money so expended was supplied by this company. At the end of the year the total number of subscribers' stations in the four companies was 111,036, in addition to those under sub-license contract, which numbered 25,753. The situation of the Michigan Telephone, of which company we are creditors to the extent of more than $1,700,000, as well as principal stockholder, is far from satisfactory. When this company came into control of the Michigan it found that company with a bonded debt of $5,000,000, in addition to the bonded debt of the Detroit Telephone Company, amounting to $594,000, which the Michigan company had assumed. After making reasonable allowance for maintenance, the net earnings of the Michigan company were insufficient to meet even the interest on its bonds, not to speak of the interest on its floating debt, which on December 31, 1901, was $2,097,318. On December 31, 1902, the floating debt was $2,393,986."

GENERAL TELEPHONE NEWS.

The Chicago Daily Tribune gravely states that "Microphones are now made so sensitive that by their use one may hear the groans of a dying fly."

The Petroleum Telephone Company of Oil City, Pa., with 1,800 subscribers, has gone into the hands of receivers on the application of the George H. Bissell Company of New York city.

Farmers are talking of building an extension to the Farmers' Inland Telephone Company's line at Harrington, Wash., to connect some of the large ranches and farms northwest of Harrington.

The Union Trust Company of Detroit, Mich., receiver for the Michigan Telephone Company, is said to have declined the offer of $125,000 cash made by the Citizens' Telephone Company of Kalamazoo for the Michigan company's plant in that city.

This is an example of telephone advertising in Chicago: "It is the purpose of the management of the Chicago Telephone Company to place a telephone at the most reasonable rates, within easy and immediate reach of every person whose income is sufficient to permit him to ride in street cars."

A deal has been completed by which the Merchants' Telephone Company of Montreal has passed under the control of a New York syndicate. Mr. Arthur Johns of New York represented the syndicate in the deal. The total common stock of this company amounts to $61,000, and in addition to this there is a bond issue of about $60,000, secured on first mortgage and paying eight per cent. interest. No dividend has ever been paid on the common stock.

Strowger Company's Troubles Adjusted.

An amicable settlement of the troubles of the Strowger Automatic Telephone Exchange was reached at a meeting of the directors held in the offices of the company in the Rookery Building, Chicago, last Saturday. J. L. Kessner resigned as president and L. M. Stumer resigned as director. Subsequently Elmer Washburn, who was selected by the court to take charge of the management of the company, was unanimously elected president. M. Sello was made vice-president and Joseph Sigel, treasurer. Both claimants to the office of secretary resigned, and the office was left vacant subject to the selection of a new man by Mr. Washburn. The directors of the company now are Elmer Washburn, Adolph Nathan, Joseph Harris, A. G. Wheeler, Jr., A. E. Wilson, J. L. Kessner, Sanford F. Harris, Joseph Sigel and M. Sello. After the meeting Joseph Harris was seen at the office and spoke as follows: "The trouble among the directors of the Strowger company has been amicably and satisfactorily adjusted and the indications are that affairs of the company will be smoothly conducted under the management of the new officers. The company is working on a close-dividend basis, and the stock is in excellent condition. The selection of Mr. Washburn as president is a popular choice, and everyone is satisfied."

MANUFACTURERS AND DEALERS.

The W. J. Barr Manufacturing Company, which has been doing business at Cleveland, Ohio, and has recently been incorporated with W. J. Barr as president and treasurer, and Thomas E. Barr as general manager, will manufacture telephone transmitter arms exclusively.

The Sumter Telephone Manufacturing Company of Sumter, S. C., calls attention on a mailing folder to its line of telephones, switchboards and exchange equipment for interior, local and long-distance service. Party-line and express switchboards, bridging telephones, the Bull's-eye combined drop and jack, and the "Sumterfone" are illustrated.

The Connecticut Telephone and Electric Company of Meriden, Conn., has filed a certificate of incorporation at Hartford, Conn. Its capital is $36,000 and its incorporators are Burton L. Lawton, Ernest A. Wilcox, Louis E. Wilcox, William F. Rogers and Burton C. Rogers. The company proposes to manufacture and deal in telephones and electrical supplies.

The Swedish-American Telephone Company has leased the eight-story building at 88, 90, 92 West Jackson Boulevard, Chicago, and will remove to that location on or about May 1st. The new location is but four doors farther west and on the opposite side of the street from the company's present quarters. The new building affords fine accommodations and will be equipped throughout with the very latest machinery.

The increasing demand for the high-class products manufactured by the Jaeger Miniature Lamp Manufacturing Company of New York has again forced it to annex additional floor space in the Bible House, one of the largest buildings in New York city. This is most gratifying to C. T. Jaeger, the manager, as it is the third increase within one year's time. The company is now giving telephone switchboard lamps its special attention, making them its "paramount issue."

The Monarch Telephone Manufacturing Company, which at present is situated at Canal and Randolph Streets, Chicago, announces that, owing to the great increase in its business, it has been necessary to secure larger quarters. The company, therefore, will move about May 1st, into a new and commodious building on Clinton Street, where it will have sufficient space to enlarge its business still further, and at the same time give its customers the prompt and courteous attention they have been receiving in the past.

The Vought-Berger Company, manufacturer of telephones and switchboards, La Crosse, Wis., reports an encouraging sale of its pendent telephone. Among the companies which have recently begun the use of this type of instrument are the Consolidated Telephone companies of Scranton, Pa., the Toledo (Ohio) Home Telephone Company, Pittsburg and Allegheny Telephone Company, the Frontier Telephone Company, Buffalo, N. Y., the South Carolina Long-distance Telephone Company and the United States Telephone Company, Cleveland, Ohio.

The Chicago Fuse Wire and Manufacturing Company makes a specialty of fuse wire and strip for telephone fuses, instrument fuses, and, in fact, anything requiring a very low fusing point. These fine wires are made with the same degree of accuracy which has always been maintained for all the company's product, and they have sufficient tensile strength to be handled without difficulty. The company says it is in a position to take care of orders whether regular or special, and in large or small amounts, and make shipment promptly either from its Chicago, New York or Buffalo houses.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago recently closed contracts for switchboards with the Bergholz Telephone Company, Bergholz, Ohio, and the Winona Telephone Company, Winona, Ohio. The company has also recently sold telephones, switchboards and supplies to the following-named Illinois companies: Wataga Mutual Telephone Company, Wataga; Gays Mutual Telephone Company, Gays; Cullom Mutual Telephone Company, Cullom; Fairbury Farmers' Telephone Company, Fairbury; Millikan & Stokes Telephone Company, Edinburg; Central Illinois Telephone and Telegraph Company, Lincoln; Farmers' Mutual Telephone Company, Ashmore.

Fahnestock "Button" Telephone Transmitter.

The accompanying cuts illustrate a new type of telephone transmitter which in appearance and construction presents quite an innovation and departs radically from the "solid back," which seems so far to have held the field as the correct principle for all transmitter construction. This instrument is known as the "button"-type transmitter and derives its name from the "button," a full-size illustration of which is given in Fig. 3.

This "button" is entirely self-contained and is in itself a very efficient transmitter if placed on a table and spoken to. It carries within itself two sound diaphragms, a carbon chamber and two electrodes and is designed to slip into the sound chamber carried at the end of the pivoted arm, as shown in Figs. 1 and 2. Two cords are carried up through the inside of the arm to make the necessary electric connection. The "button" is not a permanent part of the sound chamber, and may be removed and replaced by a new one at any time by removing the face plate and loosening the cord connections.

In its construction the "button" consists of a carbon chamber and two vibratable electrodes, carried by mica washers. These mica washers carrying the electrodes are clamped by steel rings to opposite sides of the carbon chamber, effectually sealing the same and making it moisture-proof. Each electrode has clamped to it a sound diaphragm, which diaphragm has no other support. This allows freedom for the periphery to vibrate and insures the tuning of the two diaphragms to the same characteristic note. It also permits of a perfect and permanent adjustment of the electrodes, inasmuch as the support of the carbon chamber and electrodes cannot be at variance with the support of the diaphragm, as is often the case with instruments of the "solid-back" type.

Means are taken to connect the periphery of the sound diaphragm flexibly to the "button" after it has been clamped in place on the electrode. This flexible connection prevents the sound waves from impinging on its under side.

It is asserted that this method of supporting the sound diaphragm not only gives greater tone volume, but as well clearer and sharper articulation. It is for this reason that the size of the diaphragms can be so materially reduced from standard, as shown in the cut, and the volume of tone produced still be above that ordinarily obtained with "solid-back" instruments. When the "button" is in place within the sound chamber the surface of the diaphragms is transverse to the line of progress of the sound waves, and the "button" presents to the opening at the mouthpiece only its edge. This effectually prevents any mechanical injury and removes the necessity of having a mouthpiece with a protective bottom. The sound waves on entering the mouthpiece are divided by the edge of the "button" and then impinging on the beveled sides of the sound chamber, are deflected against the diaphragms.

The instrument is constructed throughout of a special hard non-corrosive alloy, and each part is cast in a brass mold, which insures accuracy and interchangeability of all parts, while the non-corrosive feature of the alloy entirely eliminates all possibility of corrosion by the moisture of the breath. The finish is entirely of black enamel, which would seem to insure a greater durability of finish than is ordinarily obtained by those instruments having extensive nickel-plated parts. The transmitter has been produced by Ernest B. Fahnestock, an experienced telephone engineer and designer, and is being manufactured by the Fahnestock Transmitter Company of 74 Cortlandt Street, New York city.

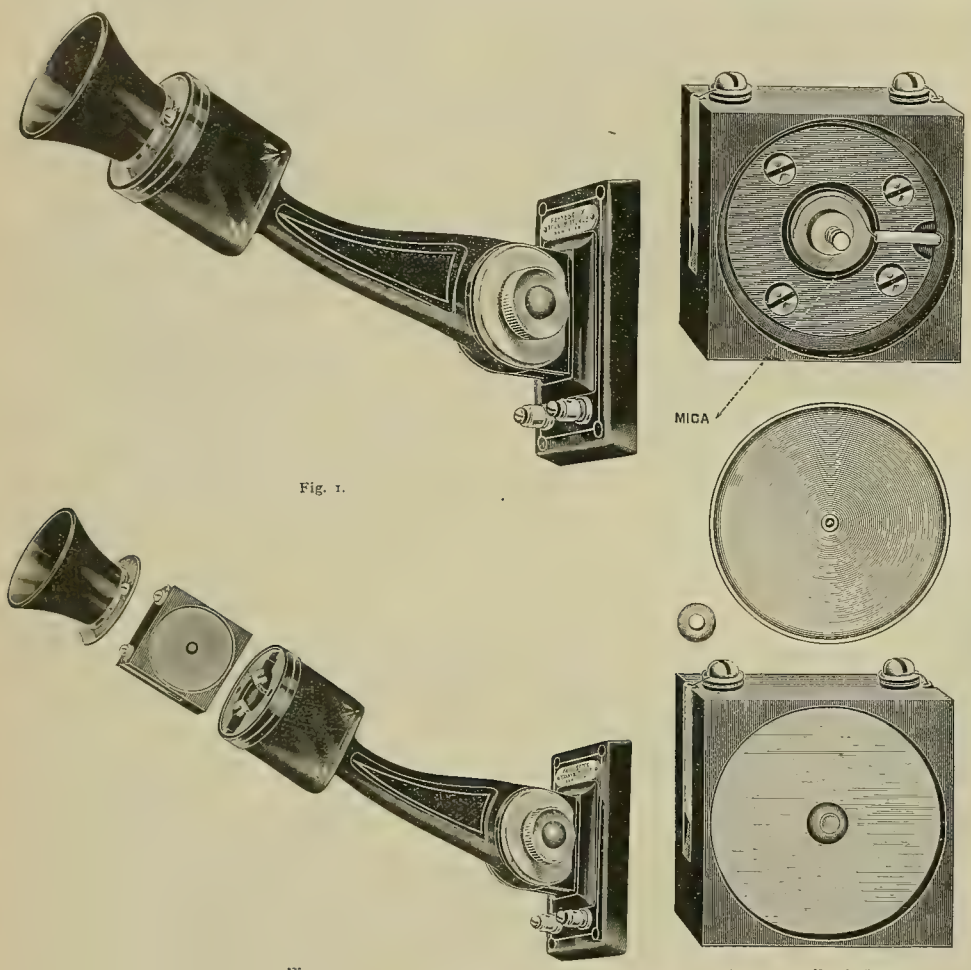


Fig. 1.

Fig. 2.

Fig. 3. Details of "Button."

FAHNESTOCK "BUTTON" TELEPHONE TRANSMITTER.

American Electrochemical Society.

The American Electrochemical Society will hold its third general meeting on April 16th, 17th and 18th at the Chemists' Club, 108 West One-hundred-and fifty-fifth Street, New York city. On the evening of the first day there will be a reception and banquet at the German Liederkranz, and on the evening of the 17th the society will meet with the American Institute of Electrical Engineers at the Chemists' Club, when W. J. Hammer will read a paper on "Radium and Other Radioactive Substances, and Certain Phosphorescent and Fluorescent Substances; the Properties and Applications of Selenium; the Treatment of Disease by Ultra-violet Rays." On the last evening of the convention President Joseph W. Richards will deliver his annual address and Dr. Max von Recklinghausen will give a demonstration of the Cooper Hewitt mercury lamp, after which there will be a smoker.

Among the papers to be presented at the meeting are the following: "The Electrolysis of Water," by J. W. Richards and W. S. Landis; "Insulating Materials; A Field for Chemists," by M. von Recklinghausen; "An Historical Review of the Storage Battery," by H. B. Coho; "The Use of Pyroxyline in Electric Storage Batteries," by Elmer A. Sperry; "The Corrosion of Metals by Electrolysis," by A. A. Knudson; "Ions and Electrons," by Louis A. Parsons; "Uniformity of Electrochemical Equivalents," by Carl Hering; "Electromotive Force of Alloys," by W. D. Bancroft; "A New Type of Electrolytic Cell," by P. G. Salom; "What is the Capacity of Molecules for Electric Charge in Electrolysis?" by Alfred H. Cowles.

The Supreme Court has sustained the right of the Louisiana state Legislature to pass the Wilson law, providing for separate accommodations for whites and blacks in the street cars.

Westinghouse Motors for New York City Subway.

As recently stated in the Western Electrician, the motor-equipment contract for the cars of the Interborough Rapid Transit Company, more popularly known as the New York Subway, was divided between the Westinghouse Electric and Manufacturing Company and the General Electric Company. The subway company will operate two classes of train service. The first will consist of five-car local trains, composed of three motor cars and two trailers, making an average speed of approximately 16 miles per hour. The second will be eight-car express trains, comprising five motor cars and three trailers, making an average speed of 25 miles or more per hour. The same motors and gearing will be used for both classes of service. Each motor car will be equipped with two motors.

The motors to be supplied by the Westinghouse company were designed especially for this purpose and were made to fit the particular conditions and requirements involved. One of these requirements, and perhaps the most difficult, made necessary the designing of a motor of large capacity to fit into a limited space. As a result, it is stated that the present motors are probably of smaller size for their output than any built heretofore.

These motors, known as No. 86, are of the heavy railway type, similar in general appearance to the well-known Westinghouse 50-C motor. They will be supported on the truck by nose suspension. The nominal capacity of the motor is 300 amperes at 570 volts, or 200 horsepower, for one hour. With this current and voltage, a tractive effort of 4,150 pounds is developed at the periphery of a 33-inch wheel, at a speed of 19 miles per hour. Although designed for an average voltage of 570, the motor will operate satisfactorily with voltages up to 625. It will carry loads up to 500 amperes without injurious sparking.

The motor has a field frame of cast steel, divided into halves on the line of the centers of armature and axle, and completely surrounding the axle. The four pole-pieces are made of laminated-steel punchings, held between heavy end plates and secured by rivets. The field coils are made of copper strap wound on edge.

The armature is 20 inches in diameter and weighs 1,930 pounds. It is of the slotted-drum type and is composed of sheet-steel punchings assembled on a cast-iron spider. The commutator is also carried on the same spider, and the shaft may thus be removed and replaced, should this ever become necessary, without disturbing the armature winding or its connection to the commutator.

The completed motor will stand an insulation test between winding and motor frame of 4,500 volts alternating momentarily, or a test of 3,000 volts for one minute.

Armature and axle bearings are lubricated by oil fed to the journals by waste, in accordance with standard railway practice. The gears are solid, of cast steel, with cut teeth. The pinions are forged steel with cut teeth. The whole motor can be dismantled with great ease and dispatch, without the use of any special tools. The total weight of motor, gear, gear case, etc., is about 6,600 pounds.

Proposed Susquehanna River Power Plant.

It is now asserted that the scope of the plans of capitalists to utilize the Susquehanna River for the generating of power to be distributed through the territory lying between Harrisburg and Washington is greater than was originally announced. Instead of building three power houses with 150,000 horsepower, six power houses, with an aggregate capacity of 300,000 horsepower are planned. Extensions may give a total of half a million horsepower, or sufficient, it is said, to operate every street car and small machine and light every city, town and village within a radius of territory including Harrisburg, Lancaster, Philadelphia, York and Baltimore.

The most tangible move yet made in the gigantic scheme is the incorporation of the Tidewater and Susquehanna River Railroad, capitalized at $1,300,000. The officers of this corporation are: President, M. Hampton Houseman; vice-president, John S. Bull; secretary, Stephen J. Caldwell, and treasurer, Charles R. McConkey. The directors are James H. Harlow, Charles R. McConkey, Charles T. Davis, George K. McGaw, Stephen J. Caldwell, John S. Bull and M. Hampton Houseman. It is the object of the company to build a line of railway from Havre de Grace northward to the town of Wrightsville. This will be built to aid in the easy transportation of the machinery for the power plants, and will connect with the Baltimore and Ohio, the Pennsylvania, and the Maryland and Pennsylvania railroads.

An electric railway is to be built by the newly incorporated Illinois Electric Railway Company to extend through Knox, Warren, Mercer, Rock Island and McDonough Counties, Ill. The company has a capital stock of $10,000, and its principal offices will be at Monmouth, Ill. The directors are John S. Brown, I. M. Kirkpatrick and William H. Sexton of Monmouth; Robert P. McGeehan, Kansas City, and James E. Gregg of Colorado Springs.

Ericsson Cordless Telephone Switchboards.

The Ericsson Telephone Company of New York has placed on the market two new types of switchboards which in their construction differ entirely from the styles generally used. They are especially intended for small country exchanges, large offices or factories, etc., which are connected by a trunk line with the main exchange. The old way of connecting two subscribers with a pair of cords has several objections, the most serious being that the cords wear out and that it is often necessary to send a man out to repair the board. These new switchboards are so constructed that there is practically nothing that can wear out and cause trouble.

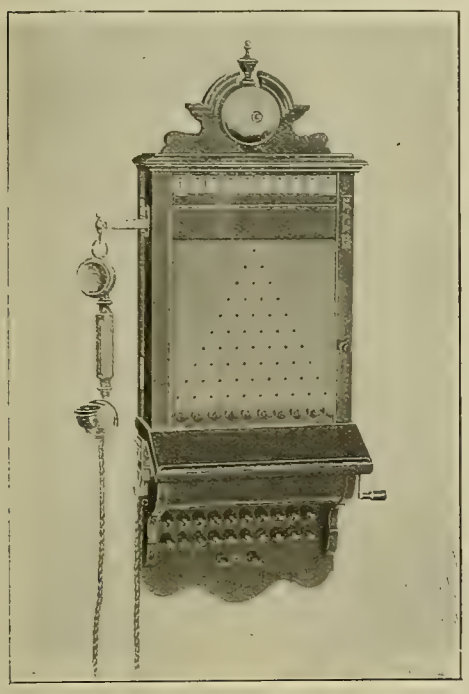


Fig. 1

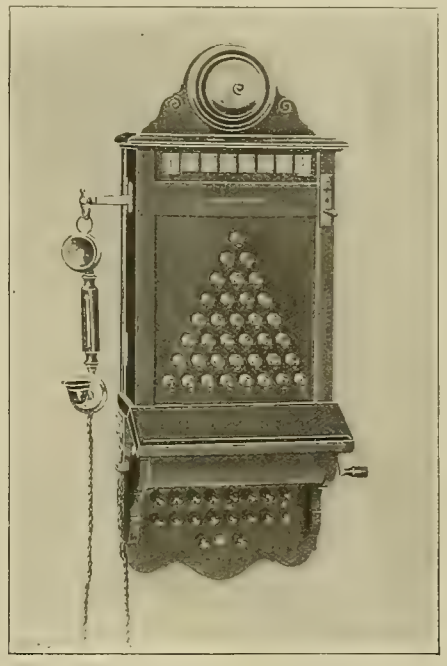


Fig. 2.

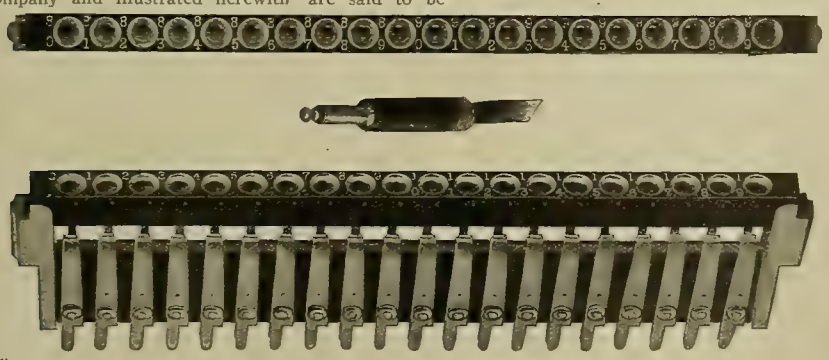
ERICSSON CORDLESS TELEPHONE SWITCHBOARDS.

Referring to the illustrations, Fig. 1 shows a cordless switch for 10 metallic circuits, complete in every respect. When a subscriber has called the operator puts one of the plugs in his jack and answers. The wanted subscriber is called by putting the same plug in his number and turning the generator crank. The connection is completed by changing the plug to a jack marked with the numbers of both subscribers. The panel contains one jack for every possible connection within the board. The clearing-out signal throws the bridged drop of the calling subscriber, the other drop being cut out. All drops are armored and have a high self-induction. Fig. 2 shows an eight-line board with keys instead of plugs and jacks, the manipulations being analogous.

The finish of the woodwork is excellent, and the workmanship and details are the same as characterize all Ericsson work. The switchboards are made for three up to 12 numbers, the smaller types being used in connection with a telephone which serves as an operator's equipment.

American Banks of Multiple Telephone Jacks.

The banks of multiple jacks for telephone switchboards made by the American Electric Telephone Company and illustrated herewith are said to be entirely different from anything heretofore attempted in the construction of such an article, being constructed with hard-rubber front, brass ends and a substantial steel bridge, on which the jacks are substantially mounted. This steel bridge is 1½ inches wide and one-eighth of an inch thick. It is intended to do away with the warping and twisting out of shape, which has caused so much trouble in this class of telephone work. The german-silver springs are not insulated individually on this steel frame, but as a whole, making much more substantial insulation than can be obtained from the use of many small pieces of rubber or mica. The plugs are of the two-conductor type, and the sleeves have an interesting fastening, for they are held in place by a spring arrangement which permits the shell to be removed without the loosening of screws. Every switchboard inspector knows how troublesome it is to put screws through the plug shell and how many of these screws are lost from time to time, and so will appreciate this feature.



AMERICAN BANKS OF MULTIPLE TELEPHONE JACKS.

Steam Turbines.

A recent computation has placed the total aggregate power of steam turbines in use or under construction or ordered in different parts of the world at over 500,000 horsepower. Of this total the major portion is used or to be used for the driving of alternating-current generators, while the next in point of power consumption is marine engines. An item in point is the contract recently given to the British Westinghouse Electric and Manufacturing Company, by the Metropolitan District Railway Company of London, England, for four turbo-alternators. Each of these machines is designed for a normal capacity of 5,500 kilowatts, but will be capable of carrying an overload of 50 per cent., giving for each unit a maximum output of 8,250 kilowatts, or about 11,000 electrical horsepower. These turbines will be not only the largest steam turbines ever made, but also the most powerful single-expansion engines of any type whatever in the world, while very few multiple-cylinder engines existent have greater power. Notwithstanding the great power they will develop, the dimensions of these engines are only 29 feet in length, by 14 feet wide, by 12 feet high, the overall length of turbine and alternator being 51 feet nine inches. The steam pressure will be 165 pounds per square inch, and the speed 1,000 revolutions per minute.

TELEPHONE MEN.

Thomas Dyer, who has been with the Baldwin Milling Company, Minneapolis, has been appointed contracting agent for the Northwestern Telephone Exchange Company of Minneapolis.

C. F. Alston, manager of the Central Union Telephone Company of Rockford, Ill., has resigned his position with the company and is succeeded by Frank L. Eby, who has been city foreman for the company for several years.

James T. Land, superintendent of the Michigan Telephone Company, has left Detroit for Kansas City to assume his new duties as general manager of the Missouri and Kansas Telephone Company. About 100 of his friends tendered him a complimentary banquet at the Fellowcraft Club in Detroit last week.

NEW COMPANIES.

A company has been formed by W. E. Storm, S. M. Blythe and A. W. Treat, to be known as the Gays Mutual Telephone Company. It will furnish telephone service to the citizens of Gays, Ill.

A telephone system will be installed at Norwood, St. Lawrence County, N. Y., by the Norwood Telephone Company, recently organized, with W. J. Fletcher, F. L. Smith and A. C. Healey, directors.

Articles of association have been filed by the Henrietta Telephone Company, Henrietta Township, capital $5,000; Monroe County Telephone Company, Dundee, capital $15,000, and the Hillsdale Telephone Company, Pittsfield, capital $15,000. All are in Michigan.

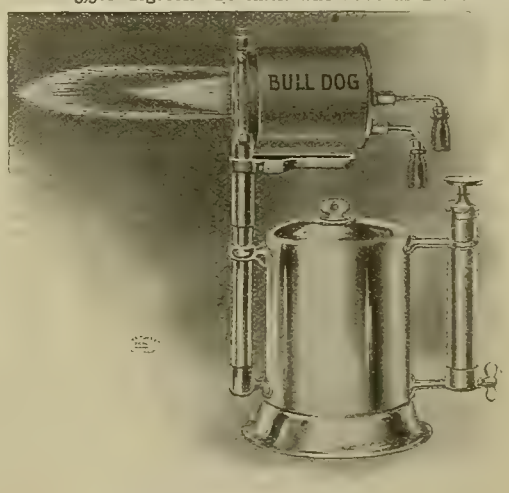
The New York and Long Island Telephone Company, which may operate a telephone system in Kings, Queens, Nassau and Suffolk Counties in New York state, has been incorporated with a capital of $100,000. The directors are W. H. Bennett, G. L. Deneo and B. P. Tabbot of New York.

The Illinois and Indiana Telephone and Telegraph Company, capital $2,000,000, to construct and operate telephone and telegraph lines, was incorporated at Trenton, N. J., on March 17th. The incorporators are Louis P. Bailey, Joseph H. Mitchell and K. K. McLarin, all of Jersey City, N. J.

The Chicago City Council committee on streets and alleys south has recommended for passage the franchise ordinance of the Woodlawn Park Telephone Company, referred to in the Western Electrician of March 7th. The company has authorized capital of $2,500, and J. C. Dean, F. A. Warren and J. P. Harrold are the incorporators. By the terms of the ordinance the company must have 500 telephones in operation by January 1, 1905.

Turner Bulldog Gasoline Torch.

The Turner Brass Works, Chicago, are offering to the trade the Turner Bulldog gasoline torch, herewith illustrated. This device is especially interesting to electricians and line men on account of the assertions that it produces the maximum degree of heat possible to obtain by mechanical means and that it will not blow out in the wind. The secret of the intense heat is the double burner. In this burner the air and gas enter the combustion chamber separately and are under absolute control of the operator. This independent control of the air and gas enables the operator to mix them in exactly the right proportions to produce perfect combustion and thereby produce a temperature of 3,500 degrees. Linemen who have used the Turner Bulldog gasoline torch state that it works satisfactorily in the strongest wind, and that they can handle Nos. 4 and 6 wires out of doors easily, and, in some cases, more conveniently than with the slush pot and furnace. It is said that as this torch produces twice the heat of the ordinary torch it enables the operator to do ordinary work in one-half the time.



TURNER BULLDOG GASOLINE TORCH.

Gas Engines for Electric Lighting.[1]

Mr. Graham in opening his paper explained that the ordinary industrial type of gas engine failed for electric-lighting purposes, whether the dynamo was direct-coupled or belt-driven, by reason of the excessive variation of speed between full and half loads. For direct-current generators the gas engine could be so modified as to give perfectly satisfactory results, but for alternating currents no gas engine had yet been designed—so far as was common knowledge—which could be said to give even moderately satisfactory results, and the uneconomical expedient of driving gas engines in parallel has to be resorted to in such cases. The requirements were very exacting, the limit being a variation of speed of only one-half per cent. under varying loads. In the ordinary gas engines the speed variation might be 7½ per cent. and yet be unnoticeable by reason of the reduction in speed through the second and tertiary motion shafts, but in engines supplied for electric-lighting purposes—he spoke then of direct-current plants—such a variation would be objectionable.

With a reasonable increase of speed between engine and dynamo—if belt-driven—or by an efficient elastic coupling—if direct-coupled—the speed variation might be kept constant within 1¾ to two per cent., and under the maximum limit the lights would appear quite steady, and might be considered satisfactory.

He next alluded to the flywheel problem. Flywheels were usually too light or too small in diameter. The diameter of the flywheels on an ordinary gas engine has been usually a matter of convenience more than one of calculation. The distance between the center of the crank shaft and the ground line, made up usually by the cast-iron bedplate resting on a slab of stone placed on the top of the concrete foundation, was sufficient to afford easy access to the parts under the cylinder jacket, such as the exhaust valve, exhaust-valve adjustable spring shackle and relief water cock (the latter for use in frosty weather). Unless two wheel-pits were sunk (in which practice there was an element of danger) the diameter of the flywheels was, therefore, fixed by other details of design, allowance being made for a clearance of about one inch between the periphery of the wheel and the floor.

For electric-lighting purposes it was necessary either to increase the weight of metal in the rims of the wheels, to increase the diameter of the wheels, or to increase both weight and diameters in moderation. To increase the diameters alone would be the most preferable method, since the weight required in the rims varies inversely as the square of the diameter; but this enlarging of the wheels was checked by the periphery safe-velocity limit before a sufficient increase was attained. To increase alone the weight of the rims would be to also increase the cost considerably, and at the same time decrease the mechanical efficiency of the engine by the increased inertia to be overcome. The most convenient method was, therefore, to increase the diameter of the wheels until the periphery of each attained a velocity of 85 feet per second, and then to add the required weight to the rims. In practice, however, it was found that the addition of weight to the wheels necessitated a crank shaft of stronger proportions, which again required larger bearing surfaces in the journals. With new wheels, new crank shaft, new brasses, and, in consequence, a new bed-plate, the ordinary gas engine was, to all intents and purposes, a new engine, and it was doubtful whether it would not be cheaper and better to redesign the engine altogether from another standpoint. Having to resort to wheel-pits, there was no longer any strong incentive to keep the two flywheels, and so in practice it was found preferable to build engines for this purpose with only one large and heavy flywheel, the additional bearing surface being provided by an extra bearing in the pedestal form. The most suitable arrangement was for the flywheel and pit to be placed on the left-hand side of the engine, thus removing a source of danger to the attendant, who was entirely occupied with the right-hand, or lay-shaft side, whereon are to be found the timing valve, speed governor, main lubricators, self-starter, half-compression lever and all cams and rollers.

The second point of difference between the low and high-speed engine was in the form of balancing the crank and connecting rod. On the low-speed engine the counterbalance was invariably cast under the rim of the flywheel, but for accurate balancing this method could not be considered as efficient as the direct counterbalance studded to the crank webb and rotating at the same radius as the crank pin, the center of the weight to be counterbalanced. In hotels, private houses, hospitals, and even in many business concerns, comparative noiselessness was a desideratum. For this reason it was not always advisable to rely on air silencers and—patent or otherwise—exhaust mufflers, but it was better to place the engine, and, in fact, any machinery, in a separate outbuilding. In such cases the main gas cock in the outbuilding might be operated from the main building by a switch. The details of this were then described. This arrangement obviated a regular visit every evening to turn off the gas, but the ignition apparatus as usually fitted on gas engines was still a source of possible annoyance. He did not say a regular source of annoyance, for such was not the case, but whether a common iron ignition tube, a Hacknum metal ignition tube, or a fireclay or porcelain tube were used, one was always subject to their failing at an unexpected moment. Notwithstanding its occasional failings, the fireclay tube was, for many reasons, the most satisfactory. It could be heated sufficiently to fire the initial charge in less than two minutes, only required two to three cubic feet of gas per hour passed through a Bunsen burner to remain incandescent, and two out of three would last for months with fair treatment; but even its warmest admirer must confess that it was liable to end its career without a moment's warning.

To prevent these stoppages, it occurred to him that the tube might, at the very moment of ending its career, at least perform one parting act of grace before reaching its final stage of disintegration. In brief, the engine was fitted with an electric sparking ignition plug as an emergency standby. The porcelain ignition tube supported a lever; on the collapse of the porcelain tube the lever fell through an arc of 15 degrees, and in doing so drew over a switch and completed the emergency circuit, and the engine continued as before, only the form of ignition being changed. The lever in falling also dropped an ignition valve retainer, which kept this valve on its seat, and so prevented a leakage which would otherwise have been sufficient to cause the engine to stop if under full load at the time, and turn out the Bunsen burner. It also performed a third function, in starting an alarm bell placed in a convenient spot in the house, which might be, of course, immediately switched out of circuit, but not before it had given its message from the engine room.

He thought it to be necessary to say that no reciprocating bearing should be fitted to an engine without some means of adjustment to compensate for wear; yet it must be confessed that few gas-engine makers considered it necessary in the case of the crosshead pin. He spoke of the pin connecting the small end of the connecting rod to the piston; the whole force of the explosion was borne by this pin, and a bump was bound, sooner or later, to be heard, generally after the short guarantee had expired, and a new pin was then necessary. The splitting of the pin and the insertion of a piece of paper as packing he rejected as an unmechanical means of adjusting a machine, besides lowering the strength of the pin itself. If it were argued that the pin was twice the necessary strength before being split, it was evident that the piston was unnecessarily weighted by such a design. This detail was of particular importance to electric-light engines, because the jar at each explosion was far more likely to cause annoyance to their purchasers than would be the case with engines employed to work a Massey hammer or a battery of stamping machines. Much annoyance was also often caused on engines required to run long hours without attention by the faulty design or bad arrangement of the automatic lubricators. It was surprising that the revolving dipper type of mechanical lubricator has enjoyed such widespread, almost universal, adoption, for it could not be considered either an economical or even moderately able servitor. In the first place, if it was more than half filled, the oil would find its way through the lubricator crankshaft bearing, and trickle down the belt working from the cam shaft on to the lubricator pulley; and if too generously filled, it would even entirely empty itself, syphon-like. In the second place, when it was half-filled to its safe limit, it delivered an all but constant stream of lubricant, but as the level of oil in the basin became lower and lower, so the quantity of lubricant became less and less; and it followed that it either delivered a great deal too much when first started after replenishment, or else a great deal too little when the oil became low in the basin. Another lubricator which the author exhibited showed a method which he considered superior to that just described. Instead of a crank at the end of the shaft was fitted a cam. The shaft bearing was, therefore, capable of being put at the top of the basin, and a basin of the same size would, therefore, contain a third more storage in the latter than in the former. The cam at the end of the shaft raised a valve, and the lift of the valve was adjustable to suit the speed and proportion of working strokes of the engine. The quantity of oil passed was exactly the same, whether the basin was nearly full or nearly empty.

He then turned to a very important side of gas engines, the gas consumed per horsepower-hour. It had often happened that a moderate-priced engine with a guaranteed gas consumption of 16.5 cubic feet per brake-horsepower-hour had been rejected in favor of one 20 per cent. dearer with a gas consumption of one-half a cubic foot less per brake-horsepower-hour, without ascertaining the fact that the first guarantee was on a gas of about 850 British thermal units, while the latter was on a gas of 700 British thermal units. The advantage was, of course, entirely on the side of the moderate-priced engine. The photometric value of a gas bore no fixed relation to the calorific value of a gas. Two gases both of 16 candlepower (illuminating) might be capable of differing as much as 25 per cent. in their respective average calorific (heating) powers; but this was not all, for gas taken from the same mains might vary another 25 per cent. within a few hours.

A gas of 14 candlepower might be of equal value for use in an internal-combustion engine to a gas of 17 candlepower. Considering the large number of gas-engine users in every manufacturing town, it was most surprising that in a supposedly scientific age, the calorific value of municipal gases did not receive more attention.

Discussion.

Henry Lea thought that Mr. Graham was rather contradictory at times. He himself had found no difficulty with the gas engines when proper flywheel arrangements were made, and he failed to follow the author in the allusions to flywheel proportions. He cited the case of a Westinghouse gas engine in the district driving an alternator satisfactorily, and thought that the gas-engine makers must build vertical gas engines. He suggested the flywheel of the disk pattern, which was lighter and cheaper than the ordinary wheel, giving the same momentum and requiring no outer bearing. He was glad to see the speeds increased, but thought that was a line of development. As for the author's remarks about silencers, he (Mr. Lea) had fixed six exhaust boxes as fitted by Crossley Bros., so that the gas came out at right angles in each box to the admission pipe, and found it most effective. For small plant it was an axiom to put in a storage battery. Batteries were highly objectionable, but they were also very necessary evils for small lighting plants. He advocated electrical ignition and the abandonment of the porcelain tube altogether. Mr. Graham's remarks about revolving dippers did not at all agree with his experience of them. He attributed the fall in calorific value of Birmingham gas to the introduction of water gas, and gas-engine users were only getting about 93 per cent. of power for the same money that they used to pay before water gas was introduced. It was most important to state the calorific value of the gas when tendering for an engine.

Professor Burstall said that he thought Mr. Graham would not mind him saying that he had heard a good deal about many things that evening, but not much about gas engines for electric lighting. Perhaps the author had assumed that the construction of such engines was perfectly well known to all present. As for the statement that little improvement had been made in the last year, he (Professor Burstall) had learned more in the last year than ever he could many years before. Immense progress had been made, and they knew a good deal more now than previously. For example, the introduction of the Körting, the Westinghouse, the great engines of Deutz and the John Cockerill; these had all come on immensely in the last two or three years. In this country several very large engines had been put up and a great amount of experience had been obtained. The really interesting problem for the future was the construction of medium engines from 40 horsepower to 200 horsepower and from 250 horsepower to 1,000 horsepower for electric lighting. He had recently seen plans for a 1,000-horsepower, and one well-known firm was prepared to guarantee an engine of 2,000 horsepower. All of these were for electric work, and embodied many principles not found in small engines. The introduction of the multi-cylinders for powers about 250 horsepower was in order to get better speed regulation. If gas-engine makers wished to obtain any share of the work from consulting engineers for central stations, they must use four-cylinder engines to give nearly an even turning moment. No engineer would look at a large engine unless he were confident that the speed regulations did not depend upon the flywheel. In the larger sizes it was necessary to water-cool the exhaust valve. Electric ignition was compulsory, the principle being that called the magneto, the igniter points being soft iron; fresh points could be put in without stopping the engine. In that way a large engine had been made to run for 80 days without stopping.

J. C. Vaudrey was rather disappointed with the paper. He had hoped to hear more about the large-power gas engine, and there was no doubt that there was a field for this type of engine, for large power stations.

Mr. Clough spoke of the evil effect of the synchronizing current surging between alternators, and in this respect gas engines, which were always provided with very large flywheels to overcome the initial variation in the impulse had the advantage that the secondary variation due to the synchronizing currents was proportionately very much smaller. He gave figures to prove his case, and said that the fact of the synchronizing current flowing between two alternators instead of improving the conditions, had a detrimental effect. This might appear rather a paradox, but it was a fact.

Mr. Bate suggested two ways in which it was possible, even with small engines, to do with comparatively light flywheels for parallel running, although he could not speak from experience as to whether they were effective. One was that of regulating the voltage of a gas-driven dynamo by inserting resistances automatically into the shunt circuit at the moment, or immediately before the moment of every explosion. By careful experimenting it would be possible to time the movements of the resistance lever so that the volts of the dynamo were reduced just when the increase of speed would have sent them up. Another way—he knew it was open to very serious criticism, but still it was possible for a small power at any rate—was in the same direction in which large steam engines had been developed—namely, by increasing the speed and not merely increasing the number of cylinders, but by going up

1. Abstract of a paper by H. B. Graham, read before the Birmingham Section of the British Institution of Electrical Engineers, January 21, 1903.

to such speeds as were in use in motor cars. This would enable a very small dynamo with a large number of cycles per minute to be used and the cyclic irregularity would be of very little importance. There would be heavy wear and tear, but the first cost of the engine and dynamo would be very much less, as would that of cleansing and repairing. He knew one such plant had been put in by Messrs. Mavor and Coulson, but he had no particulars.

Mr. Whittaker asked if at the Metropolitan Carriage Works there were two or three engines and alternators, and if the alternators were coupled in parallel. The difficulties at present in getting the explosions of the engines at exactly the same moment were very great, and there were considerable hunting currents passing from one alternator to another.

C. A. Smith said that he had seen the engines working at the Metropolitan Carriage Works in parallel, and he believed that it was done by means of a flexible coupling between the engine and dynamo, Apparently, as far as he could judge from an hour's inspection, the engines ran perfectly well under a varying load, and they were of the Westinghouse vertical type. It was a matter of satisfaction to know that Messrs. Richardson and Westgarth were quite willing to quote for and guarantee gas engines of the two-cylinder tandem type up to 250 horsepower to drive alternators in parallel, and, by coupling two of these engines with his four cylinders on to the same shaft, with the alternator between them, 5,000 horsepower could be developed in one unit. Mr. Graham had really dealt only with the small gas engine, but, judging from the reports of the technical press concerning the Diesel oil engine, since power could be developed at a running cost of one-tenth of 1d. per brake horsepower, he thought that gas-engine makers must look for a harvest with bigger engines. No doubt, in a short time central stations for generating power would use the gas to be provided by the Mond company at 2d. per 1,000 cubic feet.

Mr. Hunt said that some of the continental makers came somewhere in the neighborhood of a quarter of one per cent. speed variation. He asked if the tandem-cylinder gas engines now being built were on the same principle as the old Griffin engine discarded from the Belfast station, and he presumed that additional means had been taken for dealing with the trouble with the piston rod.

Professor Burstall said that the engines referred to were worked on one connecting rod, and improvements had been made to prevent the heating of the piston rod.

Mr. Graham then replied. He had purposely not dealt with the larger engines. He hoped at a later date to be able to approach the subject, and he entirely agreed with everything that Professor Burstall had said. At the present time a large factory was being put down very near Birmingham for manufacturing large gas engines. He agreed that electrical ignition was superior to any type, but the difficulty was to prevail upon people to accept it. He thought that Birmingham people were getting even less than 93 per cent. value quoted by the chairman in comparison with what they got some years ago. It was questionable if they got 80 per cent.

New Chicago and Milwaukee Electric Railway.

It is announced that the Chicago, Milwaukee and Inland Lakes Traction Company, which was incorporated some months ago, has definite plans for building an electric railway between Chicago and Milwaukee, passing through Waukegan, Zion City, Kenosha and Racine. The Standard Oil people are said to be back of the enterprise, and they are represented by Mr. Whitman, formerly a confidential man for C. T. Yerkes. The company is now purchasing a right-of-way in Lake County which is of a uniform width of 100 feet. It is said the road will enter Chicago by way of Milwaukee Avenue to Niles and that it will run north about two miles west of the Northwestern Road and will not pass through Evanston. Both passenger, express and freight cars will be run, and trains will go at a high rate of speed. One account states that the passenger trains will run over the Union Loop, and will make the 36 miles between Waukegan and Chicago in 30 minutes. The incorporators are W. T. Black, Charles H. Lambert, Edward B. Smith of Chicago, W. D. Ball of Evanston and Frederick Mackinnon of Oak Park.

St. Louis Street-railway Improvements.

At the recent annual meeting of the St. Louis Transit Company Murray Carleton was re-elected president, and the other officers were also re-elected. President Carleton, in outlining the future work for the transit company, especially during the World's Fair, stated that with 600 new cars which had been provided for, the company should be able to handle the crowds between the city and the fair grounds at the rate of 60,000 an hour. The report of the auditor showed that in 1902 the earnings of the company were $6,452,218, as against $5,783,912 in 1901. The expenses and taxes for 1901 were $3,967,721, as against $3,692,400 the preceding year. The income for last year was $2,484,497, less interest and rental amounting to $2,752,581, leaving a deficit in operation of $268,083, against a deficit last year of $525,630. During last year the transit company carried 185,077,940 passengers.

The report is being circulated that the company is about to borrow $6,000,000 to pay for new cars, take up the floating debt and provide for other needs.

Municipal Lighting at Howell, Mich.

The municipal electric-light commission of Howell, Mich., of which Glen H. Brown is secretary, has made a report to the Common Council of the village in which it expresses gratification at the showing made by the plant in 6½ months from July 1, 1902, to January 15, 1903. The village has 51 street arc lights and 2,617 incandescent lamps, the total cost of the plant to January 15th being $21,369.96. The average income from commercial lights has been $255.22 a month. In determining the cost of operating the arc lamps used for street lighting for the time stated above, Mr. Brown begins with the total amount charged in his summary (apparently for operation and maintenance), $4,778.29. From this is deducted $4,669.67, the total amount for permanent construction, income from commercial lighting, income from sundries and merchandise on hand, leaving a balance of $108.42, which is considered to be the cost of operating 51 street lights for 6½ months. The report concludes as follows: "This gives a total cost of $16.68 per month for 51 lights, or 33 cents per lamp per month outside of depreciation and interest."

BOOK TABLE.

How to Become a Competent Motorman. By Virgil B. Livermore, Chief Instructor with Brooklyn Rapid Transit Company, and James Williams, Shop Foreman with Brooklyn Rapid Transit Company. D. Van Nostrand Company. 1903. Pp. (four by six inches) 232, with 49 diagrams. Price, $1.

The position of motorman is one of much importance, as every motorman is responsible for the safety of his car and passengers, and also, to a great extent, for the lives of the people crossing the street immediately in front of him. He must be quick to think and act, and this comes not only from experience in handling cars, but from an intelligent understanding of the power under his control. This book has been written in as simple a manner as possible, so that any man of average intelligence can readily understand every word contained between its covers, and, understanding it, the reader should be competent to pass any examination that would be likely to be required of him to become a motorman. It is made in a convenient form, so as to be carried in the pocket, and can be referred to at any time. On the title-page is the statement that the book is indorsed by the leading railroad managers of the United States.

Alternating-current Machines. By Samuel Sheldon, Ph. D., and Hobart Mason, E. E. New York: D. Van Nostrand Company. 1902. Pp. (5¼ by 7¾ inches) iv., 259, with 184 illustrations. Price, $2.50.

The work is the second volume of "Dynamo-electric Machinery; Its Construction, Design and Operation," and, like its companion volume on "Direct-current Machines," is primarily intended as a text-book for use in technical educational institutions. It is also written with an idea that it will be of considerable help to electrical, civil, hydraulic and mechanical engineers, whose work requires some knowledge of alternating currents. Of the many and varied methods of treating alternating-current problems, the authors have used in each case that method which was deemed clearest and most concise. In this way no complexity of methods occurs and as there are no complex imaginary numbers used, the text can be easily followed by those who have acquired some proficiency in mathematics.

In the first four chapters the authors discuss the properties of alternating currents, self-induction and capacity, and solve several problems on alternating-current circuits. Following chapters treat of alternators, transformers, motors and converters, the several different essential problems concerning each being handled concisely yet clearly. The chapter on power transmission takes up frequency, voltage, number of phases, aluminum line wire, line resistance, inductance and capacity, line constants and weight of copper. Although this chapter is short it contains much good material, and the last chapter, which contains the solutions of various tests on alternating-current apparatus, is equally valuable. Only American machinery and practice are considered, and while the diagrams of circuits are well presented, the illustrations of machines smack a little too much of manufacturers' catalogues. However, the work as a whole is a valuable addition to electrical literature.

The Atlantic City and Suburban Traction Company is constructing a suburban electric railway from the famous Board Walk at Atlantic City to Pleasantville, N. J., from which place the road will branch in two directions, one leading to Absecon and the other to Somer's Point, a total distance of approximately 18 miles. This road will operate 12 cars, each being equipped with four Westinghouse, 12-A motors, and five trail cars.

CORRESPONDENCE.

London Letter.

London, England, March 14.—Mr. Trotter, the electrical adviser to the Board of Trade, has made a report upon the fatal accident which occurred at Christmas time, when two bathers at the Fulham baths received electrical shocks. Mr. Trotter states that the pressure of 200 volts, while not dangerous in ordinary conditions, did become dangerous under the conditions which obtained, and the additional precautions should have been taken which the Board of Trade prescribes for more dangerous pressures. The regulations made by the Board of Trade for the safety of the public provide that the pressure of a supply delivered to any consumer shall not exceed 250 volts at any pair of terminals, and the further regulation, among others, that the electric wires besides being run in metal cases, should be connected to earth. The presence of the wooden fuse box, however, nullified the latter regulation, and as the pressure was only 200 volts, of course it could not be enforced. The report confirmed the statement made at the inquest that had the proper earthing been carried out, it would have been impossible for the accident to have occurred.

An addition to the municipal electric-lighting undertakings in London has just been made by the opening of the Hornsey electricity works. The provisional electric-lighting order under which the concern runs is dated as far back as 1898. The capacity of the dynamos at present installed is 600 kilowatts, and the engines aggregate 1,000 horsepower. The system is that of three-wire direct current at 240 volts, and the whole scheme has cost $385,000.

The storm of last week has caused a considerable delay and damage to the telegraph system of the United Kingdom, and especially to the more exposed portion in the North and in Scotland. In Ireland, too, similar effects were felt, and it is expected that many months must elapse before permanent repairs can be made. The gale happened at a most opportune moment for the purposes of a deputation which waited upon the postmaster-general as to the provision of further underground telegraph and telephone cables between London, the north of England and Scotland, and it is satisfactory to note that the government is still willing to expend money in this direction. Some $700,000 is to be allocated to this object, that is, of course, with the consent of the treasury.

Two rather novel tramways have been opened during the last week. One is at Sheerner, in Kent, where a short line is equipped with the Siemens' bow collector, and not a trolley arm (the only instance in this country), and the other is a similarly short line on the ordinary trolley system, but with unusual features as regards power transmission. The line belongs to a joint stock company which takes current from the power house of the Portsmouth corporation at 5,500 volts three-phase, which is submitted to a sub-station six miles away and converted and transformed down to the usual 500 volts continuous.

The Glascow corporation is to borrow $400,000 for its municipal telephone system, in addition to the amount already borrowed, viz., $1,220,000.

W.

New York Notes.

New York, March 21.—The city lighting-plant scheme which was offered by Commissioner Robert Grier Monroe last week, continues to be a subject of interesting consideration. Blackwell's Island has been suggested as an excellent site for the plant if the city should decide to erect one. On Thursday Colonel Monroe appeared at Albany with a bill to authorize the establishment of such a plant and it was duly introduced into the state Legislature. The bill authorizes the commissioner of water supply, gas and electricity to secure the necessary land and to erect a municipal electric-lighting plant. The controller is directed, when authorized by the Board of Estimate and Apportionment, without the concurrence or approval of any other body, to raise, on requisition of the city, sums of money sufficient to carry out the project. No limit of cost is fixed. That is left entirely to the discretion of the Board of Estimate and Apportionment. It is further provided that the water commissioner shall have the right to contract with private persons or with any corporation for the maintenance and repair of the plant, including not only the buildings, but the machinery, mains, conductors, conduits and general appurtenances.

At a public hearing on Wednesday before the commissioners recently appointed by the Appellate Division of the Supreme Court on the Pennsylvania Railroad Company's tunnel, some interesting points concerning its construction were brought out. Charles M. Jacobs, chief engineer of the North River division of the tunnel, said there are to be two tunnels, each accommodating a single track and sidewalks, one on either side of the track. The cylinders or tubes are to be of metal and concrete. They will be sunk beneath the bed of the river, in the sediment that has accumulated there. The caissons will be about 15 feet in diameter, and the railroad tracks will be firmly fixed on them. There will be a single

rom [illegible] columns under each track, and they will number about 700 altogether. The tunnel will have a total length of about 6,000 feet. Where the river tunnel is to end will be sunk a shaft, and from that the borings will be made both to the west, under the river, and to the east to the terminal. The street will not be opened from the river to the terminal, and the tube there will be on the average 26 feet below the surface. There will be room, under the plans submitted by Mr. Jacobs, for 32 tracks at the terminal station, with a total of 7½ miles. The underground area for the station will be 28 acres. He said that electric power would be used, and because of that it was not considered necessary to install artificial ventilation, it being believed by engineers that the movement of the trains would carry sufficient air into the tunnel by suction.

The Hudson and Manhattan Railroad Company of New York city has been incorporated with a capital of $3,000,000 to construct a tunnel railroad approximately one mile long from Broadway and Cortlandt Street underground in New York city and under the bed of the Hudson River to the boundary line of the state of New Jersey, there to connect with the railroad of a New Jersey corporation extending westwardly to a point in Jersey City. The directors are George P. Lester of Bloomfield, N. J., Howard Slade and William H. Siegel of New York city, Clinton Graham of Flushing, Robert Maroney, Charles H. Aaron, James Davidson and A. F. Richter of Brooklyn, and A. B. Proctor, Jr., of Boonton, N. J. William G. McAdoo, president of the New York and Jersey Railroad Company, which company is to build the trolley tunnel from Fifteenth Street, Jersey City, to Morton Street, New York, is interested in the new company, but has declined to discuss in detail the venture.

The Rapid Transit Commission has decided to abandon the plan for an underground railroad station at One-hundred-and-fourth Street and Central Park West. The work on the rapid-transit subway, which hitherto has been hurried forward to completion, and is likely to be finished ahead of schedule time, is being retarded by a strike of the structural ironworkers at the power house, at Fifty-eighth and Fifty-ninth Streets and Eleventh Avenue.

The New York City Interborough Railway Company, a new corporation formed for the purpose of operating electric lines in the Bronx, has been granted franchise rights by the Board of Aldermen to construct eight routes in that borough, with a total of 36 miles of track. Better terms were secured in the franchise by the city than has ever been made with a railroad corporation.

Oren Root, Jr., formerly assistant general manager of the Metropolitan Street Railway Company's system, has been promoted to the position of general manager of the system. He probably is the youngest street-railway manager in the country, being only 29 years old. Mr. Root was born in the little town of Columbia, Mo. In 1895 he entered the service of the Metropolitan Street Railway as a clerk. He attracted the attention of President Vreeland, who determined to teach him thoroughly the street-railway business, and sent him out as a motorman, a conductor, and gripman. He was gradually advanced through the grades of inspector, car starter, barn superintendent, etc., until he finally became assistant general manager, from which position he has just been advanced. Mr. Root is a nephew of Elihu Root, secretary of war.

The Interurban Street Railway Company reports for the quarter ended December 31st: Gross earnings, $3,875,179; operating expenses, $1,920,084; net earnings, $1,955,095; other income, $185,185; total income, $2,140,280; charges, $2,187,838; deficit, $47,558; cash on hand, $1,081,763; deficiency, $55,802. O.

New England News.

Boston, March 21.—The Millbury, Mass., selectmen have granted a franchise to the Millbury, Singletary Lake and West Millbury Street Railway Company. It permits the building of a railway between West Millbury and the Town Hall at Millbury Center, a distance of two miles. The new company proposes to carry express and freight. Its cars will connect with cars for Worcester and Providence.

Contemplated changes in the Cambridge, Mass., sanitary rules have led the chairman of the city's board of health to introduce an order compelling street-car companies to fumigate thoroughly every car in service at the end of each day, and when a car is in use its ventilators must be open at least one inch; the ventilators and doors to be kept wide open when the car is not in service.

The Lynn and Boston Railroad Company has petitioned for permission to dredge a channel 22 feet deep, to fill a portion of the flats, and to build a pile structure at its East Boston property, where it intends to enlarge its coal pockets and make a channel for coal barges, so that they can be discharged at the coal pockets. The company proposes to fill about 50,000 square feet of the flats on which it will build a turntable.

The Bar Harbor and Ellsworth Light, Gas and Power Company has obtained the Union River Light and Power Company's option on the Union River dam properties and the electric-light properties in Ellsworth and Bar Harbor, Maine. The company will extend the lighting system to Northeast Harbor and Seal Harbor, and will build a dam large enough to develop the power sufficient to supply all the locations and also manufacturing industries.

The Worcester Consolidated Street Railway Company has followed the example set by other electric-railway companies in this section, by classifying its employes under a system of wages ranging from 20 to 25 cents an hour, according to the length of service. The schedule is to go into effect April 1st. Two years ago the company made a scale by which conductors and motormen of three years' or less service received 20 cents per hour, and those of more than three years' service received 22 cents an hour. The new scale, therefore, reduces no wages.

When the Boston and Worcester Street Railway Company gets its trunk line in operation (probably in June) it will classify its motormen and conductors and pay them from 20 to 25 cents an hour, according to length of service.

The building numbered 72 to 78 Stanhope Street, Boston, owned by the Edison Electric Illuminating Company of Boston, is to be enlarged and arranged for the housing of electric vehicles. The cost of the alterations will be $30,000.

The Framingham and Cochituate Street Railway Company has been formed. It has a capital of $50,000, and proposes to build an electric railway between Cochituate and South Framingham, Mass., a distance of four miles.

The Stanley company has so many orders for transformers that its Pittsfield, Mass., plant is being run nights. B.

From the Buckeye State.

Cleveland, Ohio, March 21.—Roy A. Williams, assistant superintendent of the Pittsburg Steamship Company, and Charles Hubbell, of Cleveland, are making preparations to build an electric line from Brooklyn, a suburb of Cleveland, to Medina and Berea. The plan is to build along the Wooster pike to Medina and where the Bagley road intersects this pike build a branch to Berea. Although the other road will reach this point the claim is that the new one will be 12 miles shorter. This is getting to be a point in this state with electric roads. While formerly the plan was to take a route that would reach the greatest population, both the length of the route and the population must now be considered.

The directors of the Cincinnati Gas and Electric Company, at a recent meeting, decided to increase the capital stock of the company by the addition of about $2,000,000, which would make the total $31,000,000. The stockholders will vote on the proposition later on.

A rumor is current that the electrical manufacturing plants of eastern Ohio, western Pennsylvania and western New York are on the point of uniting their interests. There are several large plants at Youngstown and Warren which are said to be interested, but it is impossible at this time to confirm the report.

The Falk Company of Milwaukee has taken the contract to build 33½ miles of the Cincinnati, Milford and Loveland line between Cincinnati and Loveland. Materials are now being secured for it and the work will be completed as rapidly as possible.

The Lake Shore Electric Railway Company expects 10 new cars by June, when it will inaugurate a through-service between Cleveland and Toledo without change at Norwalk. The sub-station at Vermillion will be completed by April 1st and the substation at Ceylon will then be transferred to the Norwalk division, giving the road first-class power facilities.

All the cars on the Columbus street-railway lines stopped about 20 minutes a few days ago for some unaccountable reason. The machinery was in operation, as usual, but there seemed to be no current on the wires. All at once it came back, however, and they were able to move on. The officials state that it was one of the tricks that electricity sometimes plays and cannot well be accounted for.

The Central Electric and Manufacturing Company of Youngstown has been incorporated under the laws of Delaware with a capital stock of $300,000. Its purpose is to manufacture and sell electrical apparatus of all kinds. O. M. C.

Information from Indiana.

Indianapolis, March 23.—The Union Trust Company will finance, with a capital of $2,000,000, the interurban line from Vincennes to Owensboro, Ky., all plans having been completed for the immediate construction of the road. A. H. Kennedy of Evansville, prominently connected with the road, says that the Ohio River will be crossed in a gasoline-operated ferry boat that will carry a carload of passengers. This company reserves the right to use steam for freighting and electricity for passenger traffic.

The Ft. Wayne Traction Company's line has been sold to a company recently organized in Philadelphia officered by George F. McCulloch president, J. L. Jones and James Murdock vice-presidents and S. B. Flemming secretary. The directors are Hugh J. McGowan, Randall Morgan, Charles Murdock and Bayard Henry. The price, $1,600,000, will be paid to the Cleveland owners on the 24th, and possession of the road will be given on April 1st. The new company is capitalized at $5,000,000, and the movement is significant as the forerunner of a combination of the Ft. Wayne and Southwestern Interurban, the Wabash Valley and the Lima and Ft. Wayne and the McCulloch-urdock systems in Indiana.

The Indiana Supreme Court handed down a decision last week calculated to give street-railway companies much trouble. In this case a judgment for damages was affirmed where the plaintiff was ejected from a car after refusing to pay an additional fare, his erroneously prepared transfer check being refused by the conductor. The court held that a car ticket is not conclusive evidence of the contract for carriage, but is merely a receipt for the passenger's fare, and as such is open to explanation; that a passenger cannot be presumed to understand the intricacies of a transfer check, nor can the company impose on him the obligation to see that it properly indicates the transportation to which he is entitled before accepting and using it. The local company said that the next day after the decision was announced passengers tried to work all sorts of transfers on the conductors, and there was evidence of attempts to provoke ejectment with a view to damage suits.

New York and Philadelphia capitalists have made the city of Richmond a proposition to buy the municipal electric-lighting plant recently constructed by the City Council. They suggest that the proposition of sale be submitted to the voters of the city and let them decide whether the sale shall be made. The city officials oppose the sale, although the plant is run at a loss to the city.

The Union Traction Company of Indiana contemplates going into the electric-lighting business, and is soon to make an offer to towns and cities along its lines and territory. The company is increasing its Anderson power plant from 6,000 to 12,500 horsepower, and as only two-thirds of this will be necessary for the operation of its lines, the remainder will be for sale to the public. The company has a number of storage and reducing stations along its lines.

A. R. Thompson & Co. of Chicago are seeking a franchise to construct and operate an electric-light, heat and power plant in Greensburg. It is generally believed that the franchise will be granted.

The boycott of the Central Labor Union against the Evansville Electric Light Company has been extended to all who use the company's electricity. The union barber shops have ceased using electric lights, and people generally, from the mayor down, are resorting to the oil lamp. The boycott promises to destroy its purposes by unreasonableness.

The officials of Washington, Ind., say municipal lighting has proved a financial success in that city. The yearly report shows that the receipts were $91,640.43, and the expenses, including bonds and interest, were $61,395.43, leaving a net profit to the city of $30,245, which they say equals 10 per cent. on the $100,000 investment. F.

Michigan.

Detroit, March 21.—The Detroit United Railway will not build from Romeo to Imlay City this year. Neither will a branch from Flint to Lapeer be constructed this year. It is probable that the proposed extension to Capac will also be deferred. Increased expense of operation, caused by the payment of higher wages, and the increased price of fuel, are said to be the reasons for not making contemplated improvements.

The high water has caused a break in the Chapin dam at Buchanan, Mich. This dam was constructed at a cost of $100,000, with an electric power plant costing $250,000, for the purpose of transmitting power to nearby points.

The Jackson and Battle Creek Traction Company expects to have its cars running between Battle Creek and Albion by May 1st.

The village of Hamtramck, a suburb of Detroit, is considering a proposition for electric lighting. It has not been decided whether to give the contract to some commercial company or to construct a plant of its own.

The construction company having the contract for the building of the new Toledo and Monroe electric line has closed a contract for the delivery of 100,000 ties for immediate delivery. All of the overhead equipment and electrical appliances for this line were purchased from the Shore Line at the time of its sale to the Grand Trunk Railroad. The poles have also been purchased and are being loaded on cars ready for shipment as soon as one of the two routes now being surveyed is determined. It is probable that the route entering Detroit via Fort Street and passing through several small towns will be the one chosen. It is expected that cars will be running between Detroit and Toledo via Monroe by next fall at farthest.

It is understood that the re-survey of the old route of the Indiana, Illinois and Michigan Railroad from New Buffalo to Chicago is in the interest of a syndicate of capitalists which will build an electric road between Grand Rapids and Chicago, touching all towns of considerable size in Western Michigan and forming connection with the Indiana electric railways at St. Joseph, Mich., ultimately establishing communication with Indianapolis.

As a result of numerous petitions, the council of Ford, Mich., is making preparation to place a bond-

ing measure before the people providing for a lighting and water system. Engineer George B. Palmer is making out the estimates. C. G. W.

Northwestern Notations.

Minneapolis, March 21.—The Gorman Electric Company of St. Paul has been incorporated with $50,000 capital stock. The incorporators are John and Gertrude E. Gorman and George E. Budd, all of St. Paul.

The Minnesota House of Representatives has passed a bill for the "electrocution" of all persons sentenced to death, at the state penitentiary. Not more than six persons shall witness the execution.

Mankato, Minn., will open bids on March 30th for the construction of a municipal electric-light plant.

A. E. Appleyard, the principal owner of the electric line at Eau Claire, Wis., has bought all but a small amount of the stock in the Eau Claire Light and Power Company. The street-railway line is to be extended in several directions soon.

The Sioux City (Iowa) Traction Company has begun demolishing the old cable-power station, and will use the material for the construction of new car barns. The company will unify the width of tracks on all the systems of the city, and will enlarge the power plant and add new rolling stock.

The Black Hills and Spearfish Valley Electric Railway Company has been incorporated at Spearfish, S. D., with a capital of $2,500,000, to construct an electric railway from Spearfish to Belle Fourche and to Lead and Deadwood, a total of about 32 miles.

The Havre Light and Power Company of Havre, Mont., has awarded contracts for the erection of a power building. The station will be 35 by 70 feet in size, and is to be completed about the first of May. The wires and poles will be in place by that time.

An electric railroad is projected by the Citizens' Electric Company of Lewiston, to Kendall, Mont., 18 miles. Waterpower is available for power. The company is about to erect a $25,000 power plant.

The Mount Ayr (Iowa) incorporators of the Des Moines, Mount Ayr and Southern Electric Railroad Company have disposed of their interests to Omaha capitalists, including H. H. Baldridge, W. J. C. Kenyon and F. L. Loomis. Surveys are to be begun at once. R.

On the Pacific Slope.

San Francisco, March 18.—Consulting Engineer F. A. Worthly of Riverside, Cal., has filed his report with the Stockton (Cal.) council, including plans and estimates for the construction of a municipal lighting plant, to cost about $140,000.

Articles of incorporation have been filed by the Clear Lake Railroad and Electric Power Company with a capital stock of $1,000,000. The incorporators are Mrs. H. C. Healey, L. H. Boggs, W. R. Prather and others. The place of business of the company will be at Lakeport, Lake County, Cal. W. T. Whitton of Lakeport has been in San Francisco in the interests of this line, and says that the road will certainly be built. The company is figuring on installing an electric power and railway plant costing $400,000. The projected electric railroad is to be about 36 miles in length, extending from Hopland to Lakeport. For the past two years efforts have been made to develop the waterpower supplied by Clear Lake to operate an electric plant, but without success. The hydraulic work necessary to utilize the mill would be very expensive.

The Union Iron Works of San Francisco has sold a new plant to the Reward Gold Mining Company for its mine in Inyo County, Cal. The electrical equipment will be constructed by the Westinghouse Electric and Manufacturing Company. It consists of a 120-kilowatt, belt-driven, three-phase generator, with a switchboard, etc.; also a 50-horsepower, 2,000-volt motor to operate a 20-stamp mill and a similar horsepower motor to operate an air compressor; also a 25-horsepower, 400-volt motor to operate a rock breaker, and the necessary lowering transformers for the above motors and for lighting service. The new equipment will be started up this month.

The council of Wilbur, Wash., has passed an ordinance granting a franchise for 30 years to the Wilbur Electric Company to operate and establish an electric plant here. Lights are to be installed by October 1st.

The Colgate electric power plant of the Bay Counties Power Company at Colgate, Cal., was damaged by fire on March 3d. The damage was confined practically to the transformers and switchboard, and amounted to between $5,000 and $10,000. The plant is now in running order again.

The Electric Supply Company of Victoria, Ltd., has been organized at Ballarat, Australia, for the purpose of converting the present horse tramways into electric lines and for establishing an electric-lighting system in the town. The improvements will cost about $600,000.

San Pedro, Cal., is to have another electric-light, gas, heat and power company. Work has commenced on the laying of the pipes for the gas system, for which a franchise was granted to H. C. Rogers and his associates several months ago, upon the payment of $2,100, that being the highest bid offered at the time. According to the terms of the franchise, the company must expend a sum of not less than $5,000 in the construction of its electric and gas systems within one year, and the entire plant must be completed and in operation within three years from the date upon which the franchise was granted.

The Globe Light and Power Company of Porterville, Cal., has secured rights-of-way, and operations will commence at once for the power houses to be erected above Duncan's, on the Middle Tule. About 3,500 horsepower will be generated. The company will supply power for electrical purposes and also for an electric road from Springville to Visalia, to connect with the Santa Fe Railroad.

C. V. Greenameyer, mechanical engineer of the Pacific Electric Company of Los Angeles, has found that by utilizing compressed air the difficulties now attendant on the use of the trolley where high speed is required, can be overcome. Another, and one of the most important features of the device, is the saving in power. It is stated that the even contact of the trolley wheel under air pressure carries more power to the motors. In using the 300-horsepower motors of the Long Beach cars there is a saving of 40 horsepower to each.

The Northern California Power Company of Redding, Cal., has purchased the entire plant and franchises of the Red Bluff Electric Light and Gas Company. The electric service will be connected with the Northern California Power System and be operated as a branch. The company will also establish a large wholesale electric-supply house in Redding.

The city officials of Seattle, Wash., have decided to commence work at once on the municipal light and power plant. The plant will generate 2,500 horsepower and will cost $590,000.

J. A. Manly of Grand Forks, B. C., has interested eastern capital in the development of 2,000 horsepower on the Kettle River, seven miles below Grand Forks. This power will be transmitted by wire to a smelter to be erected in the vicinity of Grand Forks. The smelter plant will have a capacity of 2,000 tons. A.

Seattle, Wash., March 19.—The new Cataract Electric Company, which has just been granted franchises to build and operate street-car lines in the city of Tacoma, Wash., will, in the spring, start construction covering that part of the city and suburban towns not already reached by the company now in existence. The company's new power plant on the White River will develop about 60,000 horsepower when completed.

George Nixon, an electrical engineer of Spokane, Wash., is in Colville, making estimates for the new electrical plant to be installed at Meyers Falls, to furnish electricity for lighting Colville and other surrounding towns.

J. L. Bright, president and manager of the electric-light company at Lewiston, Idaho, has announced the intention of the company to begin shortly the construction of a new electric-light plant, using the waters of Big Spring Creek. The new plant will cost about $50,000 completed. On the new location there is a 65-foot waterfall, generating 500 horsepower. The old plant of the company now in use will be used as an auxiliary to the new one.

E. A. Martell of Boston, Mass., is in Great Falls, Mont., for the purpose of auditing the books of the Boston and Great Falls Electric Light and Power Company, the Great Falls Street Railway Company and the Boston and Great Falls Land Company, recently acquired by the Marcus Daly estate.

S. A. Buck is asking the City Council of Monroe, Wash., for a 50-year franchise to build and maintain an electric-light plant at that place.

The Fairhaven (Wash.) Water, Electric Light and Power Company is building a dam to raise the waters of Lake Padden. The lake covers an area of 150 acres and has a depth of 25 feet. It is proposed to add two feet to the depth.

The Citizens' Electric Power Company of Lewiston, Idaho, has under consideration a project to connect the county seat and Kendall, Mont., with an electric railway. The new line would be about 18 miles long. P.

PERSONAL.

Dana Stevens, general manager of the Cincinnati Traction Company, is spending a few weeks at Atlantic City for rest.

City Electrician Thomas H. McCarthy of Wyandotte, Mich., died a few days ago at his home in that place at the age of 37 years.

Mayor James H. Lafarres of Bowling Green, Ohio, has been chosen general manager of the Lake Erie, Bowling Green and Napoleon Electric Railway Company.

The Pacific Electric Railway of Los Angeles, Cal., has created the office of assistant general manager, and Howard E. Huntington, son of Henry E. Huntington, has been appointed to the position.

John I. Beggs, president of the Milwaukee Electric Railway and Lighting Company, was in St. Louis on March 20th, in company with C. W. Wetmore of New York. Both gentlemen are said to be interested in the North American Company, which recently purchased the Laclede Gas-light Company of St. Louis. Reports have been in circulation for some time stating that the company was soon to acquire control of the Missouri-Edison Company.

Col. E. J. Spencer of St. Louis, an old West Pointer and a well-known electrical man, has been appointed grand marshal of the civic parade to be given on May 2d, the third day of the dedication ceremonies of the St. Louis Exposition.

W. Nephsy, late of the Montreal Street Railway, has left for Alexandria, Egypt, to take the position of general construction foreman for the Rambly Electric Company, under the supervision of F. N. Graburn, also formerly connected with the Montreal Street Railway Company.

William Du Bois of Albany, N. Y., chief electrician of the Delaware and Hudson Railroad, died in Plattsburg, N. Y., on March 16th. A week before he was thrown from a carriage, sustaining a compound fracture of the leg and internal injuries. He was about 42 years of age, and leaves a widow and two children.

James Reilly, president of the American Electrical and Maintenance Company, died on March 8th, at his residence, 12 West Seventy-seventh Street, New York city, after an illness of five days with the grip. Mr. Reilly was 65 years of age and was engaged at different times in various lines of business, principally engineering.

Ernest Blair, formerly assistant to the general manager of the Quebec Electric Railway Company, has been appointed assistant superintendent of the Montreal Street Railway and has entered upon his duties. The divisional superintendents will be abolished for the present, their duties devolving on the new superintendent.

E. H. Keating, general manager of the Toronto Street Railway Company, has been appointed by the government as one of the commissioners to report on the most suitable site for a dry dock in Montreal. This appointment will not interfere with Mr. Keating's position as general manager of the Toronto Street Railway Company.

On March 23d the Royal Geographical Society commemorated the 300th anniversary of the death of Queen Elizabeth. Prof. Silvanus P. Thompson, an enthusiastic Gilbertian, spoke of Dr. William Gilbert, Queen Elizabeth's physician and the renowned author of "De Magnete" and of the relation of Gilbert's book to modern science.

W. Kelsey Schoepf, president of the Cincinnati Traction Company, and Mrs. Schoepf will sail shortly for an extended tour of Europe. There has been some talk of an offer to Mr. Schoepf from the consolidated traction lines in Paris, and there is a supposition that he may have gone to investigate this matter. However, it is probable that his trip is merely for recreation and rest.

Mr. Bion J. Arnold lectured on "The Chicago Transportation Problem" in Fullerton Hall, Art Institute, Chicago, before members of the American Institute of Electrical Engineers and the Western Society of Engineers on the evening of March 24th. Mr. Arnold based his address, which was illustrated by lantern-slide pictures, on his recent comprehensive report as city traction expert, and an audience of 350 professional men was greatly interested.

Charles Burgher, superintendent of the Boston Automatic Fire Alarm Company, died at his home in Winthrop, Mass., on March 13th. He was born at Stapleton, Staten Island, 45 years ago. He had invented many fire-alarm devices. He was a Free Mason and a member of the Boston Electric Club, the Golden Cross, and several social organizations in Newton and Winthrop. Boston representatives of the various telegraph companies attended his funeral, which was held on March 16th.

Minneapolis people are taking an interest in the career of George W. Almour of Minneapolis, who has enlisted in the United States navy as third-class electrician. He is 18 years of age, and has made a study of electricity for five years. He installed a model telegraph and telephone system in his father's house. He passed a perfect examination, standing 100 in electricity and 100 in physical examination. He went direct to Brooklyn, and is on the Columbia. He will attend the government school for six months and will then be assigned to sea duty.

ELECTRIC LIGHTING.

The Western Tube Company of Kewanee, Ill., which was one of the first users of Nernst lamps, is now displacing all arc and incandescent lights in favor of the new illuminant.

The Union Gas and Electric Company has been incorporated in the state of Delaware with a capital of $3,475,000. H. C. Wood, Edward Clifford and M. Paul Nove of Chicago are the incorporators.

An ordinance granting Fred Griesheimer the right to operate an electric-lighting system in the half block bounded by State Street, Jackson Boulevard, Van Buren Street and the alley west of State Street was introduced at a recent meeting of the Chicago City Council and referred to the committee on gas, oil and electric lights.

An order has been entered by Judge Holdom against the Evanston Yaryan Company of Evanston, Ill., to pay $260,989.45, the principal and interest on

[illegible] which the company is alleged not to have paid. In default of payment the court orders the electric-lighting and hot-water heating plant of the company at Evanston sold by Master in Chancery Eating.

The report of the city statistician on city lighting of Chicago shows the average number of street lights operated by the city of Chicago during the year 1902 to have been 35,667. Of this number 4,557 were arc lights operated by the city and 626 were rented arcs; 24,963 were gas lights and 5,322 gasoline. The report places the average daily candlepower used for lighting the streets of Chicago at 11,601,277.

The Manila Railways and Light Company has been incorporated at Trenton, N. J., with a capital of $1,000,000 to construct and operate railways in the Philippine Islands and to supply electricity. The incorporators are Frank H. Buhl, Sharon, Pa.; P. L. Kimberly, Sharon, Pa.; Charles W. Swift, Detroit; J. P. White, New York; George C. Smith, Pittsburg; Harry J. Conant, New York, and A. C. Walls, Jersey City, and represent the syndicate which recently secured the contract from the Philippine Commission.

Sealed proposals will be received at the office of the chief quartermaster, United States Army, Pullman Building, Chicago, until April 3, 1903, for the wiring of buildings, installation of electric fixtures and erection of necessary pole lines on the reservation for the electric lighting of Fort Sheridan, Ill., in accordance with specifications and lighting plan to be seen at the office in the Pullman Building or at the office of the quartermaster, Fort Sheridan. Particulars and blanks for proposals will be furnished on application. Proposals should be addressed to Major W. H. Miller.

ELECTRIC RAILWAYS.

The Union Traction Company of Batavia, N. Y., was given a hearing by the State Railroad Commission on March 18th on its application for authority to construct an electric-street railroad nearly 50 miles long from Batavia to Olcott on Lake Ontario.

Reports come from the East that some prominent trolley promoters are planning a road to connect New York with Montreal, the line to run via Vermont. If the road is built, connections will be made with the important trolley roads in Eastern New York and the Berkshires, and nearly a dozen systems in Vermont.

Mr. De Plehwe, Russian minister of the interior, gives out the information that the Russian government has refused the application of Murray A. Verner of Pittsburg, for the St. Petersburg and Moscow traction franchises. Both municipalities opposed the application. They desire to construct the street railroads themselves.

A case coming from a lower court in which damages were awarded a passenger who was ejected from a street car because he did not hold the proper transfer was affirmed by the Supreme Court of Indiana. The court decided that passengers on street cars are not required to scrutinize their transfer tickets before alighting from cars.

The Toronto Electric Street Railway, for the first time in its history, has forged ahead of Montreal in its earnings, to the tune of $7,473, the earnings of the Toronto company being $146,539 for February, while the receipts of the Montreal concern only reached $139,066. For the combined months of January and February the Toronto Street Railway earned $308,478, and the Montreal, $307,948.

Quite an extensive electric road for the fruit district of Tulare County, Wash., will probably soon be built. James Hayes Hammond of New York has asked for a franchise to construct and maintain a single-track road for the purpose of transporting passengers, freight, express matter and United States mails. The proposed road, when built, will start from Visalia, running due east to the Broder colony, then southeast to Farmersville, where it turns east and northeast to Exeter and Lemon Grove, respectively.

The construction of the proposed electric railway between Jamestown, N. Y., and the Chautauqua Assembly grounds now seems to be assured. The directors of the Chautauqua Traction Company met in Jamestown on March 19th and discussed plans for construction. The right-of-way across a part of the Assembly grounds has been secured, which is considered an important matter, as no other company has ever been able to secure rights on the grounds. Officers were elected as follows: President, A. N. Broadhead; vice-president and treasurer, F. N. Broadhead; secretary, W. R. Reynolds; manager, George E. Maltby.

The Albany and Hudson Railroad Company has been incorporated at Albany, N. Y., with a capital of $27,000,000. The company has acquired the property and franchises of the Albany and Hudson Railway and Power Company, which operates the third-rail electric line from Albany to Hudson. The property and franchises were acquired after the latter company had gone into the hands of a receiver consequent upon two collisions which impoverished it. The directors are H. G. Runkle, C. L. Rossiter, A. M. Young, Foster M. Vorhees, William F. Sheehan, R. A. Smith and C. L. Seibert of New York; Horace Andrews of Cleveland, Ohio, and Seth L. Keeney of Brooklyn.

The Illinois Valley Traction Company has been granted a franchise by the City Council of Princeton, Ill., to operate its service in Princeton. The company now has an interurban line in operation from La Salle to Ladd, and from the latter point the line will be extended to Princeton, a distance of 14 miles. On the way it will pass through Seatonville, Hollowayville and Coal Hollow. It is expected the line now being built from Galesburg to Kewanee will be extended to Princeton, in which event, with one connecting link between Marseilles and Joliet, this will make a continuous electric line from Galesburg to Chicago, a distance of 160 miles.

AUTOMOBILES.

The Boston Automobile Dealers' Association held a show in Symphony Hall, Boston, last week. There were eight electric, 23 steam and 55 gasoline machines on exhibition.

The German kaiser is an enthusiastic admirer of automobiles and has a variety of horseless vehicles. He now has one that he uses on his visits to troops, inspections and other military expeditions, and it is reported that he intends to use it at the next army maneuvers.

SOCIETIES AND SCHOOLS

At the regular meeting of the Western Society of Engineers on April 1st in its room in the Monadnock Block, Chicago, Professor C. S. Slichter of the University of Wisconsin will read a paper on "Underflow Waters of the Western Plains."

The two-hundred-and-thirty-third meeting of the New York Electrical Society was held on March 18th. Over 300 members and their friends listened to the lecture of Professor R. H. Thurston of Cornell University, on "Steam Turbines to Date." The lecture was a masterly summary of the subject. The following-named members were elected: J. L. Moriarty, Charles E. Mandelick, Charles G. Wingate, Max J. Levy, Robert Lee Hailey, Farley Osgood, W. B. Spellmire, Frederic J. Chisholm, William H. Moon, John L. Flagg, Oskar Friedrich, Joseph Treanor McNaier, John B. Ketcham, Eugene Toussaint, Arthur L. Case and Joseph W. Scott.

PUBLICATIONS.

H. W. McCandless & Co. of 67-69 Park Place, New York city, have issued a dainty catalogue of "Miniature Incandescent Lamps," describing, in a manner befitting an attractive and interesting subject, the varieties of candelabra, stickpin, automobile, battery, surgical, telephone, kinetoscope and microscope lamps made by the company. There are also pages devoted to sockets, receptacles and fixtures for miniature lamps, and the whole is clearly illustrated and well printed. In addition to the many styles carried in stock, the company states that it makes to order on short notice special lamps of all kinds.

An excellent example of artistic catalogue work has been issued by the Standard Vitrified Conduit Company of 39-41 Cortlandt Street, New York city. The cover of the catalogue, both in color and shape, represents two of the company's conduit sections standing upright. The contents of the catalogue treat of the company's conduit installations and construction, the whole being a good exposition of standard underground construction for telephone, lighting and power companies as practiced in the United States to-day. The illustrations are remarkably good and show every conceivable style of conduit work, including the construction of manholes, methods of protecting cables, self-centering conduit, etc. The process of manufacture of the vitrified salt-glazed conduits and insulators is also described in detail.

A booklet "Of Interest to Battery Users and Others" is distributed by William Roche of 42 Vesey Street, New York city, inventor and sole manufacturer of the New Standard dry battery and other specialties. On the first few pages of the catalogue are given some points on insulation of the secondary circuit of the induction coil, regulation of the rheotome or vibrator, and make-and-break mechanism. The Roche New Standard double-pole igniter plug for gas or gasoline engines is described in detail and also Mr. Roche's "autogas" dry battery, which is said to have obtained a high reputation among automobile users. Explicit directions are given for connecting up "autogas" sets. Other specialties treated are a spark coil, dresser or night light, fire-insurance electric light, gas lighter, gas-stove lighter, hand flashlight and alarm-clock outfit. Many testimonial letters speak highly of the Roche products, and the catalogue concludes with results and curves of some interesting tests on the Roche No. 5 New Standard dry battery.

The general supply catalogues of the Western Electrical Supply Company of St. Louis, Mo., have established a reputation for the complete and up-to-date lines of electrical supplies, construction material, specialties, tools, etc., which they illustrate, and the company's No. 50 catalogue, just issued, if possible, surpasses former editions. The company states that it is prepared to furnish anything in the electrical line from a door-bell outfit to a complete central station, and from a toy motor to a complete street-railway plant, and practically everything required for such a wide range of installations is illustrated and described in the book under consideration. While not containing as many pages as the company's last catalogue, which was a volume of some 1,200 pages, the present issue has been so condensed that it lists about twice the amount of material contained in the larger volume. The book is seven by 10 inches in size and is bound in serviceable semi-flexible covers. The company has gotten out probably the largest edition that has even been issued and is desirous of getting them into the hands of everybody interested in electricity.

MISCELLANEOUS.

Let the government mind its own business and the individual attend to his; that is or was the American idea. A swollen, socialist government is not in accordance with the American idea; and if there is anything in human experience, city-run railroads will be bad for the city and bad for the railroads.—New York Sun.

Charles P. Steinmetz and Harold W. Buck appeared last week at a hearing before the Senate finance committee of the New York Legislature on a bill to establish a state electrical laboratory. "The necessity for such a laboratory and such inspection in this state," said Mr. Steinmetz, "will be understood and appreciated when I tell you that there is $2,000,000,000 invested in electrical storage plants and apparatus in this state. Such is the limited knowledge which the ordinary person has of electricity that the purchaser of that commodity has to trust to Providence for his due."

TRADE NEWS.

The annual meeting of the stockholders of the General Electric Company will be held on May 12th.

The Edison Manufacturing Company has removed its Chicago office from 144 to 304 Wabash Avenue.

The Swan Electric Company of Middletown, Conn., has begun the manufacture of dry batteries and belting.

The Jacksonville Electric Company of Jacksonville, Texas, has been incorporated with a capital stock of $20,000.

The Ardmore Electric Company has given notice of removal from Kansas City to St. Louis and of an increase of its capital stock from $10,000 to $25,000.

The Excelsior Dry Battery Manufacturing Company has been organized in New York by Charles F. McShane, George Dolman and D. E. Powers. The capital stock is $30,000.

The Allegany Electrical Construction Company of Hornellsville, N. Y., has been incorporated with a capital stock of $150,000 by J. H. Backus, O. E. Vars and H. C. Coleman of Andover, N. Y.

The Electric Storage Battery Company reports for the year ended December 31st: Surplus, $300,772, an increase of $212,943. The previous surplus was $2,022,582, making the total surplus $2,323,354.

On March 24th standard copper was quoted on the New York metal market at 14 cents a pound. Lake and electrolytic copper was quoted at 14.75 to 15 cents and castings at 14.50 to 15 cents a pound.

The Advance Furnace Company of America, with headquarters at Niagara Falls, N. Y., was recently incorporated with a capital stock of $100,000 to manufacture electric furnaces. The directors are E. L. Wells, Philip Owens and C. H. Childs of Utica, N. Y.

The Cooley Epicycloidal Engine Company with an authorized capital of $10,000,000 has been incorporated in New Jersey to acquire from the Cooley Epicycloidal Engine Development Company patent rights pertaining to rotary fluid motors, meters and pumps.

At the annual meeting of the directors of the Bullock Electric Company of Cincinnati, the following-named officers were chosen: President, George Bullock; first vice-president, J. S. Neave; second vice-president, R. T. Lozier; treasurer, Stephen R. Burton; secretary, J. W. Bullock.

The Independent Light and Power Company of Quincy, Ill., E. C. Mead, general manager, is in the market, for shipment within 90 days, of dynamos, rheostats, incandescent lamps, switchboards, meters, mast arms, iron and cedar poles, wire, engines, pumps, belting, motors, lamps, transformers, electric fans, carbons, insulators, boilers, heaters, etc.

The announcement is made that the New York office of the National India Rubber Company is now located on the sixth floor of the building, Nos. 11 to 15 Murray Street. The company will be represented as follows: Rubber insulated wire and cables, by Henry D. Stanley; hose, belting and packing, by A. B. Pratt; druggists' sundries, by R. S. Emerson.

The Westinghouse Air Brake Company will at once begin the erection of a new foundry to be 320

beet long by 65 feet wide, and constructed of brick with steel frame. This foundry will be located just west of the present air-brake works at Wilmerding, Pa., and has been made necessary by the greatly increased demand for castings used in the apparatus manufactured by this company, owing to the development of the traction-brake business.

The Arthur Frantzen Company of Chicago announces the removal of its offices to 204-208 Fisher Building and of its factory and storeroom to 102 East Van Buren Street. The company installs complete electric-light plants, does wiring of all kinds, makes complete experimental laboratory equipments and manufactures switchboards, panel boards, steel cabinets, etc. Its officers are: President, W. H. Rattenbury; vice-president, Rees D. Jones; secretary and treasurer, Arthur Frantzen.

The Sterling Electrical Manufacturing Company of Warren, Ohio, has increased its facilities for catering to the already large and increasing demand for the Sterling special incandescent lamp and the other products of this company, and has established its own office in Chicago at 57 Washington Street, where all are most cordially welcome. The factory of this company is located in Warren, Ohio, and its capacity, which has been doubled within the last 12 months, is already taxed to its utmost. To meet the demand of the consumers and the establishment and enlargement of its direct representative force more elaborate extensions in the plant are contemplated during the ensuing spring.

BUSINESS.

A. E. Whitmore, Minneapolis, Minn., well known to telephone companies and other users of poles, states that he is in a position to fill orders for all sizes of poles, as he has on hand an unusually choice stock.

The rubber-covered-wire business of the Electric Appliance Company, Chicago, has increased to such an extent that it has had to multiply its warehouse room by ten. This stock is made up of every style and kind of wire, and is large enough so that the biggest or smallest order may be handled promptly.

A. E. Darling, the popular manager of the Minneapolis office of the Chicago Lumber and Coal Company, dealer in white and Idaho cedar poles, reports a very satisfactory demand for his product. The Chicago Lumber and Coal Company is well fitted to take care of a big demand for poles, which it anticipates.

A contract, aggregating over 600 kilowatts in generators and over 1,000 horsepower in motors, was recently awarded to the Western Electric Company by Albert Schwill & Co. of Chicago. A 300-kilowatt generator was recently purchased by the Danville Street Railway and Light Company, Danville, Ill., from the Western Electric Company.

The Minnesota Electric Company, Minneapolis, Minn., manufacturer of the Chapman lightning arrester, reports that this device sells as fast as it can be made. This arrester, which can be used on any battery circuit, is used very extensively by telephone and telegraph companies, and is said to be very efficient and to give the best of satisfaction.

A. P. Hopkins & Co. of Escanaba, Mich., producers of cedar poles, state they have on hand, in their two principal yards at Corinne and Escanaba, a large stock of well-seasoned poles of standard sizes. Millard Hopkins, vice-president of the company, anticipates a heavy demand for poles and states that his company is prepared to fill all orders and make prompt shipments.

Pendleton & Gilkey, Minneapolis, Minn., the well-known producers of cedar poles, announce that they have recently broken their camps and are prepared to fill orders for any lengths. The firm has on hand a large stock of choice poles, and is prepared to quote low prices and make prompt shipments from its various yards, which are advantageously located.

Marshall H. Coolidge of Minneapolis, the well-known producer and wholesaler of cedar poles, is now on a trip to the western coast, looking over the prospects for the coming season's business, and making arrangements for business from the western states. He is expected back in about two weeks. C. B. Brooks, who is associated with Mr. Coolidge, states that in all his experience inquiries for prices for poles have not been as numerous as at the present time.

J. O. Therien, president of the Therien Tool Works of Minneapolis, announces a brisk demand for his specialties. This firm manufactures the Therien pole top, conduit scraper (which is extensively used by telephone, telegraph and electric-light companies) and a copper-wire reel. Mr. Therien has also recently placed on the market the "M.-T." telephone ringer, invented by Mr. Malthaner of Minneapolis. This device has been very highly spoken of by those who have used it.

The Pittsburg and Lake Superior Iron Company of Escanaba, Mich., which is among the largest producers of cedar poles, in anticipation of a large demand for poles during the present year, has produced an exceptionally large stock of poles, and is therefore in a position to fill orders of all kinds. H. W. Reade, the popular secretary and treasurer of the company, states that the pole business was never as prosperous as it is at the present time, and the outlook for the present season is exceptionally bright.

W. P. Bowring, secretary and treasurer of the C. H. Worcester Company, Marinette, Wis., producer of cedar poles, considers the prospects for the coming season particularly good. The past winter was an exceptionally good one for getting out stock, and as a consequence the Worcester company was able to produce an unusually well-sorted stock of poles to meet the demands from its large list of customers. The company has a small stock of seasoned poles left from last year and has been shipping poles all winter.

W. T. Reynolds of Minneapolis, Minn., is one of the leading men in the pole business, having been located in Minneapolis for the last five years. Mr. Reynolds makes a specialty of supplying only the choicest stock, and is said to make good grades his hobby. In addition to handling northern cedar, Mr. Reynolds also carries a large stock of Idaho poles. The business of Mr. Reynolds covers the entire West, and reaches as far south as Texas. Mr. Reynolds has supplied many of the largest consumers, and anticipates a heavy demand for poles during the coming season.

E. A. Lindsley, manager of the Menominee (Mich.) branch of the Lindsley Bros. Company, states that the Lindsley camps have just been broken up and the winter's cut has produced an exceptionally choice lot of poles, which are now being shipped to the various Lindsley yards. Mr. Lindsley says that his company now has at the Menominee yard in the neighborhood of 125,000 poles, including a big stock of seasoned poles left over from last year. Mr. Lindsley expects the demand for poles to be greater than usual, but thinks that by next September poles will be nearly all sold.

The Standard Pole and Tie Company of 135 Front Street, New York city, announces that the improvements which have been in contemplation on its yards in the South are now completed, and the shipments of poles will go forward without delay. Many changes have been occasioned, owing to the volume of business which the company is now doing. The company has recently closed additional orders for a large number of poles with the Empire State Telephone and Telegraph Company of Syracuse and the Central New York Telephone and Telegraph Company of Utica, N. Y., both of which companies are said to have shown a decided satisfaction in the material furnished them.

The Standard Underground Cable Company, by Mr. J. R. Wiley of Chicago, western manager, informs the Western Electrician that the A. S. Doxsee Electrical Company of St. Louis is not the agent for any of its products and has no connection with it "in any manner, shape or form." The Doxsee company, in a list of agencies on its business card, prints the line "Standard Underground Co. W. P. wire," and in a note last week the Western Electrician stated the fact, giving also the names of other concerns which the Doxsee company says that it represents as agent. The Standard Underground Cable Company is emphatic, however, in the assertion that it, at least, is not the "Standard Underground" referred to.

The Electric Storage Battery Company of Philadelphia, manufacturer of the Chloride accumulator, has recently closed several large contracts for the installation of storage batteries in connection with street-railway work on the Pacific coast. The Los Angeles Railway Company has contracted for three batteries, two consisting of 264 cells having a capacity of 1,000 amperes and one of 264 cells, having a capacity of 2,000 amperes. These batteries are to be operated in connection with differential boosters for the purpose of regulating on the railway load and for reserve in any emergency which may arise due to the temporary shutdown of machinery at the power house. The Pacific Electric Railroad Company has also contracted for a battery of 264 elements of 1,000 amperes capacity, to be operated in connection with a differential booster for regulation, peak work and emergency use. Several batteries are now in process of installation for the following roads in that section: Oakland Transit Consolidated, Los Angeles Pacific Railway, and North Shore Railroad.

The Western Electrical Supply Company of St. Louis states that in addition to the well-known Peerless direct-current desk and ceiling fan which it has been handling for a number of years it is now putting on the market an alternating-current fan made by the same company. The company states that this fan embodies all the new and up-to-date ideas of good, alternating-current fan-motor practice, and that wherever it has been installed its success has been almost instantaneous. It is made for any voltage or alternations and in all sizes, all fans being fitted with Peerless swivel trunnion, thus admitting either vertical or horizontal adjustment. It is said that this is one of the best built fans that has been put on the market, no expense having been spared either in the labor or material. The claim is made that it will throw more air with the least noise and the least current consumption of any fan on the market; also that it is the only fan on the market which has three distinct speeds. The finish is black japan body and base, with highly polished and lacquered brass blades, guard and trimmings.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 17, 1903.

722,662. Galvanic Battery. Michael M. Bair, Levallois-Perret, France, assignor to Société Anonyme le Carbone, Levallois-Perret, France. Application filed March 21, 1901.

The cover has a central aperture for the carbon electrode and a resilient wire frame holds down the cover. A number of coils on the frame are disposed about the aperture, and adapted to distribute the pressure of the frame evenly over the cover.

722,680. Relay. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 20, 1900.

The relay comprises a core, a magnetizing helix therefor included in the path of the calling current, a U-shaped armature of great inertia having its arms pivoted at their ends in the line of the core and normally lying in a plane inclined to the axis of the core, and relay contacts closed by the armature controlling the normally open branch which contains the call-bell, whereby the armature maintains a definite position and holds the call-bell circuit closed during the transmission of the calling current.

722,684. Self-winding Electric Clock. Oscar A. En Holm, New York, N. Y. Application filed December 11, 1901.

A restoring magnet is used in the clock.

722,701. Method of Treating Glowers for Electric Lamps. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 13, 1901.

The method consists in subjecting a glower blank to an arc formed between a plurality of carbon electrodes to raise the blank to conducting temperature and passing current through the blank to shrink it, the arc being utilized as one terminal for the blank during the shrinking operation.

722,702. Method of Making Electric-lamp Glowers. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed October 13, 1902.

The method of attaching terminal wires to electric-lamp glowers consists in forming a bead or enlargement around the terminal wire by compressing the glower end in a mold while in a plastic condition.

722,727. Method of Heating Rivets. Henrik V. Loss, Philadelphia, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 5, 1901.

The method consists in passing an electric current through the rivet from a point at a predetermined distance from its point or cylindrical end to a point at or beyond the junction of the shank and head.

722,728. Device for Electrically Heating Rivets. Henrik V. Loss, Philadelphia, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 5, 1901.

The device consists of a sectional clamp, the sections of which are mounted on flexible supports so that they may be moved toward or away from one another, adapted to engage the shank of the rivet, an engaging piece or seat adapted to engage the rivet at or near its head, the clamp and seat forming or being connected one to one pole and the other to the other pole of the source of electrical energy, and a flexible support for one of the contact devices so that it may be moved toward or away from the other.

722,737. Safety Device for Elevators. Alfred H. Meech, Chatham, N. Y. Application filed July 24, 1901.

In the device are a brake, an electric motor for actuating the brake and automatic means capable of operation independent of the movement of the car for throwing the motor into operation.

722,747. Electrical Heating Apparatus. John S. Peck, Pittsburg, and Karl C. Randall, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company. Application filed April 6, 1901.

722,756. Electrical Appliance for Elevators. James H. Roberts, New York, N. Y. Application filed January 13, 1903.

A compound-wound brake motor, controller, starting and stopping switches, with means for operating the switches and controller from the elevator carriage.

722,772. Current-collecting Device for Electric Railways. Charles A. Terry, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 8, 1896.

In a trolley are combined the head with two triangular plates revolubly mounted therein with bearings journaled near each corner of the plates and a wheel rotatably mounted on each of the bearings, whereby two of the wheels will be in contact with the trolley wire and one of the wheels will be in the inoperative position. (See cut on next page.)

722,790. Sorting Device for Electric-lamp Glowers. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 5, 1902.

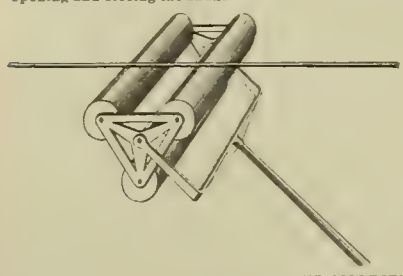
A rotatable frame provided with a series of sets of glower-holding clips and a corresponding series of ballast devices is combined with means for supplying current to the clips and means for successively heating the glowers to conducting temperature.

722,841. Electrical Massage Apparatus. Wilbur F. Hedstrom, Los Angeles, Cal. Application filed December 8, 1902.

The apparatus comprises a number of metallic tips, wires connecting the tips with a binding post, and an insulating cover for the wires.

722,852. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor to James H. Bell, Philadelphia, Pa. Application filed October 18, 1895.

In the system described are a sending device consisting of the primary of a converter connected locally to a source of current, the secondary of the converter consisting of two parts wound or connected in opposition to each other, the secondary being connected to the line-wire, a shunt circuit around one part of the secondary, and means for opening and closing the shunt.



NO. 722,772.—ELECTRIC-RAILWAY CURRENT-COLLECTING DEVICE.

722,862. Trolley. Samuel H. Limbert, Springfield, Ohio, assignor of one-half to Carl B. Limbert, Springfield, Ohio. Application filed May 8, 1902.

An arm is pivotally connected to the head by a universal joint, and a trailing trolley wheel is mounted in the rear end of the arm.

722,913. Electric Ignition Device. Nikolaus Schmitt and Johann Krannichfeldt, Cologne, Germany. Application filed February 25, 1902.

The device comprises a short, thin, flat and flexible strip of non-conductive material; short, thin, flat and flexible strips of conductive material disposed at a short distance apart on one and the same surface of, and carried by, the non-conductive strip; a mass of combustible material provided between and in contact with the two conductive strips; and means to assist the passage of the electricity from one conductive strip to the other through the combustible mass.

722,916. Motor-vehicle. Gordon J. Scott, Philadelphia, Pa., assignor to Charles H. Graham and George D. Bouton, Philadelphia, Pa. Application filed May 16, 1902.

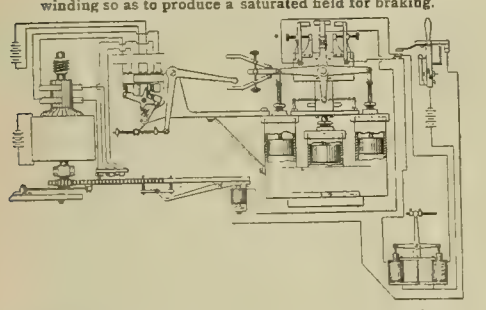
The vehicle is driven by an electric motor having a plurality of armatures arranged in a circle at right angles to the axes of rotation of the armatures, field-magnets forming a magnetic circuit common to the plurality of armatures, and gearing between the armatures and carrying wheels.

722,917. Engine-controlling Apparatus. Robert J. Sheehy, New York, N. Y. Application filed June 7, 1901.

An electric motor adapted to control the speed of a marine engine is combined with an electric circuit including the motor and two cut-outs, a vessel containing a liquid, means whereby a change of level of the liquid will actuate one of the cut-outs to start the motor, and means whereby the other cut-out will be actuated after the motor has run a predetermined time. (See cut.)

722,936. Electric-brake System. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 6, 1900. Renewed August 9, 1901.

A series motor having a subdivided field-winding is combined with a controller comprising power and brake switches, contacts on the power switch for connecting the field-winding to produce normally a field of comparatively low magnetic density, and contacts on the brake-switch for increasing the effective number of turns in the field-winding so as to produce a saturated field for braking.



NO. 722,917.—ENGINE-CONTROLLING APPARATUS.

722,946. Frame for Battery Electrodes. Herbert Cottrell, Newark, N. J. Application filed September 13, 1902.

A holder for electrode plates for reversible galvanic cells comprises a frame of sheet material, doubled to clip the electrode plates in its fold, and having a top extension perforated to receive a bolt whereby the frame may be clamped, and from which it may be suspended.

722,947. Electrode for Reversible Galvanic Batteries. Herbert Cottrell, Newark, N. J. Application filed September 13, 1902.

The electrode comprises an interior portion composed of layers of textile fabric carbonized, as an absorbent of a metallic salt in solution and carrier of a metallic oxide, to be made active in the battery, and an exterior portion consisting of plates composed of textile fabric carbonized, to form a casing for the electrode.

722,979. Electric Socket and Receptacle Attachment. Albert F. Hauss, Baltimore, Md. Application filed August 26, 1901.

A covering for electric-lamp sockets consists of a casing surrounding the socket and being secured thereto, in combination with an elastic packing securely clamped to the casing by an adjustable packing ring, the packing having an internal pliable edge closely fitting a lamp inserted therethrough, thus forming a tight joint with the same.

722,991. Rail Bond for Electric Railways. Thomas Kerr, London, Canada, assignor to George R. Kerr, London, Canada, and William W. Kerr, Chicago, Ill. Application filed August 5, 1901.

An electrical bonding wire extends diagonally across the line of and across the adjacent ends of the rails, and the ends of the wire are folded over the flanges of and abut against the webs of the rails.

722,992. Rail Coupling for Electric Railways. Thomas Kerr, London, Canada, assignor to George R. Kerr, London, Canada, and William W. Kerr, Chicago, Ill. Original application filed August 5, 1901. Divided and this application filed September 15, 1902.

The coupling consists of a base and two upright portions, the coupling being divided into two sections by dividing the base diagonally across the line of the rails, a groove formed in the base diagonally across the line of the rails, and a recess formed in each of the upright portions of the coupling.

723,016. Induction Coil. Albert L. Parcelle, Boston, Mass. Application filed August 15, 1901.

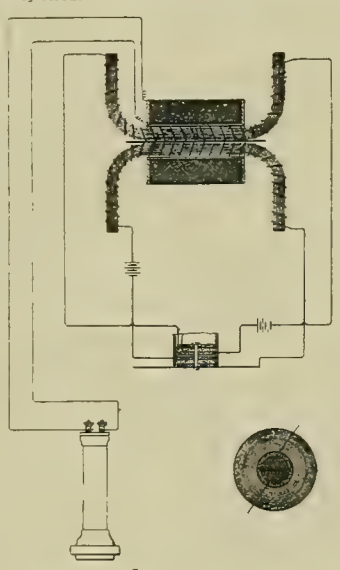
An improved induction coil is described. (See cut.)

723,019. Frame for Dynamo-electric Machines. Rudolf Pfeifer, Charlottenburg, Germany. Application filed February 18, 1902.

Combined with the annular stationary core of a dynamo is a supporting frame consisting of a number of segments of wrought angle iron.

723,048. Electromagnetic Bell-ringing Mechanism. John J. Sheahan, Buffalo, N. Y. Application filed November 3, 1899.

In the mechanism are a circuit carrying an actuating current and a solenoid, in combination with a primary circuit, and a circuit-breaking circuit closed by the action of the solenoid and energized by the battery energizing the primary circuit.



NO. 723,016.—INDUCTION COIL.

723,061. Generating Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 31, 1899.

The method consists of passing an alternating current through an electric circuit, thereby producing a magnetic field, and rotating a closed conductor within the influence of the field, thereby causing a pulsation of the admittance of the circuit of such nature as to bring the current therein partially into phase with the electromotive force in the circuit. (See cut.)

723,062. Third-rail Insulator. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 29, 1900.

A rail-insulator support is provided with ears for holding the rail upon its top and means for insuring free longitudinal and vertical movements of the rail between the ears.

723,076. Rectifier. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 15, 1898.

723,087. Shade Holder for Electric Table Lamps. Robert Walker, Meriden, Conn., assignor to the Bradley & Hubbard Manufacturing Company, Meriden, Conn. Application filed December 23, 1902.

In an electric table lamp combined with the standard and lamp socket thereof are a cup secured between the socket and standard and a shade holder comprising a ring adapted to set within the cup.

723,115. Circuit-breaker for Third-rail Shoes. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 25, 1902.

See page 242.

723,119. Controller. Thorsten von Zweigbergk, Preston, England. Application filed April 23, 1902.

One claim reads: The combination of a set of solenoid mechanisms, each including two members movable relative to each other, namely, a core and a coil of conductor, one of the members in each set being stationary, the other set of members being movable both collectively and independently, and contact mechanism operated by such movable members.

723,146. Signal Lantern. Frederick W. Dressel, New York, N. Y., assignor to the Dressel Railway Lamp Works, New York, N. Y. Application filed December 26, 1902.

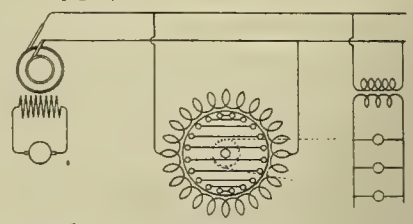
The lantern is equipped with incandescent lamps.

723,168. Propelling Means for Automobiles. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 2, 1900. Renewed August 16, 1901.

An internal combustion engine has a dynamo-electric machine driven thereby, a storage battery connected to the dynamo-electric machine, a second dynamo-electric machine, and a differential gearing to which both dynamo-electric machines are connected. (See cut.)

723,176. Apparatus for Electric Control of Devices at a Distance. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed December 16, 1898.

See page 248.



NO. 723,061. GENERATING ALTERNATING CURRENTS.

723,182. Automatic Street Indicator and Advertiser. Thomas A. Reader, Ann Arbor, Mich. Application filed July 26, 1901.

Combined with a continually moving driving mechanism are a normally open electric circuit, a movable indicator carrying the street names or other matter thereon, gearing for driving the indicator, means actuated through the closing of the electric circuit for intermittently connecting the driving mechanism with the gearing which drives the indicator, and means at each intersecting street for momentarily closing the electric circuit.

723,183. Circuit-breaker. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 29, 1901.

Means for extinguishing electric arcs comprise relatively movable electrodes, a piston for separating the same, and means responsive to predetermined conditions of the circuit including the electrodes for delivering gaseous pressure to the piston and at the arc to open the circuit.

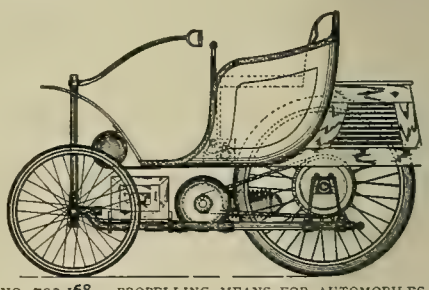
723,188. Method of Signaling. Nikola Tesla, New York, N. Y. Original application filed July 16, 1900. Divided and this application filed June 11, 1901.

See p ge 240.

723,189. Rectifying Alternating Currents. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Original application filed December 15, 1898. Divided and this application filed August 12, 1902.

723,199. Alarm Telegraph System. Albert Goldstein, New York, N. Y., assignor to Samuel Frank, Baltimore, Md. Application filed April 21, 1900.

A series of primary circuits are combined with a local alarm-transmitting apparatus connected to each circuit, a relay in each circuit, a secondary alarm-transmitting circuit at the exchange which is controlled by any of the relays, a source of electricity, a slow-acting cut-out switch operating in conjunction with each relay to cut off the control of the secondary alarm-transmitting circuit by the relay whenever there is more than the normal momentary operation of the relay, and an alarm-receiving apparatus which is operated from the alarm-transmitting circuit.



NO. 723,168.—PROPELLING MEANS FOR AUTOMOBILES.

723,205. Electrical Testing Apparatus. Harry A. Lewis, Norristown, Pa., assignor of one-half to William J. Caskey, Philadelphia, Pa. Application filed October 14, 1902.

One claim reads: The combination in a testing apparatus, of a primary circuit including a generator, a current interrupter, and the primary winding of an induction-coil, with a secondary circuit including the secondary of the induction coil, a telephone receiver and testing terminals, the secondary winding and the winding of the telephone receiver being both of relatively low resistance.

723,217. Manufacture of Titanous Chloride. Howard Spence, Manchester, England. Application filed August 15, 1902.

The process of obtaining titanous chloride from titanic chloride consists in subjecting an aqueous solution of titanic chloride to the action of an electric current between a cathode and an anode in an electrolytic cell divided by a porous partition into a cathode compartment and an anode compartment, the titanic chloride solution being contained in the cathode compartment while the anode compartment contains a dilute acid solution.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, APRIL 4, 1903 No. 14

Conversion of a Steam Road Near Cincinnati to Electric Traction.

By E. M. Stevens.

The Cincinnati, Georgetown and Portsmouth Railroad Company was organized in 1872 and received its charter from the state of Ohio soon afterwards. The company was chartered to build a steam railroad from Cincinnati, Ohio, Hamilton County, through Clermont, Brown, Adams and Scioto Counties to Portsmouth, Ohio. The road was completed first to Bethel, Clermont County, and equipped and built as a narrow-gauge railroad, but was afterward extended to Georgetown, the county seat of Brown County, to which town the road has always been and is now in operation. On October 1, 1901, the road was purchased by A. W. Comstock of Detroit, Mich., and W. R. Todd & Co. of Cincinnati, the present owners of the road. Plans were immediately made for changing from narrow gauge to standard gauge and equipping the road with electricity instead of steam.

During the last year this change of equipment has been going on and several extensions have been added to the original road, namely—from the main line at the New Cincinnati Water Works a branch has been built to Coney Island, which is one of Cincinnati's famous summer resorts, and from the power house, which is located at Olive Branch, about 15 miles from Cincinnati, another branch line has been constructed to Batavia, Ohio, the county seat of Clermont County, connecting the main line with the Norfolk and Western Railway. Its lines now comprise 50 miles of road, all of which except five miles was until lately laid to a three-foot gauge with 40-pound iron and 60-pound steel rails. At present, new 70-pound steel rail has been laid over about one-half of the road, the other half having been laid recently with 60-pound steel rail. New standard ties throughout the entire length of the road have been put in, and washed gravel of a very excellent quality is being used to ballast the road, so that when finished the roadbed will be of the highest order.

The right-of-way is owned in fee simple, the majority of it being 60 feet wide with ample sidings and facilities for freight business in all of the towns through which the road passes. In addition to this right-of-way the company owns valuable terminals in the city of Cincinnati where it has an excellent connection with the Pennsylvania Railroad which receives and discharges all freight, which it does now with the standard equipment. In addition to the terminal facilities in Cincinnati, the road has terminal facilities in the New Cincinnati Water Works, Amelia, Batavia, Bethel and Georgetown. A right-of-way has been secured and the survey completed to extend this line from Georgetown, the present terminus, to West Union, Ohio, the county seat of Adams County, a distance of 23 miles in an easterly direction. The right-of-way is private and the maximum grade encountered in this extension will not be in excess of one per cent. The average grade of the main line at the present time is less than one per cent., so that the operating expenses of this road necessarily will be small as compared with the ordinary traction roads.

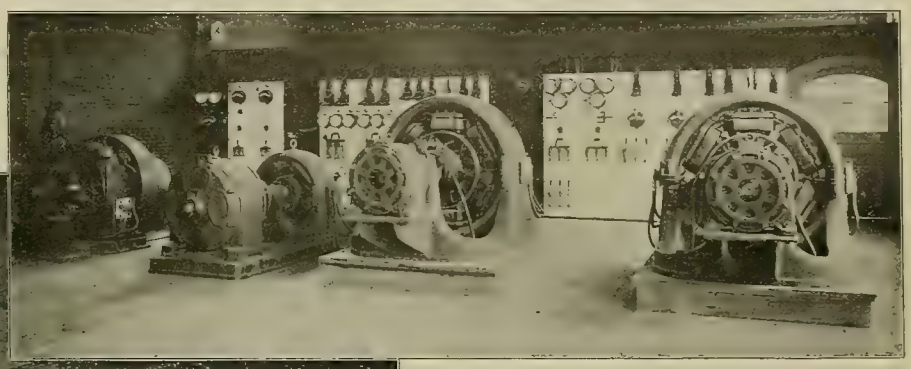
The electrical equipment now consists of the most modern that is known at the present time. The power house at Olive Branch is built of brick and concrete and is modern and up-to-date throughout, and is said by experts to be one of the finest of its kind in this part of the country. The following description of the power plant as at present installed is obtained from a report made by James Bryan, electrical engineer for the company:

The power-house building, including boiler and engine rooms, measures 151 feet 10 inches by 95 feet 10 inches. The engine room measures 151 feet 10 inches by 45 feet six inches, and the boiler room is of similar length, measuring from center to center of walls 48 feet six inches. The building is of brick with steel roof trusses, slate roofing on two-inch tongued and grooved sheeting. The boiler house is arranged for four batteries of boilers of 500 horsepower each; there being two 250-horsepower boilers in each battery. The boilers are Cahall Babcock & Wilcox water-tube boilers; there being a smokestack for each battery of boilers. There are at present installed three of these batteries with a total horsepower of 1,500. The foundation for an additional battery is constructed ready for its installation, if required, at some future date.

In the boiler room are two Worthington feed-pumps, each of sufficient capacity for feeding 2,000 horsepower of boilers. There is also one 2,000-horsepower Stillwell & Bierce open-type heater; together with all piping and fittings required. Coal storage is arranged alongside of the boiler room so that cars can be run on a trestle track and the coal dumped into bins.

In the engine room there are foundations for three cross-compound engines constructed; together with foundations for exciter engine, rotary converters and switchboard. There is a space at one end of the engine room measuring 14 by 45 feet, partitioned off by a brick wall for a transformer room. In the opposite end of the engine room is a pump pit, measuring 22 by 45 feet; the floor of this pit being some 14 feet below the level of the engine-room floor.

There are at present installed two cross-compound condensing Hamilton-Corliss engines. The dimensions of these engines are high-pressure cylinders, 24 inches diameter, low-pressure cylinders 44 inches diameter. The engines have a 42-inch stroke and are designed to operate at a speed of 90 revolutions. Direct-connected to these engines are two Westinghouse 600-kilowatt, 3,000-alternation, 360-volt, three-phase, alternating-current generators.



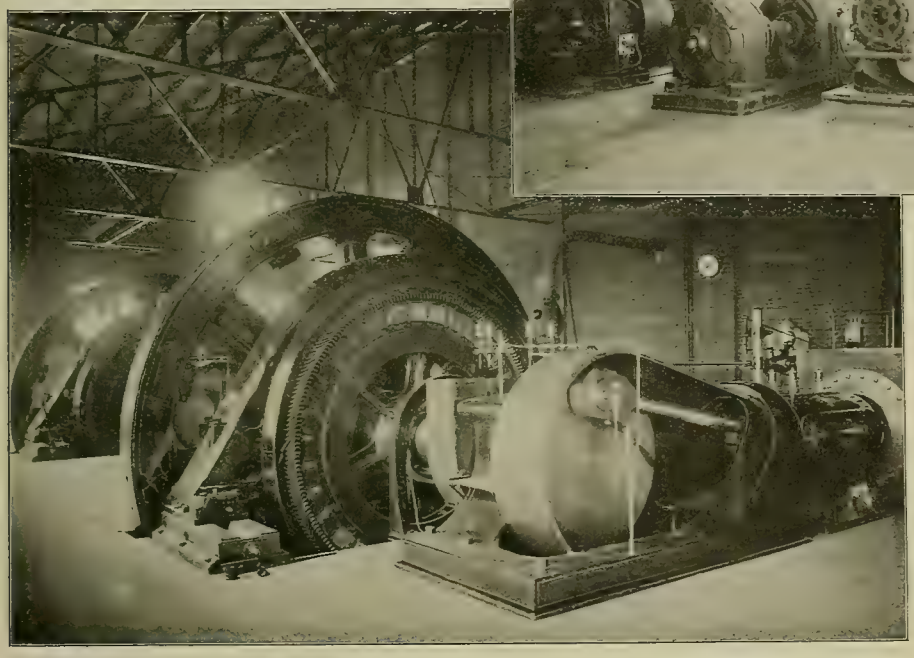


Fig. 1. Direct-connected 600-kilowatt Generating Units.

CONVERSION OF A STEAM ROAD NEAR CINCINNATI TO ELECTRIC TRACTION.—VIEWS IN POWER HOUSE AT OLIVE BRANCH.

Fig. 2. Exciter Units, Rotary Converters and Switchboards.

These units are illustrated in Fig. 1. There are also in the power house one Harrisburg exciter engine, directly connected to a 50-kilowatt Westinghouse generator; one Westinghouse motor-driven exciter set, consisting of a 75-horsepower, 360-volt, three-phase motor, directly connected to a 50-kilowatt, 110-volt generator; two 250-kilowatt, 25-cycle, 360-volt alternating-current, 600-volt direct-current rotary converters; together with marble switchboards complete, for control of generators, rotary converters and having switchboard panels for the control of long-distance transmission circuits. The exciter units, rotaries and switchboards are shown in Fig. 2. In the transformer room there are installed six 200-kilowatt, 360-15,000-volt step-up transformers; together with circuit-breakers and lightning-arresters for long-distance transmission.

The condensing apparatus consists of one central condenser of sufficient capacity for the operation of the three units for which the station is equipped. The water supply was obtained by building a dam across a natural ravine, through which flowed a small stream. The lake thus formed will average about 300 by 3,000 feet, with an average depth of 16 feet; this lake giving an ample and permanent supply of pure water.

There is in addition to the converting apparatus in the main power house three sub-stations, located one each at Mt. Washington, Bethel and Sunshine; these sub-stations being located so as to feed current to the line a distance of five miles each way. These sub-stations are also designed to answer as freight and passenger stations. The sub-station at Mt. Washington is a brick building, measuring 72 feet by 30 feet three inches, the freight room measuring 13 feet of the length and the waiting room measuring 13 feet of the length; the middle portion of the building being divided for the installation of the electrical apparatus.

The electrical apparatus installed in this sub-station is as follows, viz.: Two 250-kilowatt, Westinghouse rotary converters, and three 200-kilowatt, 360-15,000-volt step-down transformers, together with switchboard having alternating and direct-current panels, lightning arresters, choke coils, circuit-breakers, etc., complete.

The sub-station at Bethel is of similar design, excepting that the waiting room and freight room are larger. The general design of this sub-station is architecturally superior to the sub-station at Mt.

Washington; there being at one end a covered platform 25 feet wide to serve as a waiting space in the summer time. The electrical equipment of this substation consists of two 150-kilowatt rotary converters and three 100-kilowatt step-down transformers, together with switchboard and auxiliary apparatus. The sub-station at Sunshine is similar to the substations at Mt. Washington and Bethel.

The line construction is of the span-wire type. The long-distance transmission lines are supported on cross-arms on 35-foot poles. The construction of the trolley line and the high-potential transmission line is of the most substantial character; care being taken by the use of special cross-arms and special extra heavy pins and insulators to guard against stoppage of operation through mechanical failure of the transmission lines.

Provision has also been made in the construction of the transmission line eastwardly from the power house for the installation of an additional three-phase circuit to be used in event of the extension of the line eastwardly.

The trolley-car equipment consists of 10 passenger cars, having 40-foot bodies with a length of 50 feet over all and a width of eight feet 10 inches; three combination cars of the same type; 10 50-foot closed passenger cars, Pullman type, equipped with four 60-horsepower Westinghouse motors; six 40-foot open cars, equipped with four No. 68 Westinghouse motors; six 40-foot closed cars; six open passenger cars, 40 feet over all, width eight feet four inches; six closed passenger cars, 40 feet over all, width eight feet four inches. In addition to these passenger cars, there are two express, mail and baggage cars equipped with four 60-horsepower Westinghouse motors, and one combination baggage and passenger car equipped with same; 10 standard flat cars, equipped with Westinghouse air brakes and automatic couplers; 10 standard coal cars; 10 standard box cars; 10 standard stock cars.

The company has secured excellent facilities for receiving and delivering both passengers and freight at convenient points in the city of Cincinnati. With respect to the passengers, the company has entered into a contract with the Cincinnati Traction Company which, it is believed, is a most advantageous arrangement for this road, as, under the terms of the agreement, the cars of the Cincinnati, Georgetown and Portsmouth Railroad are permitted to run in over the tracks of the traction company to the very heart of Cincinnati.

Electric cars were first run on a regular schedule December 1, 1902, and the receipts since then have been 25 per cent. more than during the corresponding time last year, although the fare has been reduced one cent per mile. The present regular rate is two cents per mile, with a slight reduction for mileage, trip tickets, etc. During the past season, the Coney Island branch, which had already been equipped for electric traction, carried over 65,000 people per month.

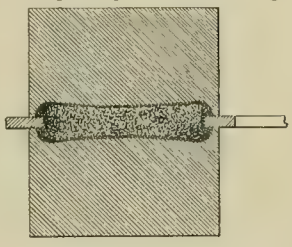
The business of the company in freight, express and passenger traffic, has shown a steady increase for a number of years. This increase has been more marked since the present management has had charge of the property. It is believed that, with the use of the electric motive power recently installed, the business of the company will be augmented many fold. Under the old regime but two passenger trains were run each way daily. It is now proposed to have at least hourly service each way over the entire line, with half-hourly or even more frequent service to points near the city, including Coney Island and other nearby popular resorts.

The present earning capacity of the road being ample for protection, the stockholders, on December 3, 1901, authorized an issue of $1,500,000 new stock and $1,000,000 bonds, having the same date cancelled all of the old bonds and stocks.

Edison Storage-battery Improvements.

Thomas A. Edison has recently added to his already large number of storage-battery patents, two new inventions including a complete battery and an electrode. The cell employs an alkaline electrolyte and one of the electrodes contains hydrated oxide of nickel as an insoluble depolarizing active material. The second electrode contains an insoluble active material, such as a mixture of electrolytically active iron and mercury, the proportion of iron employed being in excess of the mercury and being also in excess of the oxidizing capacity of the nickel, so that oxidation of the mercury, on discharge, is prevented.

The electrode which Mr. Edison has patented is illustrated in the accompanying cut. It comprises a plate with an opening in it and a pocket or receptacle containing a briquette of active material and secured in the opening. The pocket or receptacle is formed of two cup-shaped parts received one within the other, one of the parts having turned-over edges to lock the briquet therein and being in turn locked within the other part by turned-over edges. The



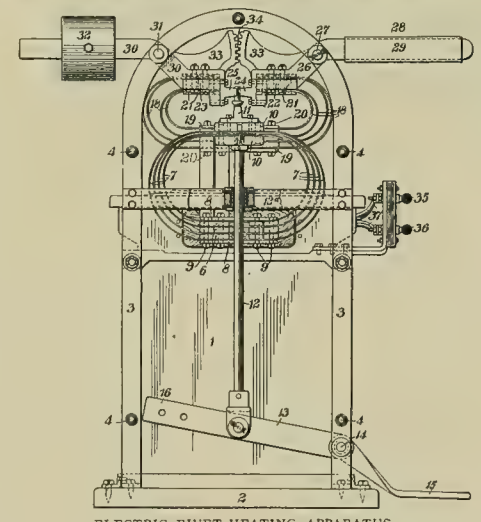
NEW EDISON STORAGE-BATTERY ELECTRODE.

exposed surfaces of the pocket or receptacle are concaved. These two inventions are covered by patents Nos. 723,449 and 723,450.

Electric Rivet-heating Apparatus.

An ingenious time and labor-saving device, recently patented by John S. Peck of Pittsburg and Karl C. Randall of Wilkinsburg, Pa., is designed to heat metal articles and particularly rivets, by electricity. The object of the invention is to provide a simple and easily operated apparatus whereby the article to be heated may be securely clamped between the terminals of the source of electricity employed for heating and as readily released when the heating operation is completed. The accompanying drawing is a view, mainly in front elevation, but partially in section, of the apparatus.

The intermediate source of electrical energy employed is a transformer, the casting (1) for which is shown as mounted upon a suitable base plate (2). The transformer itself may be of any suitable construction so as to give off from its secondary currents of large volume suitable for heating purposes. The gripping contact terminals and their operating devices are mounted upon a skeleton framework. One of the terminals of the transformer secondary is clamped between four flexible copper strips (7). The ends of the flexible strips (7) are curved upwardly and inwardly and at their upper ends are brought into close contact with each other and clamped rigidly between two blocks (10). Mounted upon the upper block (10) and in good electrical connection therewith is a removable contact block (11). The lower block (10) is securely connected to the upper end of a rod (12), which is operated by the foot lever (15). The other terminal of the transformer secondary projects a sufficient distance from the transformer to be clamped between flexible copper strips (18) by means of plates (19) and bolts (20). The copper strips (18) are curved outwardly and then upwardly and inwardly; but instead of

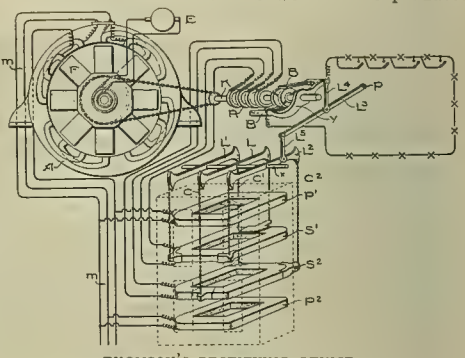


ELECTRIC RIVET-HEATING APPARATUS.

being brought together at their free ends the ends of the strips at one side are securely clamped, by means of suitable rivets (21), to an arm (22), and the ends of the strips (18) at the other side are in a similar manner clamped, by means of rivets (21), to an arm (23). The arms (22) and (23) project into the frame between the uprights (3), and their inner ends are respectively provided with removable contact terminal pieces (24) and (25), these terminal pieces together constituting clamping jaws, and are so formed as to receive and clamp one or more rivets, the head or heads of which rest upon contact block (11) when the parts of the apparatus are in operative position. Different voltages and currents may be needed for heating rivets of different sizes or because of other variations in operating conditions, and these may be obtained by any one of several means known in the art. As shown in the drawing, the inventors effect the desired result by means of two double-throw single-pole switches (35) and (36), leads (37) being brought out from proper points in the lengths of the primary winding of the transformer and connected to the stationary contact terminals of the two switches, so that the active length of the primary may be varied by proper manipulation of the switch arms.

Improvement in Alternating-current Rectifiers.

In order to obviate or reduce to a minimum the amount of sparking which may take place in the operation of rectifying devices for changing an alternating current of any particular character to a unidirectional current, it is necessary that the commutation or periodic disconnection of the alternating mains from the work-circuit carrying the unidirectional current should take place at such points in the wave of the alternating current or currents as will result in the smallest value of unbalanced electromotive force acting between the terminals of the respective circuits as they are being separated. If the relative positions of the commutator and brushes of the rectifying device at the instant of commutation bear a fixed relation in point of time to some particular phase value of the impressed alternating electromotive force, it will be evident that as the load changes in the work-circuit the instant at which commutation takes place will occur at different points or values in the current-wave, owing to the fact that the change in impressed electromotive force or effective resistance of the work-circuit produces



THOMSON'S RECTIFYING DEVICE.

a change in the phase relations between the impressed alternating electromotive force and current, wherefrom it follows that if the brush adjustment in the rectifying device be suitable for one particular load it becomes unsuitable for a different load or loads.

Prof. Elihu Thomson of Swampscott, Mass., has discovered that by automatically varying the times at which commutation takes place in accordance with varying load, such relations may be maintained between the electromotive forces acting at the instant of commutation as will result in a minimum amount of sparking of the rectifying device through its entire range of operation. He considers himself the first to devise a method for accomplishing this result, and he lays claim to it, broadly, in two patents recently granted him.

His invention comprises the broad idea of causing the operation of commutation in a rectifying device to be automatically made at such variable instants with respect to the phase of the impressed electromotive force as may be necessary to secure a minimum amount of sparking with changes of load. The brushes and commutator of a rectifying device such as he employs are relatively movable with respect to each other; but either of them may be fixed in space and the other movable with respect thereto. The drawing illustrates in diagram a rectifying device supplied with constant current and operating in accordance with his invention, the constant current being derived from the secondaries of two-phase constant-current transformers.

The alternating currents to be rectified may be derived from any suitable source, whether single phase or multiphase, and whether generated in that form directly or converted into that character by suitable transforming apparatus.

In the drawing is illustrated a two-phase generator (A), from which the current to be rectified is derived. The generator is preferably of the direct-driven slow-speed multipolar type now commonly employed. The generator has the usual revolving field (F) connected through collector rings with the exciter (E) for furnishing current thereto. The stationary member of the generator carries two sets of angularly-displaced windings in which currents differing in phase by 90 degrees are induced. These windings are interconnected in the ordinary manner, and mains (m) are connected thereto and lead to a distribution system from which current may be derived for any desired purpose—such as operating motors, lights, or other translating devices.

From the distributing mains (m) (m) connections are made to the primary coils (P′) (P²) of a constant-current transformer of the type operating by mutual repulsion of the primaries and secondaries of the same. The relative motion between the primary and secondary windings of a transformer of this type incident to changes of load in the circuit supplied by the secondary windings of the same is utilized suitably to shift the brushes which operate in connection with the rectifying device for changing the secondary alternating current into a unidirectional current. The movable secondary coils of the transformer are shown at (S′) (S²). The core of the transformer is indicated in dotted lines.

The secondary coils, as before stated, are relatively movable with respect to their respective primary coils, and in order to make the movement of each coil even, as well as dependent upon the movement of the other, the secondary coils are mounted in connection with some suitable system of mechanical devices, whereby the movement of one secondary coil toward its primary is communicated to the other secondary coil in such manner as to produce a similar movement of the latter coil. One arrangement of apparatus for accomplishing this purpose consists of balancing levers (L) (L′) (L²), to which the secondary coils are connected by flexible or link connections, as shown. The levers (L) (L′) (L²) referred to are separately mounted, so as to turn about the rod (x) as a fulcrum, or they may, if desired, be arranged on knife edges. One end of the lever (L) supports one side of the secondary coil (S′), while its opposite end supports one side of the other secondary coil (S²). The other ends of the respective secondary coils (S′) (S²) are supported through suitable connections from the opposing ends of the two levers (L′) (L²), as shown. These connections are so made and adjusted that the weight of the secondary coil (S²) overbalances that of the secondary coil (S′), with the result that when there is no current flowing the respective secondaries (S′) (S²) are brought closely adjacent to their respective primaries. It will be observed that the downward pull due to the secondary (S²) acts, through the chain (C) and lever (L), to raise one end of the secondary coil (S′), while the downward pull exerted by the secondary (S²) on its supporting chains (C′) (C²) acts, through the levers (L′) (L²), to raise the opposite end of the secondary (S′).

As the resistance in the secondary circuit increases, the current supplied thereto consequently tends to decrease, with the result that the secondary coils approach their respective primary coils, being no longer repelled by the same force as before. By this action the flux through the secondary coils is increased, thus causing an increase in secondary electromotive force and so tending to preserve a constant current in the secondary. The currents in the transformer secondaries are conducted by suitable leads to a rectifying device (K). The rectifying device may be directly mounted on the shaft of the prime mover, or it may be suitably geared thereto, as shown, or it may be driven by a synchronous motor, as may be desired. Suitable contact rings (R), carried upon the shaft of the commutating device and insulated therefrom and from each other, are connected to the respective terminals of the secondary windings, as shown. Each ring in its turn is connected to the corresponding segments of a two-phase commutator similar to the commutator in the Brush arc-lighting machine. One set of commutator segments is connected, through the corresponding rings (R), with one of the secondary coils of the transformer. Another set of commutator segments angularly displaced on the same shaft carrying the first set is connected, through other rings, with the other secondary coil. The breaks in one commutator come opposite the middle points in the conducting portions of the other commutator.

Brushes (B′) (B), carried by a suitable yoke (Y), bear upon the commutators, each brush making contact simultaneously with each commutator, as shown. The yoke (Y) is arranged to be rotated through a limited arc about the axis of rotation of the commutator in order to secure the proper adjustment necessary to a sparkless operation of the same. In order to render this adjustment automatic with changes of load in the work-circuit, suitable mechanical connections are made between the yoke (Y) and the moving secondaries of the transformer, the currents from which are to be rectified.

In the operation of the mechanical connections it will readily be seen that the reciprocating motion of the secondary coils (S′) (S²) of the transformer consequent upon changes of load in the circuit supplied thereby is transformed into an oscillating motion and is communicated to the yoke (Y), carrying the brushes (B). By proper attention to the mechanical design of this structure the motion communicated to the yoke (Y) may be made such as to shift the brushes (B) backward and forward as the load changes in such a manner as will result in a minimum amount of sparking at the commutator.

Machinery Building at St. Louis Exposition.

The rapid progress that has been made in the construction of the Machinery Building at St. Louis is well shown in the accompanying reproduction of a photograph taken but a few days ago. Although the building has been under construction less than four months, it is rapidly nearing completion, and will probably be among the first to be turned over to the exposition authorities. It is usual, among the contractors on the exposition buildings to cause each sub-contract to be completed before the next is taken up, but in this case, work was started on the west end of the building, and as soon as the footings were placed, the erection of the wall timbers was begun. Each gang of men followed the preceding, and as soon as the roofers had finished the extreme western end, the staff contractor began to apply the final covering, with the result that the west end of the building is now almost complete, even to the glass skylights, while the last roof trusses are being hoisted into place over the east end. The concrete foundations are now being laid for the Westinghouse generating plant that will be installed in the western part of the building, and this plant will be put in service as soon as possible, as the need of electricity, both for power and light, is beginning to be felt. As stated in an earlier issue of the Western Electrician, three 3,500-horsepower engines will be installed, direct-connected to 2,000-kilowatt generators.

MACHINERY HALL AT ST. LOUIS EXPOSITION.

B. J. Arnold Nominated for President of the Institute.

At the meeting of the American Institute of Electrical Engineers in New York on the evening of March 27th Secretary R. W. Pope made the interesting announcement that at the meeting of the board of directors in the afternoon the following ticket was formulated:

For president—Bion J. Arnold of Chicago.

For vice-presidents—Calvin W. Rice, Pittsburg; W. S. Barstow, New York; Ralph D. Mershon, New York.

For managers—Dr. Samuel Sheldon, Brooklyn; W. C. L. Eglin, Philadelphia; George F. Sever, New York; A. H. Armstrong, Schenectady, N. Y.

For treasurer—George A. Hamilton of New York.

For secretary—Ralph W. Pope of New York.

C. O. Mailloux was nominated for president by two of the directors, but his nomination was withdrawn at his own request.

The annual election of the Institute will be held in May. The directors' nominations are usually considered tantamount to election.

Boiler House with Concrete Walls.

The permanent boiler house, in which will be erected the big bank of boilers to generate steam for use on the World's Fair grounds, will be of novel construction—at least in that portion of the country. The framework of the building will be of steel, the construction work being done by the American Bridge Company, while the walls will be composed of concrete, three inches thick, and without a seam or joint. The piles to carry the framework are now being driven, and 125 will be required. The building will be 220 by 300 feet, the cornice being 50 feet above the ground. The steel-roof trusses will be supported on 45 latticed girder posts, and will have a span of 75 feet. They will weigh about five tons each. The Roebling Construction Company of New York has the sub-contract for pouring the walls of the building. When the steel frame is in place board casings will be fastened to the columns, leaving a space of about three inches between the boards. A mixture of cinders and concrete will then be rammed into place, and allowed to set. This construction makes an ideal fireproof building. A track will be laid into the boiler house to facilitate the installation of the equipment, and another permanent track will extend along the western side of the building, from which coal may be taken, by means of automatic conveying machinery, supplemented by crushers and screens. Between the boiler house and Machinery Hall will be installed briquette machines, cooling towers, etc. Lieutenant Carden, who is now in Europe, expects to have installed, on an exhibit basis, the most advanced types of briquette machinery, and it is possibile that the advent of these will have a decided influence on the fuel question in this country.

Electrical Exports for February.

The electrical exports from the United States for the month of February, 1903, amounted to a total value of $662,143, as compared with $847,537 for the corresponding month in 1902, showing a decrease of $185,394. The month also shows a falling off of $43,406 from the total for January, 1903. A comparison of figures for February of the present year and last year shows a greater decrease in the exports of electrical machinery than in electrical appliances, the figures being: Electrical machinery, 1903, $416,039; 1902, $592,374; electrical appliances, 1903, $246,104; 1902, $255,163. In the value of electrical machinery exported to the United Kingdom alone there has been a decrease of $161,221, the figures being for February of the present year $141,557, as against $302,778 for the corresponding month last year. This nearly accounts for the total falling off of $185,394.

Classified according to destination, the exports of electrical machinery to some of the principal buyers during February, 1903, were as follows: United Kingdom, $141,557; British North America, $135,674; Brazil, $55,979; Mexico, $33,430; British Australasia, $11,450; Japan, $7,194; Colombia, $5,578; France, $4,837; Central American States and British Honduras, $1,788; Argentina, $1,748; British Africa, $1,722; Germany, $1,556. With but four exceptions there has been a decrease in the value of exports to the above countries as compared with February, 1902. British North America and Brazil show the only substantial increases.

Electric Wagonettes in Detroit.

An electric-vehicle system has been organized in Detroit to compete with the Detroit United Railway. The Citizens' Transit Company is the name of the new organization, which will in about 90 days put on 15 automobile wagonettes, to run between the City Hall and Belle Isle. The vehicles, which are now nearing completion, will be somewhat of a novelty in Detroit. For summer use they will be operated as double-deckers, seating 40 passengers on the two levels. They are designed to run on any smooth road, the power being furnished by storage batteries. They will be fitted with electric lights and electric heaters. The company plans a modest beginning, with 15 vehicles. If successful, the scheme will be extended to take in most of the city lines and also tap new territory. The motto of the new company will be "No seat, no fare," and it is estimated that the trip can be made in about one-third less time than on the street cars, owing to the headway of the new wagonettes, which, when filled, will not be obliged to stop in the congested business district. The new vehicle is called the Imperial, and is the invention of Charles Berg of Chicago. A straight five-cent fare will be charged.

Arrangements are being made to carry mail between Seattle and Tacoma, Wash., over the Interurban Railway. The plan is to have mail leave the two cities about seven o'clock in the morning and again at noon.

POWER TRANSMISSION ON HIGH-TENSION LINES.

PART I.

At the regular meeting of the American Institute of Electrical Engineers in New York city on March 27th the subject discussed was power transmission on high-tension lines. The meeting was very well attended and was called to order by President Charles F. Scott. Several short papers were presented, and the contributions to the discussion that were sent in and the discussion which took place at the meeting were valuable and comprehensive. Much credit for the success of the meeting is due to Ralph D. Mershon, the chairman of the committee on high-tension transmission, which had charge of the meeting. President Scott introduced the subject and reviewed briefly the wonderful progress that had been made in the electrical transmission of power. The last 10 or a dozen years had witnessed a steady advance in the voltages in commercial use. He spoke of the purpose of the transmission committee of the Institute and mentioned how the progress in high-tension transmission was indicated by the transformer statistics of one of the large manufacturing companies, whose output for the last two years had exceeded that of the preceding 10 years.

Ralph D. Mershon then presented his paper which had been prepared to get discussions sufficiently full on which to base recommendations to the standardizing committee of the Institute on a standard pin. Mr. Mershon's paper follows:

MECHANICAL SPECIFICATIONS OF A PROPOSED STANDARD INSULATOR PIN.

BY RALPH D. MERSHON.

At present no general standard exists in the matter of insulator pins. As a result, there is often confusion and dissatisfaction in ordering and obtaining pins. This discussion of a proposed standard pin is intended to lead up to a general specification covering wooden pins, and, so far as it may, metal ones.

Theory.—The expression for the extreme fiber stress at any point of a beam of circular section fixed at one end and loaded at the other, as in Fig. 1 is

$$s = \frac{P\,x}{.0982\,d^3} \qquad (1)$$

where (assuming inches and pounds as our units)

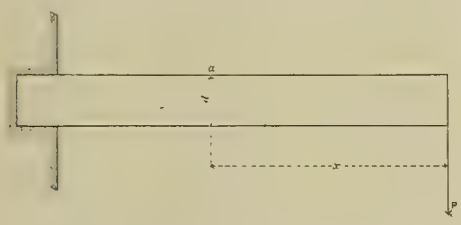


FIG. 1. POWER TRANSMISSION ON HIGH-TENSION LINES.

P is the pull or weight in pounds; x is the distance in inches from the point of application of P to any point (a) of the beam; d is the diameter in inches at the point (a); s is the extreme fiber stress in pounds per square inch, i. e., s is the stress on the extreme fibers at the top and bottom of the beam at the point (a).

This equation shows that for a given pull P the fiber stress at any point (a) at a distance x from the point of application of P varies directly as x and inversely as the cube of d. It is possible, therefore, to design a beam of circular section whose diameter in passing from the point of application of P to the point of support shall vary in such a way that s will have the same value all the way along the beam. Such a beam will be of uniform strength throughout its length. The value which, in such a beam, d must have at any point distant x from the outer end may be found by assuming s and P constant in equation (1) and solving for d in terms of x. This gives

$$d = \left(\frac{P}{.0982\,s}\right)^{\frac{1}{3}} x^{\frac{1}{3}} = K\,x^{\frac{1}{3}} \qquad (2)$$

where K is a constant whose value must be determined from the extreme fiber stress allowable with a given pull P. Equation (2) shows that in order to have the beam of uniform strength throughout its length, its diameter must vary as the cube root of the distance from the point of application of its load.

An insulator pin is the case of a beam of circular section fixed at one end and with a load (any side pull which may come upon it) applied at or near the other end. There is no object in having an insulator pin any stronger at any one point than at another. It should, therefore, in its capacity as a beam be tapered as nearly as practicable in such a way that s will be constant throughout, that is, so that equation (2) will apply to it.

The point where pins usually break, their weakest point, is just at the cross-arm. The wooden pin most generally in use is one having a diameter of about 1½ inches in the cross-arm and a length such that the wire is from five to six inches from the cross-arm. Let us obtain the value of K in (2) on the assumption of d = 1½ inches and x = five inches. This gives the value of K as .877, so that, substituting, (2) becomes

$$d = .877\,x^{\frac{1}{3}} \qquad (3)$$

From (3) we may find the diameter required at any point in any length of pin, the pin to be of uniform strength throughout. Substituting various values of x we have a table which shows that for a pin having upon it a pull one inch above the cross-arm,

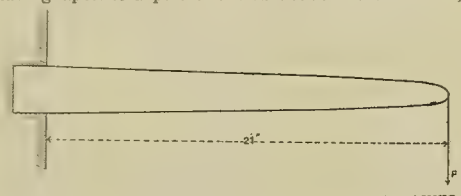


FIG. 2. POWER TRANSMISSION ON HIGH-TENSION LINES.

the diameter at the cross-arm must be, 0.877 inch; that one having a pull upon it 10 inches above the cross-arm must have a diameter at the cross-arm of 1.88 inches, etc. Fig. 2 is a sketch of such a theoretical pin drawn by platting the above values to a scale one-quarter of full size. Fig. 2 represents all sizes of pins up to and including one, the pull upon which is applied 21 inches above the cross-arm. That is, if we want a theoretical six-inch pin, we must cut six inches off the end of Fig. 2 and use that; for a 10-inch pin we must cut off 10 inches, etc.

The practical pin must be a modification of the theoretical pin. The end must be square and a portion of the small end must be threaded. The pin must also have a shoulder just above the cross-arm. It will be noticed that, except near the end, the sides of the theoretical pin are practically straight. It will suffice, therefore, if in designing a pin we fix the diameter at the lower end of the thread portion and the diameter just above the cross-arm and make the contour between these points a straight line.

Threaded End.—It is proposed to make the diameter of the small end of the pin one inch; the length of the threaded portion 2½ inches, and the diameter at the lower end of the threaded portion 1.25 inches, so that the threaded portion will taper from 1.25 inches to one inch in a length of 2½ inches. The threaded portion of the insulator should have the same dimensions and taper as that of the pin.

Shoulder.—It is proposed to make the shoulder three-sixteenth inch on all pins. That is, the diameter of the pin just above the cross-arm will be three-eighths inch greater than the nominal diameter of that portion of the pin in the cross-arm; it is proposed to carry this diameter one-fourth inch above the cross-arm before tapering the pin.

Dimensions in Cross-arm.—It is proposed to make the diameter of that portion of the pin in the cross-arm, just below the shoulder, one thirty-second inch less than the diameter of the hole in the cross-arm and at the lower end of the pin one-sixteenth inch less than the diameter of the hole in the cross-arm. It is proposed, also, to designate this portion of the pin as having a nominal diameter equal to that of the hole in the cross-arm into which the pin fits. Therefore, that portion of a pin which is to fit a 1½-inch hole in a cross-arm will have a nominal diameter of 1½ inch, but will have an actual diameter just below the shoulder of one fifteen-thirty-second inch, and at the lower end of the pin of one seven-sixteenth inch.

Thread.—It is proposed to use on all pins a thread having a pitch of one-fourth inch, or four threads to the inch, the form of thread to be that shown in Fig. 3. As there shown, the angle between the faces of the thread is 90°, and the top of the thread is flattened by cutting off, from the form the thread would have if not flattened, one-fourth its unflattened depth. The form of the thread in the insulator should be the same as that on the pin. If this is done it will insure the bearing surface being always on the sides of the threads and never on the edges.

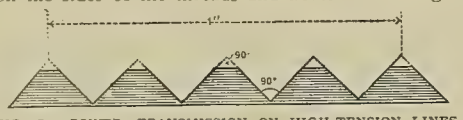


FIG. 3. POWER TRANSMISSION ON HIGH-TENSION LINES.

Designation.—It is proposed to designate that portion of the pin above the cross-arm as the "stem" of the pin. That portion in the cross-arm as the "shank" of the pin. It is proposed to designate a pin by the length of its stem, i. e., a pin whose stem is five inches long will be designated as a "five"-inch pin, one six inches long as a "six"-inch pin, etc.

Dimensions of Standard Pins.—In accordance with the above, the following table has been prepared, giving a number of sizes of pins, and their dimensions, which it is proposed to make standard. The diameter of the shank has in each case been fixed by making it approximately equal to (slightly larger than) the diameter of the theoretical pin corresponding to the length of the stem of the pin in question. The headings of the columns of the table refer to the lettering of Fig. 4. Fig. 4 is a full-size unthreaded five-inch (proposed standard) pin.

Size of Pin.	A	B	C Nominal.	C Actual.	D	E	F	G	H	I
5"	5"	4¼"	1½"	1 15/32"	1 7/16"	1¼"	1"	¼"	1⅞"	2½"
7	7	4¼	1¾	1 23/32	1 13/16	Same for all sizes of pins	Same for all sizes of pins	Same for all sizes of pins	1⅞	2½
9	9	4¼	1⅞	1 27/32	1 13/16				1⅞	2¼
11	11	4¾	2	1 31/32	1 15/16				2⅜	2⅜
13	13	4¾	2⅛	2 5/32	2 1/16				2⅛	2⅛
15	15	4¾	2¼	2 5/32	2 1/16				2⅝	2⅝
17	17	5¾	2⅜	2 13/32	2 5/16				2¾	2¾
19	19	5¾	2½	2 13/32	2 5/16				2⅞	2⅞

DISCUSSION.

M. H. Gerry, Jr., of the Missouri River Power Company: Mr. Mershon has suggested the adoption as standard of certain forms of wooden pins, the designs of which conform to common construction. Most engineers of experience, however, would be in favor of a diameter greater than one inch at the top of the pin, and a greater length of thread than 2½ inches. Wooden threads most frequently fail by shearing, and the strength in this particular is greatly increased by a larger diameter of pin, and a greater length of thread. The longer thread is an advantage also, in preventing the insulator from tipping out of line, when the fitting is loose between the thread of the pin and that of the insulator. The shoulder of the pin, as suggested by Mr. Mershon, has certain disadvantages for heavy construction. On account of the rounding off of the top of the cross-arm, this form of shoulder does not bear well, and the sharp corner at the point of greatest strain introduces an element of weakness. A form of shoulder which has been used by the writer with considerable success tapers at an angle of 60°, and fits into a counterbore, in the top of the cross-arm. With this design the pins may be driven to a firm bearing at the top of the cross-arm, which has the effect of steadying the pin and increasing the strength of the construction at this point.

In lieu of the form of thread proposed by Mr. Mershon, the writer suggests a design in which the square top of the thread is as wide as the groove, resulting in increased area of wood to withstand shearing strains.

William R. C. Corson, Hartford, Conn.: Mr.

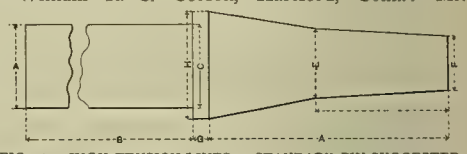


FIG. 4. HIGH-TENSION LINES.—STANDARD PIN SUGGESTED.

Mershon's method of developing the table of dimensions of the proposed pin is so rational that criticism of it is difficult. Briefly stated, of course, this method assumes the pin in general use as a basis, and mathematically determines the diameters of pins of different length which shall be capable of sustaining the same tension at their extremity as will this pin. In other words, the safe load that may be applied at the top of the proposed pins is of constant value in all. This value is not discussed, and, feeling that its determination would be of interest to me and might prove of value, I have made a series of tests in a Seller's machine to ascertain the value of "s" in equation (1) for the ordinary locust pins under the actual conditions of support suggested.

C. L. Cory of San Francisco: The mechanical strength of insulator pins for use on long-distance transmission lines has been given much consideration by electrical engineers in California during the last six years. For the most part the insulator pins in use are wood. On the 33,000-volt, 83-mile double circuit, three-phase transmission line of the Edison Electric Company, from its Santa Ana power house to the city of Los Angeles, iron pins with porcelain sleeves are used, and in this transmission is the most notable system in California at the present time using insulator pins other than wood.

Eucalyptus has been found to be perhaps the best wood to use for insulator pins. After being turned up and threaded, they are usually treated with hot linseed oil. This treatment is desirable more on account of the protection which such treatment gives the pin against weather than on account of the insulating qualities of the oil or oil treatment.

It should be understood in this connection that an insulator pin should be depended upon only to support the insulator. The insulator in turn should be depended upon to provide the necessary insulation for the line wires. No pin after being in use for a few years on a pole line can maintain to any marked degree the insulating qualities originally existing, due to such oil or paraffine treatment.

Some tests were made in the electrical laboratory of the University of California for the purpose of determining how near the pins generally in use in California conform to the proposed standard pins suggested by Mr. Mershon.

The average results, referring to the "real breaking load" of the tests of two pins are, respectively, 1,085 pounds for the 6⅞-inch pin and 2,310 pounds for the 10⅛-inch pin. The character of break in the two pins, however, is not the same. Almost without exception the 6⅞-inch pins were broken approximately square off at the cross-arm. The larger pins, however, split in the stem, the beginning of the split

being just at the bottom of the thread. The shank is the weakest part in the 6⅞-inch pins, while the stem, and particularly the upper portion of the stem or thread, is the weakest part of the 10⅛-inch pins. The variation of the "real breaking load" for the different 6⅞-inch pins tested is from 705 pounds maximum to 1,360 pounds minimum. For the 10⅛-inch pins this variation is from 1,475 pounds minimum to 3,190 pounds maximum.

For good construction on lines using 30,000 to 60,000 volts, the larger pin must be used. It does not seem, however, that any good reason exists for a great number of different sizes of pins, as it would seem probable that the two sizes tested might be used to fulfill almost every requirement for transmission work where wooden pins are at all allowable.

In many respects an iron pin is better than one of wood. In the first place, to secure sufficient strength in the shank, the wooden pin must be of such a large diameter that the size of the cross-arm is necessarily increased. In addition, using an iron pin, the insulator can be held down on poles or supports where the tendency of the line wire is to raise or pull the pin out of the cross-arm. In using wooden pins, this is usually prevented by driving a nail through the cross-arm into the shank of the pin.

D. L. Huntington, electrical engineer of the Washington Power Company, Spokane, Wash.: Wooden pins are subject to so many uncertainties where used in connection with very high voltages, especially where the atmosphere contains salt, smoke or dust, that it seems desirable to abandon their use for such purposes, wherever possible, and to substitute a metallic pin. The construction of a long-distance line for 60,000 volts led the writer to make some investigation as to what could be done in this direction without excessive cost.

It was decided that a drop-forged or a turned-steel pin would be so expensive as to exclude either, even if the time at our disposal would have permitted. Experiments were made with cast-iron pins almost identical in dimensions to that shown in Fig. 8 of Mr. Chesney's paper, except that it was cored out internally so as to make its weight about 10 pounds. The diameter of the shank was 2⅛ inches. This pin sustained a load slightly in excess of 3,000 pounds, suspended from near the end of the threaded portion, before fracturing.

We have designed and adopted a pin 18 inches long, made of 1⅛-inch round-milled steel bar, and having a shoulder and shank cast upon it. This pin we find will begin to bend when loaded with about 1,000 pounds at the upper end—the shank being rigidly supported. This is much lower than the results obtained by the cast-iron pin referred to above, but it is believed that it is more reliable and that it is sufficient for nearly all ordinary work. In addition, the steel bar will not snap off under sudden shock, but will support the insulator and line safely even when badly bent.

W. N. Smith, New York: In this table of dimensions for a standard pin, which is proposed, it seems to me that the dimensions given are all very well for a pin carrying a certain weight of wire, but it does not seem to me that a single standard table of dimensions could be laid down to cover anything like all the conditions of various power transmission lines all the way from a line of 5,000 or 6,000 volts, No. 4 wire, up to a line like the Niagara Falls power transmission plant, which has a 300,000-centimeter cable. It struck me the scheme of the tabulation should be enlarged and gone over carefully, so as to have a separate tabulation for a small range of weights of copper wire to cable.

P. H. Thomas, New York: Something should be said about the method of treating the pins to make them waterproof and to do it without destroying the mechanical properties of the pin. Another point is, there is trouble experienced in putting up a line where the pin comes to a bearing on the inside of the insulator.

Mr. Mershon: There was a remark made by Mr. Gerry to the effect that it is too early to adopt a standard pin. I think if we adopted a standard and changed it from year to year, we should not be any worse off than we are now, when we have no standard.

Transposition and Relative Location of Power and Telephone Wires.

BY P. M. LINCOLN.

There are three ways in which disturbing current in telephone circuits may be caused by the high-tension circuit: (1) Electromagnetic induction. (2) Electrostatic induction. (3) Leakage.

It is the first two causes of disturbances which will claim particular attention in the following discussion.

Electromagnetic induction may be briefly described as a transformer action. In Fig. 5 let (a), (b) and (c) be the conductors of a three-phase line, and (m) and (n) the two wires of a paralleling telephone circuit; (a) and (b) may then be regarded as the primary and (m) and (n) as the secondary of a transformer. The electromotive force in circuit (m) (n) will depend, among other things, upon the amount and frequency of the current in the inducing circuit. By transposing (m) and (n) in the well-known manner, the electromotive forces set up in one part of the telephone circuit will be neutralized by equal and opposite electromotive forces set up in other parts. Thus, the electromagnetic effects between (m) and (n) may be entirely neutralized by transposing the telephone wires only, regardless of whether the transmission wires are transposed or not. It may be well to note, however, that while the electromotive force between the two telephone wires may be reduced to zero by properly transposing the telephone wires only, the electromotive force between the two telephone conductors considered as one side of a circuit and the earth as the other, can be reduced to zero only by transposing the power wires. This point is of little importance, however, as any electromagnetic electromotive force between the telephone wires and ground is entirely overshadowed by the electrostatic which will be considered later.

Electrostatic effects will also take place in (m), (n), due to transmission circuit (a), (b), (c). If conductor (a) has a minus charge, for instance, it will induce a certain plus charge on (m) and a smaller plus charge on (n), on account of (n's) greater distance from (a). If now the minus charge be removed from (a) current will flow from (m) to (n), proportional to the difference in the amounts of these charges. The electrostatic influence of (b), being opposite (a) in sign, will reinforce the action of (a). Transposition of the telephone wires will have the effect of neutralizing this tendency of setting up electrostatic currents between (m) and (n). It is important to note that a system of transpositions designed to correct electromagnetic induction between the wires will also be correct for electrostatic induction.

Considering the comparative electromagnetic and electrostatic disturbances in a section of untransposed telephone line, it may be interesting to observe that the first is in the nature of a constant-potential effect and the second of a constant-current effect. The electrostatic and electromagnetic effects become roughly equal with an arrangement shown in Fig. 5, when (a), (b), (c) is a line carrying 50 amperes at 20,000 volts, and the telephone circuit contains a total resistance of 1,000 ohms, including receivers.

The bridged telephone has almost universally taken the place of the series instrument for all telephone work. The series telephone is particularly objectionable for use on a circuit in which static induction takes place to any great extent. The reason for this is seen by an inspection of Fig. 6. The telephone wire (m) has between (A) and (B) a plus charge induced and between (B) and (C) a minus charge. There is, therefore, at the transposition point (B) a flow of current from one section of (m) to the other. If now a series telephone be placed in series with (m) at (B), it not only gets the benefit of this charging current between the two sections of (m), but it also creates a difference of potential and, therefore, disturbing currents in telephones at (A) and (C) as well.

The points, therefore, which deserve careful consideration in the installation and operation of a telephone line when it is to be operated in proximity to a high-tension transmission line are the following: (1) Insulation. (2) Transpositions. (3) Use of bridge telephones instead of series telephones. (4) Making static capacity of telephone wires to ground

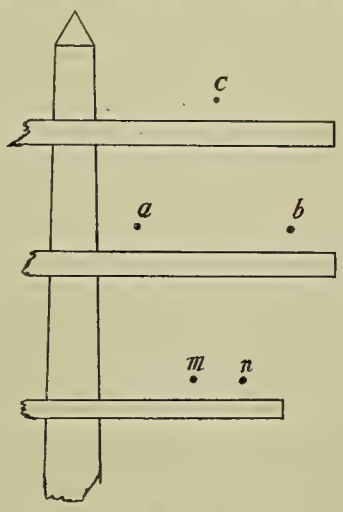


FIG. 5. HIGH-TENSION LINES.

as great as possible, and capacity to power wires as small as possible.

Insulation is put first as being the point of first importance. A ground on the transmission line is going to cause either volts or trouble on the telephone line. There is no reason why the telephone wires wires will not transmit speech properly, even if it does differ in potential from the ground. But to obtain this result, disturbing currents from the line to earth must be prevented by perfect insulation. When it is realized that the potential between the telephone line and ground may be as high as 30 per cent. of the potential between power wires, the importance of insulation is better understood. By insulation, too, is meant the insulation throughout the entire line.

When providing high-tension insulation for the telephone line, the insulation of the man using it should not be forgotten. This insulation of the telephone user is advisable, not only to protect him from the induced voltage but also to protect him in case of a cross with the power line.

The necessity of transposing the telephone line is almost so apparent as not to need comment. Otherwise continuous disturbances will exist, due both to electromagnetic and electrostatic effects. So far as the telephone line is concerned, transposition of the power wires is not so important.

In Montana there is a line in operation at 50,000 volts. Other lines are projected as high as 60,000 to 80,000 volts, and there is a possibility of going higher. When one realizes that with the usual construction as shown in Fig. 5, there may be in such cases an elevation in the potential of the telephone wires of 20,000 to 25,000 volts above ground he begins to cast about for some method of reducing this potential. The total voltage between the neutral

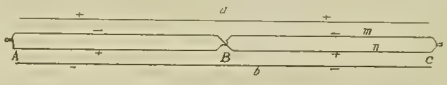


FIG. 6. HIGH-TENSION LINES.

point of the power wires and ground may be considered as taken up across two condensers, one consisting of the power and telephone wires, and the other the telephone wires and earth. To decrease the possible potential of the telephone wires to ground, therefore, one must either decrease the capacity of the power wire, telephone wire condenser, or increase the capacity of the telephone wire, earth condenser, or both. This may be accomplished by increasing the distance between power and telephone wires, and decreasing the distance between telephone wires and earth. If the same supporting structure be used there is a limit to which this can be carried, at which the possible voltage between telephone wires and earth may be still prohibitive. The capacity of the telephone wire-earth condenser, may be still further increased by bringing the earth to the telephone wires, instead of the telephone wires to earth. That is, one or more ground wires may be run in close proximity to the telephone wires, thereby increasing the capacity of the telephone wire-earth condenser to almost any desired limit. By this means the possible potential between telephone wires and earth may be brought within limits where it may be taken care of with safety.

[*To be continued.*]

Chicago Street-railway Situation.

Both Carter H. Harrison and Graeme Stewart, candidates for election as mayor of Chicago, have appointed committees of prominent men to go to Springfield and advocate the passage of the Mueller municipal-ownership bill by the Illinois Legislature.

Former Judge Egbert Jamieson, at one time counsel for Charles T. Yerkes and the North Chicago Street Railway Company, has delivered a report to the local-transportation committee of the Chicago City Council, arguing the invalidity of all rights based by the street-railway companies on the so-called "99-year act." The report assumes the validity of the act, but shows that it was later modified with the consent of the street-car companies in such wise that the 99-year rights were abrogated. It is a contradiction of the opinion delivered by Benjamin Harrison.

At a recent meeting of the Chicago City Council an ordinance for a franchise to be given William Eliot Furness and Solomon Sturges for a "moving sidewalk" was presented and referred to the local-transportation committee. The privilege of transporting passengers, freight and merchandise is asked. The sidewalks are to be constructed in subways. The promoters point to the fact that the moving sidewalks can carry great numbers of passengers without delay and without accident, obviating the necessity of long waits, and they use the experiments made at the different expositions as proof of the fact.

Student Membership of the Institute.

The American Institute of Electrical Engineers has arranged to extend certain privileges to those who are regularly pursuing studies in electrical engineering. Such individuals will be designated as students of the American Institute of Electrical Engineers. Students regularly pursuing electrical studies may attend technical meetings of the Institute, receive the monthly Transactions and purchase the bound volumes of Transactions by paying $3 a year and complying with certain entrance formalities. No student shall have these privileges for more than three years. It should be understood that these privileges render eligible not only those students who are pursuing studies in higher technical institutions, but also young men who are pursuing electrical studies either through the help of correspondence schools or privately. The purpose of the Institute is to assist these young men by bringing them into closer contact with the electrical engineering profession and furnishing them with the monthly Transactions containing valuable papers and discussions, which will be of great assistance to them in their work.

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DATES AHEAD.

Iowa Electrical Association, Masonic Temple, Davenport, Iowa, April 8th and 9th.

American Electrochemical Society, Chemists' Club, 108 West One-hundred-and-fifty fifth Street, New York city, April 16th to 18th.

National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

QUITE a striking similarity is shown in the reports of exports of electrical machinery from Germany and the United States in the year 1902. The official figures of valuation are: Germany, $5,229,360; United States, $5,937,643. It is not known whether the classification of apparatus under the head "electrical machinery" is the same in the two countries, but probably there are some variations. The total value of electrical exports from the United States in 1902 was $9,997,195, of which $4,059,552 was contributed by electrical appliances, including telegraph and telephone instruments. If the German government lumps all electrical exports under the head "electrical machinery," the United States is seen to have a much greater volume of foreign electrical trade; otherwise the two countries are quite evenly matched, on last year's returns, with some advantage in favor of the American manufacturers.

IF, as has been stated, the London Times is receiving transatlantic news service by space telegraphy, the fact will go far toward the "doing something" on the part of the "wireless" inventors and promoters for which the Western Electrician asked last week. Still one is curious to know how the new service compares with the cable in speed, reliability and cost. Is it adopted as a novelty or as a practicable auxiliary in news gathering? Do the space-telegraph messages appear regularly every day? What measures are taken to preserve the secrecy of the dispatches? And if press matter is now accepted for transmission, when will commercial messages be taken? These are some of the questions that are asked, in no unfriendly spirit, by those who think that the time is ripe for space telegraphy to pass from the experimental stage to the domain of practical usefulness.

"HAVE you a traction record?" is now a typical Chicago salutation. What with Strap Hangers' Leagues and Universal Transfer Associations and Municipal Ownership Clubs and traction, traction, traction from the platforms of a hundred political meetings daily, it is no wonder that the man in the street should be glad to get some amusement out of the situation by the use of a new catch phrase. The cause of these thunderous billows of talk is the lashing of the sea of politics in a mayoralty campaign on the rocky eminence of franchise-expiration. The official platform utterances of the two principal parties were given in the Western Electrician last week. They are vigorously ambiguous enough to suit almost anybody, but the utterances from the stump are still more contradictory, bellicose, uninformed and—funny. One of the candidates for mayor, in airing his highly esteemed "traction record" in a South Side hall a few evenings ago, said that the local-transportation committee had gone out of town to get an engineer named Arnold and that this expert had been a year and nine months in making his report! Such is fame.

AFTER lo, these many years, the American Institute of Electrical Engineers, through its board of directors, has nominated a western man for president in the person of Bion J. Arnold of Chicago. The directors could not have made a better choice, and we heartily congratulate both the Institute and Mr. Arnold on the selection. The nomination should be, and presumably is, equivalent to an election, and Mr. Arnold will no doubt have the pleasure of presiding over the Institute during the period of the World's Electrical Congress—if there shall be one—at the time of the St. Louis Exposition. In every way—in engineering attainments, in vigor, energy and enthusiasm, in wide acquaintance and in personal popularity—Mr. Arnold is well fitted to occupy the chair of the Institute and carry on the renaissance that has been such an acceptable feature of the administrations of Steinmetz and Scott. In addition, he is a western man, although spending much of his time in New York city and vicinity. Now, while no man shrould be elected president of the society merely because he is of the West, nevertheless it is wise for the Institute to distribute its honors with some consideration for geography, in this great country of ours, if other things are equal. Mr. Arnold will be the first president, if elected, to represent a state west of Pennsylvania, and as we have said before, it was high time, if the Institute desired to rid itself of the imputation of sectionalism, that the very natural desire of the West for recognition should be heeded. Happily, in the nineteenth year of the society's history, the directors of the organization have found a western man worthy of its highest honors. We are pleased that this is so, and we make no doubt that the western members are equally pleased; but even more gratifying is the fact that the honor is bestowed at once on the West and on a man so worthy of it, no matter what his place of residence, as Bion J. Arnold.

IT will be a pity if the city of New York is added to the list of cities that are experimenting with municipal electric-light plants. Administered as they are, American cities are not well fitted to conduct industrial enterprises. It is usually the case that the real cost of producing the product is either unknown or deliberately minimized. The men who conduct such plants have only a temporary interest in them at best, and, no matter how honest or well intentioned, they are subject to many conflicting interests which militate against good service. At the worst, the municipal plant is merely a part of the political machine, loaded down with placemen whose first duty is to their political masters. The manager of the private plant, on the other hand, has a single aim—the good of the property.

As an abstract economic proposition, it is perhaps fair to put such a service as lighting the streets for police protection on a par with the supplying of water for sanitary and fire protection and say that in both cases the municipality has a right to provide for itself that which it would otherwise buy from others. This is different from the selling of current by municipal plants to private consumers or from entering into competition with established industries in other lines of business. But in practice, even municipally operated plants for street lighting have proved unsatisfactory. College professors and doctrinaires may exhibit tables showing remarkably low lamp-year costs to their hearts' content; but in how many cases will these figures show that proper charges for interest, taxes, water and depreciation have been included? In private enterprises business men want to know exactly where they stand; in municipally operated plants it is only too often the case that the endeavor is simply to make a showing to add to the prestige of the party in power. These are well-known facts, and thoughtful men conclude from them that it is best to assign to governments (particularly municipal governments) the tasks for which they were instituted and which only they can carry out, leaving industrial enterprises to private incentive, suitably restricted, where public franchises are involved.

But the central-station companies are not altogether blameless in their attitude toward the street-lighting question. More than one municipal electric plant has been established because the local company proposed extortionate rates. A street-lighting contract has been known to be regarded as a "fat thing," procured at inflated prices by methods that would not always bear the closest scrutiny. Sometimes the price has been boosted a trifle too high, with the resultant lamentable demise of the goose that laid the golden eggs. It is logical to point out that if the municipality is to be restrained from conducting an industrial enterprise because it is commercially unfit to perform the work, the private company must do its business for the municipality on a strictly commercial basis, figuring in a commercial profit, and no more. What the price shall be, including such a profit, varies, of course, under differing conditions. We observe that the New York Edison Company charges $146 a lamp-year (2,000 candlepower), and that this charge is regarded as excessive by those who are agitating for a municipal plant. In Chicago, where there is a municipal plant, the private company gets $103 a year for such 2,000-candlepower arc lamps as it supplies for street lighting. There is a considerable discrepancy here, and while much of it may be accounted for by varying items that enter into the cost in the two cities, it would seem that there must be a chance for the city authorities and the New York company to get together and arrange a satisfactory readjustment of rates on the basis of a long-term contract, or something of that sort. If they are wise, both sides will make concessions to avoid the establishment of a municipal plant. Such a plant will certainly do the central-station people no good, while, on the other hand, it is very doubtful if it would prove of any real lasting benefit to the city of New York,

Nernst Lamp History.

The Nernst lamp and its progress in Europe formed the subject for discussion at a recent meeting of the Institution of Electrical Engineers. J. Stottner gave the history of the lamp in a sort of catalogue of the successive types which have been turned out by the holders of the German patents. At the time of the discovery of Walther Nernst and the disposal of the patents, a two-day meeting of the holders of all the patents was held in Berlin, those present being the representatives of the English company, George Westinghouse, who holds the American patents, the Allgemeine Elektricitäts Gesellschaft and Ganz & Co., who held the European patents. The idea of the meeting was to arrive at some common understanding by which all the holders of the patents should work in unison, but this could not be agreed upon, and consequently each went to work separately.

The English company, called the Nernst Electric Light, was formed, the chief characteristic of which was a boisterous set of shareholders, although some very eminent men were at the head of affairs. The clamorings of these shareholders prevented the success of the company, and it lay very dormant. Meanwhile the Allgemeine Elektricitäts Gesellschaft had worked with a will, and has succeeded in producing a creditable article. and the English company entered into business arrangements with the German people. Ganz & Co. appear to have dropped the idea of developing the patents, owing to the great expense, and George Westinghouse at first appeared to turn all his attention to the alternating-current type, in contradistinction to the German direct-current lamps.

The German type is turned out in two styles, and is being largely used in Great Britain. The A type is for one ampere up to 250 volts, and half an ampere from 200 to 250 volts, and the B type is manufactured for ¾ and ½ ampere up to 150 volts, and ¼ ampere up to 250 volts. The compensating or bolstering resistance in these lamps is made of iron wire sealed in a glass globe, exhausted and filled with hydrogen. Should the current increase five per cent., the resistance of the iron increases about 75 per cent., and thus prevents the destruction of the filament. A life of about 300 to 400 hours is the average figure, it is said.

Tests of Nernst Lamps in England.

In the discussion of Mt. Stöttner's paper Robert Hammond said that he had had the pleasure of visiting the Buffalo exhibition, and had been very much impressed with the splendid exhibit of Mr. George Westinghouse, and he had spent more time in that portion of the exhibition than in any other. He had come back to England feeling that there was no reason why street lighting by means of Nernst lamps should not be started at once. At Hackney he had carried out a mile of street lighting with Nernst lamps experimentally, and in due course he had been called upon to report upon the desirability of extending this system to the whole 125 miles of street in Hackney. He, therefore, had made a report, giving these conclusions: "Our opinion is that the Nernst lamps at present obtainable in England leave much room for improvement, and considerable improvement is being made in their manufacture already. The details of construction will perhaps settle down to some standard in about a year. Meanwhile extensions should be limited as much as possible and confined to streets in which mains are laid and where it is immediately necessary to provide a better light. It must not be understood from this statement that we have no faith in the Nernst lamp. Although we are not enthusiastic about its good qualities at present, we foresee that sufficient experience in its manufacture will produce a really economical lamp. We, therefore, do not advise a large immediate extension, which at the end of a year might leave the council with a considerable number of lamps of an obsolete type on its hands."

In arriving at these conclusions Mr. Hammond stated that when a few lamps were tried at the works, glowers for 220 volts and resistance for 20 volts were recommended by the manufacturers. Under these conditions the life of the burners and resistances seldom exceeded 75 hours. Burners were then tried made for 225 volts and resistances for 20 volts with greater success, and practically no diminution of light. Such burners and resistances were ordered for the Amhurst Road trial, and there is reason to believe that in future still more satisfactory results will be attained by the use of burners for 220 volts and resistance for 30 volts, because, with a larger resistance, the regulation of pressure on the glower, and therefore its temperature, will be more constant. The average life of burners tested until they failed was 305.95 hours, the longest life being 875 hours, and the shortest, 15 hours. The lives of burners which had not failed on December 17th are not included in the above average, but it is interesting to note that there are among them some which had run from 500 to 1,000 hours, and are still in fair condition, and it seems that had the test been of greater duration the general average would have been higher. For even if the assumption be made that they all failed on December 17, 1902, the average life is raised to 328.8 hours. A life of at least 350 hours may be safely taken for the basis of the estimate. One satisfactory feature of the test was that only one regulating resistance had failed.

Compared with incandescent gas lighting (No. 4 Kern burner) it was found at Hackney that in order to light the same area of pavement equally effectively, Kern lighting would cost £6 14s. 8½d., against Nernst lighting, £5 17s. 9d.

Mr. Stöttner furnishes the following table showing the result of a test of the life of Nernst lamps made by the Electrical Standardizing, Testing and Training Institution of London. The report, dated March 7, 1903, related to Nernst lamps numbered 16 to 27, inclusively.

No.	Hours.	Cause of Failure.
16	926	Filament broken.
17	716	Filament broken.
18	1,000	Still burning.
19	574	Connection to filament broken.
20	50	Heating coil broken.
21	176	No apparent cause.
22	500	Filament broken.
25	470	Filament broken.
26	95	No apparent cause.
27	1,000	Still burning.

Space-telegraph Test for Armour & Co. in Chicago.

For several days last week messages were successfully transmitted by space telegraphy between the packing house of Armour & Co. in the Union Stockyards and P. A. Valentine's office on the eighth floor of the Home Insurance Building, at the corner of LaSalle and Adams Streets. The DeForest company's system was used, the transmitting apparatus being located at the stockyards and the receiving apparatus at the city end. For transmission a 70-foot mast was erected on the roof of the packing house, while at the Home Insurance Building the flagstaff at the corner of the building was utilized. In each case a gaff was mounted on the pole and from this two wires were carried to the instruments. Alternating current from the Armour power plant was used, less than a horsepower being necessary for the transmission. At the receiving end the message was received by means of a telephone receiver, which is said to be much more sensitive than the coherer used in other systems. The distance traversed by the electrical waves was between five and six miles, and as a large number of steel structures intervened the outcome of the tests, which were conducted for demonstration purposes, was regarded as very satisfactory. The officials of Armour & Co. are said to be very much interested in a proposition of the DeForest Wireless Telegraph Company to connect their offices at Chicago and Omaha and also those at Omaha and Kansas City, and if such a proposition is carried out, it will be the most extensive strictly overland application of wireless telegraphy yet attempted.

Space Telegraphy on the Great Lakes.

Land on Lake Erie at Buffalo, Cleveland and Grosse Isle, Detroit, has recently been purchased by the DeForest Wireless Telegraph Company, and space-telegraph stations are now being constructed at these three cities. That at Buffalo will be completed first. Each of these stations is to be of 10-horsepower capacity, and will comprise two masts, each 200 feet in height, placed 100 feet apart. Between the tops of these masts a horizontal wire will support 20 vertical wires, which will converge into the station house, placed midway between the two masts.

It is expected to reach Detroit from Buffalo and during the winter season to carry on private leased-wire service between these three cities. It is said that arrangements have already been completed with newspapers in Cleveland and Detroit for transmitting local news at night between these cities, and the contract for equipping the boats of the Cleveland and Buffalo Transportation Line has been obtained. The Detroit and Buffalo line boats will probably make use of the service upon the completion of the Detroit station, and it is hoped to have DeForest apparatus on a large number of lake carriers before the close of this season.

After these three stations are placed in operation other small stations will be erected at Port Huron, Sault Ste. Marie, Mackinac, Marquette and Duluth. A site for the Chicago station has been obtained in North Evanston, and there a tower 200 feet high will be erected, to be followed next year by two others of similar height, the three to comprise a very powerful station for operating with St. Louis during the World's Fair. The Chicago station will completely cover Lake Michigan, Milwaukee, Wis., and St. Joseph, Mich., being also in the circuit. At Whitefish Bay and Grand Island, Lake Superior, are harbors of refuge into which vessels are frequently driven by storm, some times for several days being absolutely without means of communicating with their owners. The company has been requested to connect these two points with the Soo and Marquette, and it is estimated that service can be installed during this summer.

The DeForest Wireless Telegraph Company of Canada has recently been incorporated in Toronto and two stations at Toronto and Hamilton, 40 miles apart over the lake, have been opened and are now in daily commercial operation. The Canadian company proposes to establish communication on the Pacific Coast from Vancouver north, ultimately reaching Dawson, and is endeavoring to secure governmental subsidy for this work. Stations are also to be opened by the Canadian company this spring on Lake Huron. It is stated that signals have been received at Toronto from Marconi's Glace Bay station.

News Service by Space Telegraphy.

The London Times, in its issue of March 30th, led its foreign news with two New York dispatches of about 200 words, headed "By Marconigraph." In an editorial the Times says that the messages mark the establishment for the first time of the regular transmission of news by the Marconi company upon a contract basis and that the event marks an epoch in the development of wireless telegraphy. After asserting that messages can be sent between the United States and England at a cost only a little in excess of the cable rate from England to France, the Times predicts that considerable interests are going to be seriously affected by these developments and warns those who are responsible for national interests to watch and anticipate the bearing on various strategical problems of an agency that more than ever before annihilates space and time.

Another innovation in the way of newspaper publishing has been started by the Los Angeles Times of Los Angeles, Cal. A new paper called the Wireless, and issued under the auspices of the Times, is published at Avalon, Catalina Island, 25 miles out in the Pacific Ocean. The interesting feature about this paper is the fact that it is the first regular daily newspaper in the world depending entirely on space telegraphy for its general news service. Each morning, it is said, the epitome of the news will be telegraphed from the Times office to the Wireless by the Pacific Wireless Telegraph Company, which has been doing a commercial business with the island for a number of weeks. The first issue of the Wireless, published March 25th, was but a small, four-page sheet, but the demand for the paper is said to have been so great that it will be enlarged at once. Heretofore the news of the world has not reached the island until the arrival of mail by steamer at one o'clock daily. The heavy storm in progress at the time the first news items were sent did not interfere with the prompt delivery of the messages, it is asserted.

Report on Berlin-Zossen Speed Trials.

Chief Engineer Reichel has made a report upon the results of rapid-transit electric-railway experiments over the military line between Berlin and Zossen. At a speed of 100 miles an hour the electromotive force was up to 15,000 volts. Mechanical power equal to 2,500 horsepower was used in starting the trains, which, when in full speed, required only 700 horsepower. Mr. Reichel, in his report, gives it as his opinion that a speed of 125 miles can be attained, provided the required amount of electric energy can be supplied, as during full motion from 1,400 to 1,500 horsepower is required. For freight transportation also electric power gave good results. A train of 200 tons gross weight was easily moved, even over grades of 1.2 per cent. at a speed of 32½ miles an hour. Through the possibility of supplying the motor car directly with a current of 10,000 and more volts, the weight of the motor cars and that of the transformers could be reduced from 92 to 78 tons.

Ohio Federation of Electrical Workers.

The first convention of the union of electrical workers of Ohio was held in Cleveland last week and was a very interesting one. The most important action taken, perhaps, was the recommendation of the establishment of a uniform system of admission to membership, and to this end it was suggested that all be tested as to fitness by an examination. Unions in smaller towns are lax in the matter of membership, and in some there are no examinations. It is suggested that the examinations themselves be conducted under a uniform system. The officers chosen are as follows: President, Frank Estinghausen, Cleveland; first vice-president, Andrew Laughlin, Dayton; secretary, Frank J. Sullivan, Cleveland; treasurer, H. Buckley, Cincinnati. It was decided to call the organization the Ohio State Federation of Electrical Workers, and a constitution and by-laws were adopted, Cleveland will be made the headquarters.

Test of a Buffalo Engine.

Some interesting and comprehensive tests were recently made at the power house of the Worcester Polytechnic Institute, Worcester, Mass., upon a horizontal center-crank class A engine manufactured by the Buffalo Forge Company of Buffalo, N. Y. The tests were made by Sidney A. Reeve, professor of steam and hydraulic engineering, assisted by C. M. Allen, assistant professor of experimental engineering, and the following facts are taken from their report:

The engine was a single-cylinder, horizontal, center-crank, shaft-governor engine, having a cylinder measuring 12 by 12 inches and scheduled to run at 300 revolutions per minute. It was erected upon temporary foundations on the power-house floor, as shown in Fig. 1, and belted to a quill upon the main-line shaft. Steam was drawn from vertical boilers through 36 feet of permanent covered pipe and 17 feet of temporary naked piping. The exhaust was led through three elbows and 14 feet of pipe into a surface condenser with which all other connections were broken. During the tests the quality of the steam at the throttle was observed many times by means of a throttling calorimeter. The condition of the steam supplied to the engine was frequently investigated. It was at all times practically dry saturated steam.

In order to ensure absolute steadiness of power developed, the engine's governor was blocked into such positions as would give the various cut-offs desired. The speed was maintained constant by ensuring that the load was at all times greater than that which the engine would drive, the balance being made up by a second engine belted to the same line shaft. The governor of this second engine performed the regulation for the entire system. The speeds recorded are therefore no record of the action of the governor of the engine tested. The variations between the several tests are due to variety of adjustment of the governor of the second engine and of the load between the two engines. During any one test the speed was sensibly constant.

During all of the tests all of the exhaust from the engine was condensed in a surface condenser and the steam consumption was taken as its weight. During all of the "non-condensing" tests, care was taken that the pressure within the condenser was just atmospheric, while at the same time no vapor was allowed to escape. During the "condensing" tests the vacuum maintained in the condenser, about 22 inches, was the best that could be, in view of the limited size of the condenser.

This arrangement left the steam pressure as the only variable in any one test, and this was kept as nearly constant as possible by skilled control.

The duration of each test was 20 minutes. Although not included in the original agreement, the friction of the engine when run empty was carefully determined. The result of the whole is that the engine's friction is estimated at very close to three horsepower or 4.3 per cent. of the engine's rating. The unusual lightness of this friction led to the repeated checking of its observation, as just noted, before accepting the result.

The results of the tests are shown in the accompanying table of figures and the water-rate curves (Fig. 2). The only explanation needed is perhaps in regard to the column of "cylinder efficiency." These figures show the proportion of the heat available for work, under the conditions actually prevailing at the time of the test, which the engine succeeded in converting into work. The results from the engine are good standard ones.

In addition to the efficiency tests was run a 36-hour endurance test under 80 pounds of steam pressure and a load of 69.67 horsepower. During its imposition, two observations of efficiency were made. Their results are scheduled with the others as Tests No. 100 and 101. As to the showing made by the engine under this endurance test, it can only be said that no fault or suggestion of fault developed itself. The engine ran smoothly and quietly, with cool bearings, throughout the test. When shut down it was apparently ready to start upon a second similar run with equal success.

Professors Reeve and Allen conclude their report as follows:

"As to the general design and construction of the engine, we are glad to say, that with all which could be seen, upon dismembering the engine both before and after the series of tests was run, we were much and favorably impressed. For simplicity, compactness, good distribution of metal and convenience of arrangement, it provoked favorable comment from all who saw it."

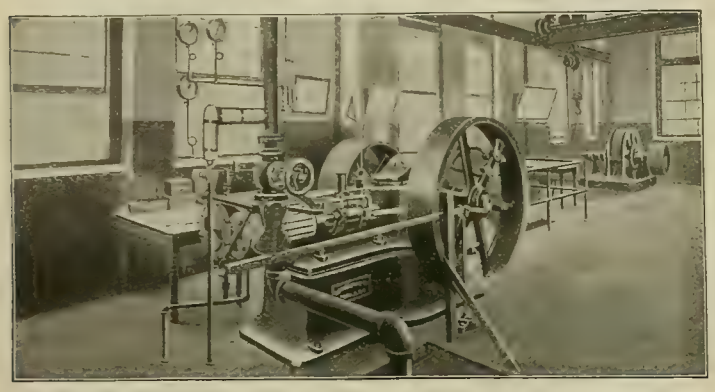


Fig. 1. Engine as Erected for Test.

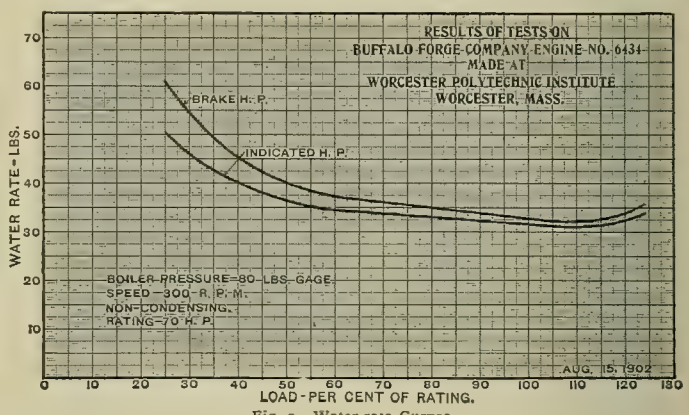


Fig. 2. Water-rate Curves.

TEST OF A BUFFALO ENGINE.

TEST OF A BUFFALO ENGINE.

Test No.	Conditions of Engine.	Actual Pressure Gauge	Speed Revolutions Per Minute.	Power. Observed.	Power. Average.	Water Rate.	Cylinder Efficiency, Per Cent.	Thermodynamic Efficiency, Per Cent.
14	Normal cut-off	125.50	321.6	125.90	123.5	27.6	55.6	9.16
15	125 pounds	124.00	302.6	121.10		27.5	56.1	9.17
3	Normal cut-off	79.30	304.1	74.10		30.6	60.9	8.30
4	80 pounds	81.30	308.4	69.35		31.0	59.4	8.20
5	80 pounds	76.10	296.1	75.82	71.55	31.6	60.4	8.07
100	80 pounds	81.60	301.1	69.50		31.7	57.7	8.04
101	80 pounds	81.50	299.3	69.00		31.9	57.8	7.98
8	25 per cent. under load	79.40	297.8	56.00	56.18	33.3	55.9	7.65
9	80 pounds	80.30	297.7	56.35		33.0	56.1	7.71
6	50 per cent. under load	82.00	305.0	37.20	37.09	35.3	52.0	7.21
7	80 pounds	81.80	304.3	36.97		35.5	51.8	7.17
10	75 per cent. under load	81.50	306.1	16.39	16.65	52.3	39.3	4.87
11	80 pounds	81.50	306.5	16.90		49.9	36.9	5.10
16	25 per cent. over load	81.60	304.0	89.30		33.1	55.3	7.69
17	80 pounds	81.10	300.9	87.30	87.00	34.4	53.7	7.41
18	80 pounds	79.00	298.9	84.40		34.6	54.1	7.36
12	Normal cut-off	81.90	312.2	88.85	87.64	27.8	66.2	9.15
13	Condensing	80.00	310.3	86.42		27.5	67.4	9.27

In the 36-hour test Pressure, 82.78 pounds gauge. Horsepower, 69.67 (average). Friction of the engine when run empty: 3.0 horsepower, equal to 4.3 per cent. of rating.

Advertising Literature for Germany.

Advocates of the metric system will note with approbation a recent communication from Consul J. J. Langer, Soligen, Germany, who says: "Advertising matter is frequently received by concerns here from manufacturers in the United States, which, being in the English language, is of practically no value. A local hardware dealer some time ago received catalogues of wire fences. While he was interested, he could not understand the description, the sizes being expressed in inches and pounds, and, even after reducing these to the metric system, he could tell nothing of the detailed construction. He would not, he said, object to giving them a trial, but would not order them without knowing more about them. When an American manufacturer desires to introduce goods into this country, he should find some responsible agent to keep stock, or at least a full line of samples on hand, and let him introduce the article among the trade. Better still, of course, where larger sales come into consideration, is to send able salesmen who can speak the German language, select the houses they wish to deal with, and make arrangements as to terms, etc. If printed matter is used, it should certainly be in the language of the country to which it is sent."

Blades Starting-box Patent Sustained.

Judge Kohlsaat of the United States Circuit Court for the Northern District of Illinois rendered a decision on March 26th, sustaining the Blades patent No. 418,678, covering the starting box for electric motors provided with an automatic release attachment. The claims held to be valid and infringed are as follows:

"1. In a shunt-wound electric motor, the combination, with the field circuit, a hand switch adapted to open and close the armature circuit, said switch arranged to be held in its closed position by the magnetism of the said magnet, and means for automatically retracting the said switch to its initial position when the magnet is de-energized by the cessation of the current through the field circuit, substantially as described."

"4. In a shunt-wound electric motor, the combination, with the field circuit, of a magnet in said circuit, a hand switch adapted to open and close the armature circuit, said switch arranged to be held in its closed position by the magnetism of the said magnet, and a spring for automatically retracting the said switch to its initial position when the magnet is de-energized by the cessation of the current through the field circuit, substantially as described."

These claims cover broadly the starting box now generally used with direct-current motors operating in an isolated position. Where motors are used for driving street cars, automobiles, and similar vehicles, it is customary to employ a series motor, and since the series motor is not self-regulating under varying load, the attendant must constantly be at hand to control the action of the motor as the load varies, or as it is desired to vary the speed of the vehicle. With motors thus used for driving electric vehicles an automatic release attachment is not necessary, since the attendant is always at hand and can protect the motor should any accident or danger arise.

Where motors are used for driving shop or factory tools it is not practicable to have an attendant constantly at hand to watch the motor, and the shunt motor has been universally adopted for use in these positions, where direct-current motors are used, since the shunt motor is self-regulating under varying load; that is, the motor will continue to run at a practically uniform speed, regardless of changes of load on the motor. When motors are thus employed in isolated positions, and without an attendant, it has been found necessary in practice to provide some automatic protective device which will prevent the motor from injury due to accidents which frequently arise during the operation of the motor, such as the cutting off of the current supply, the opening of the field circuit, and the like. To overcome these dangers Harry H. Blades, the patentee of the patent which has just been sustained, conceived the idea of employing with the ordinary manual-starting box a retaining magnet which would serve to hold the contact arm in the "on" position against the tension of a spring, which spring acted to move the contact arm to the "off" position as soon as the magnet was de-energized. In order that the magnet may be de-energized under the proper conditions, and at the proper time, Mr. Blades placed the retaining magnet in the shunt-field circuit. The cutting off of current supply from the motor, or the opening of the shunt-field circuit from any cause, de-energizes the retaining magnet, and thus causes the automatic return of the contact arm of the starting box to the first position, shutting down the motor and protecting it from harm. The peculiar feature of novelty in this structure was the provision of the retaining magnet associated with the spring, so as to make the structure entirely automatic, and the placing of the magnet in the shunt-field circuit, where it would respond at the proper time and under the proper circumstances to give to the motor the required protection.

The patent is owned by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., and the decision is considered a signal victory, since this patent had previously been held invalid by Judge Baker of the United States Circuit Court for the District of Indiana. In a suit brought by the Detroit Motor Company against the Jenney Electric Motor Company, decided in 1897, Judge Baker held this patent to be invalid. Notwithstanding this decision, the

present suit was commenced in 1898, and has been bitterly fought since that time, the record covering over a thousand printed pages, and testimony having been taken in all parts of the United States. Judge Kohlsaat refused to follow the former decision of Judge Baker, and, notwithstanding that adverse decision, holds that the Blades patent is valid, and is infringed by the defendants.

The complainants were represented by W. Clyde Jones and Keene H. Addington of the law firm of Jones & Addington, Chicago, and the defendants (Hammer et al.) were represented by the law firm of Parker & Carter, also of Chicago. It is not known, at this writing, whether the case will be appealed.

The Cutler-Hammer Manufacturing Company has had a rapid growth. It was organized in Chicago as a partnership in February, 1893, by H. H. Cutler and E. W. Hammer, and was shortly after incorporated with a capital of $6,000 with F. S. Terry as president, H. H. Cutler as treasurer and E. W. Hammer as secretary. In the fall of 1896 the capital stock was increased to $50,000, and Mr. Hammer's entire interest was purchased by Mr. Cutler, who then became the president and treasurer. The company continued to grow so rapidly as soon to require more capital, causing a third reorganization and an increase of the capital to $100,000, with F. R. Bacon as president, F. L. Pierce as vice-president, J. G. Hickox as secretary and treasurer and H. H. Cutler as general manager. About this time Mr. Hammer started another company incorporated as the Chicago Rheostat Company, and the suit for infringement of the Blades patent was begun. The patent which has just been declared valid was originally licensed to the Cutler-Hammer company in 1893, and was intended to be the basis of its business. This, however, proved to be an illusion, as the invention was of such value that, according to the Cutler-Hammer people, it was at once appropriated and infringed upon by the trade. Notwithstanding the fact that the Cutler-Hammer company never derived the slightest benefit from this patent it has continued to develop devices covered by the patent and built up a large and prosperous business. It is at present capitalized at $500,000, with the following-named officers: President, F. R. Bacon; vice-president and chief engineer, H. H. Cutler; treasurer, F. L. Pierce; secretary, A. W. Berresford.

Anti-smoke Ordinance for Chicago.

A smoke and boiler-inspector ordinance that has been contested in the Chicago City Council for over a year was finally passed by that body on March 23d by a vote of 47 to 15. The ordinance places in one department the offices of smoke inspection and boiler inspection, and puts at the head of them, in conjunction with the boiler and smoke inspectors, an official to be known as the chief mechanical engineer. The new ordinance increases the penalty for smoking chimneys from a maximum of $50 to one of $100. Three minutes in each hour are allowed for smoking. All in excess of that becomes a violation.

The most important feature of the new law is the provision for the inspection of plans for new plants before permits may be issued. The board of inspectors of the department must pass on the specifications to see that proper provisions have been made for the prevention of smoke. If the plans for the power plant of the proposed structure meet the approval of the board, the building commissioner is notified, and he is expected to see that the specifications are observed in the construction of the building.

The work of inspecting boilers will include the work of inspecting fireboxes. If the inspector finds that the construction of the firebox is not calculated to make prevention of smoke possible, the proprietor will be given an opportunity to make the necessary alteration. If he fails to accomplish the desired results by the alterations that does not relieve him from prosecution. He, however, is entitled to the advice of the inspectors in making the alterations and they are supposed to aid him.

This provision will require the complete alteration of many of the power plants in the city, and for this purpose the council has granted a year of grace, during which time the proprietor may give notice that he will make the changes, and the law will not become effective so far as he is concerned.

The effect of the year of grace is a stay of execution so far as present buildings and plants are concerned. It becomes operative at once—or as soon as the mayor signs it—so far as new plants are involved.

It is made obligatory on the firm selling a boiler to notify the board when a sale is made in the city and the name of the person to whom it is delivered.

A fine of $25 to $100 is provided for any engineer who may endanger the lives of persons by carelessness.

The ordinance applies equally to locomotives, tug boats and stationary power plants so far as the smoke nuisance is concerned.

A motorman recently wrote a letter to a St. Louis newspaper saying that St. Louis citizens ought to blush when teamsters blockade the car tracks. The paper replied: "They do—at the remarks exchanged between the teamster and the motorman."

Electric Power for the City of Mexico.

Further details of an important hydro-electric enterprise are furnished by C. H. Cahan of Halifax, Canada, attorney for the Mexican Light and Power Company, who is in the City of Mexico looking after the legal details of that large corporation, preparatory to carrying out the plans for the construction and operation of the plant. The company has a capital stock of $12,000,000 gold. It has just entered into a contract with the city authorities of the City of Mexico for the installation within the city limits of sub-stations and wires for the transmission of electrical energy. In certain specified streets the wires may be overhead. The contract requires that the company shall, within four years, be in a position to provide 8,000 horsepower of electrical energy in the City of Mexico. The work of constructing the power plant has begun. The waters of the Necaxa and Tenango and Catepuxtla Rivers, in the state of Puebla, are to be utilized. Hydraulic plants are to be installed at Necaxa and vicinity for the generation of electricity, and transmission lines will be constructed from these hydraulic plants to the City of Mexico, Pachuca and other manufacturing and mining towns. The waterpower is situated 88 miles from the City of Mexico. The transmission line will be 95 miles long, with a branch line to Pachuca, a distance of 26 miles. Discussing the enterprise, Mr. Cahan said:

"There will be two hydraulic installations at Necaxa. The first installation will consist in the diversion of the waters of the Tenango River into the Necaxa, by an open cut and tunnel; the construction of a storage dam on the Necaxa River; a small dam lower down to form a regulating reservoir; a tunnel and four lines of 46-inch feeders to the power station, containing hydraulic and electric machinery for the generation of 40,000 horsepower; transmission lines to the City of Mexico, and to other centers of consumption, and substations for the reception, transformation and delivery of electrical current. The static head of the first installation will be 1,253 feet, and this installation will cost about $5,000,000 in gold. The second installation will utilize a further fall of 1,220 feet, and will be practically a duplicate of the first, with the exception that many of the items provided in the first installation will not be the same, and will cost $3,500,000 gold."

Mr. Cahan says that the company has already obtained assurances of a sufficient demand for power to insure the financial success of the enterprise. The consulting engineer of the company is F. S. Pearson, formerly chief engineer of the Metropolitan Street Railway Company of New York city. The resident engineer is Hugh L. Cooper. The officers of the company are: President, James Ross of Montreal, Canada; vice-presidents, J. H. Plummer and F. S. Pearson; secretary, A. R. Doble; treasurer, W. G. Ross. It is stated that President Ross is vice-president of the Bank of Montreal, president of the Dominion Steel Company, and a man of great wealth.

H.

National Electric Light Association.

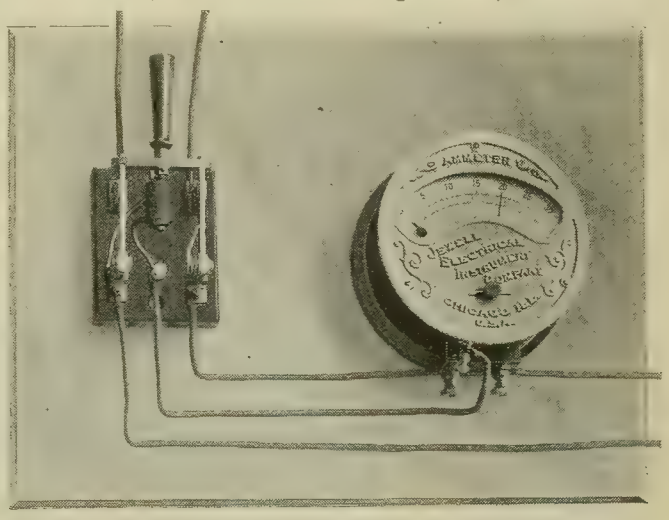
Henry L. Doherty, chairman of the committee on the analysis of flue gases of the National Electric Light Association, will make a very complete report at the convention to be held in Chicago on May 26th to 28th, and will give practical demonstrations of a simple method of detecting and preventing the loss of much power that is often allowed to go to waste. This report will undoubtedly be of great interest to central-station managers who are not satisfied with the results they are obtaining from fuel consumed. Among the new members recently added to the association are the Union Electric Company, Dubuque, Iowa; Mountain Electric Company, Denver, Colo.; DeKalb-Sycamore Electric Company, DeKalb, Ill., and New York and Queens Electric Light and Power Company, Long Island City, N. Y. The manufacturing and supply companies are also showing that they appreciate the usefulness of the association, and the following-named have recently joined as associate members: Crocker-Wheeler Company, Ampere, N. J.; Chase-Shawmut Company, Boston; Charles F. Johnson, Buffalo, N. Y.; Gregory Electric Company, Chicago, Ill.; Buckeye Electric Company, Cleveland, Ohio; Adams-Bagnall Company, Cleveland; Hemingray Glass Company, Covington, Ky.; Stanley Instrument Company, Great Barrington, Mass.; Green Fuel Economizer Company, Matteawan, N. Y.; Alberger Condenser Company, New York city; Standard Vitrified Conduit Company, New York; Doubleday-Hill Electric Company.

Jewell Circuit-breaking Ammeters and Voltmeters.

The illustration shows a simple new device, just placed on the market by the Jewell Electrical Instrument Company, Chicago, Ill., the object of which is the protection of electrical machinery and the automatic control of electricity.

The application of the electric motor has been increasing to a remarkable extent and in many cases the power is greatly underestimated, the motors, which often are directly coupled to the machine to be driven, being called upon to furnish power greatly in excess of their rated capacity, with the result that the motor is burned out, causing not only great expense, but exasperating delays. The majority of these burn-outs are due to the improper handling of the machine, and could be avoided if the operator had a reliable instrument indicating to him at all times the power he is using; so that in the most up-to-date plants it has been the practice of late, to equip each motor with an ammeter which indicates continuously the amount of current passing through the motor. While this has doubtless been of great service, it could not furnish absolute protection any more than a steam gauge on a boiler can relieve an excessive pressure. Some sort of a safety valve is required.

The circuit-breaking ammeter, illustrated herewith, performs not only the function of the steam gauge, but acts as a safety valve as well. The operation of the apparatus is very simple. The contact arm of the instrument is set to any desired point on the scale by revolving the milled head on the front of the instrument. When the index needle of the instrument reaches this point an electric circuit is established through the small magnet on the switch which operates a latch, and the powerful coiled spring instantly opens the switch. This arrangement makes a "quick-break" switch. Where large currents are broken at high voltage the usual carbon contacts are provided.



JEWELL CIRCUIT-BREAKING AMMETER.

It will be evident that this device can be used as an "underload" and "overload" circuit-breaker by providing two contact arms instead of one, one always remaining below and the other above the index needle. This is particularly useful in the charging of storage cells. The same device is applied to a voltmeter, so that an excess of voltage will open the switch. In the charging of storage cells the charging circuit can be opened, either by the "underload" contact of the ammeter, thus cutting out the cells when the current falls to the minimum desired, or by the "over-voltage" contact of the voltmeter opening the switch when the voltage of the cells reaches the maximum, preventing an overcharge of the batteries, or a combination of both devices can be used.

The circuit-breaking instrument affords a sure and accurate method of opening the circuit at any predetermined point. It can be instantly set at any point desired, or it can be arranged to release at any predetermined point, without any exterior adjustment on the instrument, where the apparatus is to be placed in the hands of inexperienced persons.

Edison United States Patents.

An interesting news despatch from Washington, D. C., states that the clerks of the Patent Office began several years ago to keep a systematic account of the patents issued to Thomas A. Edison. They have his various inventions tabulated and indexed, so that they can put their hands on each different idea he has protected by patent from the beginning of his career of invention. When a pending claim is allowed, as it no doubt will be this month, Mr. Edison will have received 791 patents in all. He is not adding to the list as many ideas nowadays as he did some years ago. Up to 1895 he had taken out 711 patents. Since then he has added to the list from three to 23 patents each year. Last year he took out 19. This year, so far, he has received six. In ordinary fees for patents Mr. Edison has spent over $51,000.

DEVELOPMENT OF THE TELEPHONE FIELD.

Annual Report of the American Telephone and Telegraph Company.

For the year 1902 President Frederick P. Fish of the American Telephone and Telegraph Company makes the following report:

The results of the business for 1902, as shown by the treasurer's statement, were as follows:

Gross revenue	$13,277,457.33
Expenses, including interest and taxes	5,442,185.14
Net revenue	7,835,272.19
Dividends paid	6,584,403.75
Carried to reserve	522,246.71
Carried to surplus	728,621.73

The net output of telephones during the year was 624,714, making the total number in the hands of licensees 3,150,320.

The number of exchange stations at the end of the year was 1,277,983, an increase of 257,336.

The total mileage of wire for exchange and toll service was 3,281,662 miles, of which 836,378 miles was added during the year.

Including the traffic over the long-distance lines, the daily average of toll connections was about 239,700, and of exchange connections about 9,323,000, as against corresponding figures in 1901 of 187,378 and 7,531,761; the total daily average for 1902 of connections, both toll and exchange, reaching 9,562,700, or at the rate of about 3,079,000,000 per year.

The expenditure for new construction, to supply the increasing demand of the public for telephone service, was larger than that of previous years, the proportion of increase bearing a close relation to that of the business before recited.

The total amount added to construction and real estate by all the companies constituting our system in the United States during the year 1902 was:

For exchanges	$26,014,800
For toll lines	8,282,900
For land and buildings	3,038,800
	$37,336,500

The amount added in 1900 was $31,619,100; in 1901, $31,005,400.

The expenditure by this company in 1902 for the construction, equipment and supplies required for its long-distance lines was $3,379,982, making the total investment in long-distance lines and equipment to the close of the year $22,496,191.

These figures show that the active development of the business which has been characteristic of recent years still continues, nor are there any signs of a diminution of the demands upon this company and its operating companies for increased construction to meet the call for telephone service throughout the United States. There is hardly a section of the country in which it can be said that the point has been reached at which the supply of telephone facilities equals the demand. During the past year the operating companies have made larger gains in their lists of subscribers than in any previous year, and, almost without exception, they look forward to a still greater increase in the near future.

The demand for additional toll lines, and the use of those already constructed, are greater than ever before. A striking illustration of the growth of the toll-line business after it is established appears in the fact that the estimate for the coming year, merely for new circuits on the now existing long-distance lines which are operated directly by this company, calls for an amount equal to about 10 per cent. of the entire investment made to date by this company on its long-distance plant.

Large as has been the investment in the past of this company and the operating companies associated with it, it is clear that to fulfill the duty of giving to the country a complete and comprehensive system of telephonic transmission, there must be a constant extension of facilities, involving a corresponding increase in investment. It is even more true of the telephone business of this company and its associated companies than of any other like business, that the necessary facilities to cover the territory, which in our case is the whole country, must be supplied to the full extent required to meet the reasonable demands of the public. The users of telephones recognize the enormous advantage of a complete service, such as is afforded by the Bell companies, and expect to pay a proper compensation for the same. There can be no room for doubt that whatever investment is necessary to enable the business to be done properly will receive an adequate return.

During the past year the company received from the issue of new stock offered at par to its stockholders the sum of $21,226,122. Of this amount $9,965,550 was received in January, 1902, from an issue authorized in 1901 and $11,260,572 in September, 1902, from an issue authorized in 1902. The balance of the proceeds of the latter issue was received in January, 1903.

Further stock issues will undoubtedly be necessary in the future.

An essential obligation on the part of this company and the operating companies with which it is associated is to use every effort to give to their patrons the best possible service. To do this the apparatus must be of the best design and quality, and must be installed under the most favorable conditions. More than that, the working force, including not only the telephone operators who come in direct contact with the public, but all those upon whom is imposed the duty of keeping the apparatus in order and of arranging with the public for its use, must be thoroughly trained, as well in the practical part of their work as in meeting and dealing properly with the public.

There is no apparatus more complicated than that employed in telephony when organized on a large scale, and no conditions exist in which a failure to adopt and act upon a high standard, both of mechanism and of relations to the public is more incompatible with success.

This company and its associated companies are devoting their energies not only to that great development which the public interest requires, and which is so essential to the prosperity of the telephone companies themselves, but also to perfection of apparatus, the discovery of improved methods of operation, and the training and discipline of employes.

In former reports, reference has been made to the many features of engineering and of mechanism in which constant improvements have been made from year to year.

During the past year there has been even greater progress in the same direction. More of the wires in the larger towns have been placed underground. At the present time about 55 per cent. of the entire mileage of wires used for exchange service throughout the country is in underground conduits. To a greater extent every year the operating companies acquire land and erect buildings specially designed to meet the requirements of modern exchange operation, locating them at points from which the distribution of the wires can be most economically and effectively made.

The introduction of the modern form of switchboard in the place of the older forms has progressed steadily. New and more effective cables have been designed and put into use, and in all the details of the work one improvement after another has been adopted as soon as it appeared that the adoption would contribute to the improvement of the service.

During the past year, special efforts have been made to standardize the apparatus used throughout the country by this company and its operating companies, and to insure that in all parts of the country the most efficient central-office equipment, underground and toll lines, and subscribers' station apparatus were employed. Much attention has been given to methods of operating, and while perfection has not yet been attained, and probably can never be attained in so difficult an art as that of telephony, there is no doubt that the service of the Bell companies, both long-distance and local, throughout the country, has very generally improved. Every effort will be made to improve it still further, both by the introduction of better apparatus and by the adoption of better methods of operating, to the intelligent study of which the best men available are devoting constant attention.

In the report of your directors for the year ending December 31, 1901, the following reference was made to the competition of telephone companies not associated with this company:

"Competition from telephone companies not associated with this company has existed for several years, and is likely to continue in some places for some time to come. While it has in some localities affected the licensees of this company disadvantageously, by reducing, for a time at least, the number of their subscribers and forcing them to meet competitive rates that are not based upon a proper recognition of the cost of doing the business or an adequate appreciation of the amount that should be set aside from earnings for maintenance, reconstruction and depreciation, the consequences of the competition to the business as a whole have not been of serious moment. The public in each community will determine for itself whether it is for its advantage that there should be two telephone exchanges serving one body of people. It would seem as if but one conclusion on this point was possible.

"In any event, the comprehensive character of the system of this company and its licensees, organized as the system is to afford uniform and adequate telephonic intercommunication throughout the country, and the intention and ability of the company and its licensees to give good service at fair rates must insure the permanency and prosperity of their business in the future as in the past."

The developments of the past year confirm the views then expressed. Since that report was presented to the stockholders there has developed a recognition on the part of many of the competing telephone companies, particularly those which were in the business in such a way as to be forced to look the situation in the face, that the rates generally adopted by them were much too low. It was very largely because of the belief on the part of these competing companies that they could do business at rates which were, in fact, below the cost of supplying the service, that they succeeded in making their competition with our companies in some instances effective by offering to give service at abnormally low rates. Moreover, their apparent views as to what rates were remunerative were, as was but natural, accepted to some extent by the public. It is but reasonable to assume that, by reason of the admissions of many of the most prominent of these competing companies, based no longer upon the representations of promoters but upon their actual experience, the public will be educated to a recognition of what are proper and reasonable rates for telephone service; in which event our companies will be in a position to relieve themselves of what is substantially the only ill effect that has followed from competition, namely, the reduction in certain localities of the rates charged to subscribers to a point which allowed no profit, and in some cases involved a loss.

The public has also in some instances during the past year seriously considered the question whether or not there should be two telephone exchanges serving one community, and has come to the conclusion that a duplication of telephone service was undesirable. We believe that this sentiment will grow, in which event it will be the fault of the Bell companies if their facilities, their service and their relations to the public are not such as to secure for them proper recognition.

The most important single transaction concluded during the year was that briefly referred to in the last annual report, by which the controlling interest in the capital stock of the Western Telephone and Telegraph Company was acquired by this company. The Western company purchased the majority interests in the stocks of the Cleveland Telephone Company, the Michigan Telephone Company, the Northwestern Telephone Exchange Company, the Southwestern Telegraph and Telephone Company and the Wisconsin Telephone Company, before held by the Erie Telegraph and Telephone Company.

The revenue of the Western company, derived from its holdings of stocks and other securities of the above-named companies, during the first year of its organization, has been sufficient to provide for two dividends of two per cent. each upon its preferred stock, which were paid in August, 1902, and February, 1903, respectively. The second dividend does not appear in the accounts of the company for 1902.

During the past year, by agreement between this company and the operating companies with which it has contracts, a new and simpler plan for determining the amounts to be paid this company as rental for telephone has been adopted, which plan involved a substantial reduction in the rentals paid to this company from and after January 1, 1902. This modification of the rental arrangement was clearly justied by the existing conditions. It is believed that it will work to the advantage, not only of the operating companies, but of this company.

If this reduction in rentals had not been made, the amount carried to surplus on the books of this company for the year 1902 would have been substantially greater.

Appended to Mr. Fish's report are comparative statistics showing the development of the business of the company and its licensees, with a statement of the ledger balances of the company as of December 31, 1902, and a comparative statement of the earnings and expenses for the years 1901 and 1902.

These tables show, as stated in the body of the report, that the total number of instruments in the hands of licensees under rental on December 20, 1902, was 3,150,320, an increase of 573,194 for the year. For comparison, it may be noted that the whole number of instruments in use on December 20, 1893, was 566,491, or less than the increase during the year 1902.

On January 1, 1903, the number of miles of toll lines of the company and its licensees was 122,409 and the number of miles of toll-line wire 837,912. These show respective increases of 11,950 and 121,647 for 1902. The average daily number of toll connections is 239,689.

Statistics of the licensee companies are given as follows:

	Jan. 1, 1894.	Jan. 1. 1898.	Jan. 1. 1902.	Jan. 1, 1903.	Increase.
Exchanges	838	1.025	1.411	1.514	103
Branch offices	571	937	1,594	1,861	267
Miles of wire on poles and buildings	231,168	341.091	841,140	1,109,017	267,877
Miles of wire underground	120.675	282,634	883.679	1,328.685	445.006
Miles of wire submarine	1.637	2.675	4,200	6,048	1,848
Total miles of wire	353,480	626.400	1,729.019	2,443,750	714,731
Total circuits	205,891	295.904	592,467	742,654	150,187
Total employes	10.421	16.682	40,864	50,350	9,486
Total stations	237,186	384,230	1.020,647	1,277,983	257,336

EXCHANGE CONNECTIONS.

The estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, is 9,322,951.

The number of daily calls per station varies in different exchanges, the average throughout the United States being 7.3. [The average in Chicago is between 17 and 18.]

Ledger balances of December 31, 1902, are stated as follows:

DEBTORS.

Construction, equipment and supplies	$ 22,496,191.76
Telephones	6,522,106.35
Real estate	1,745,280.15
Stocks and bonds	114,864,798.77
Patent account	166,014.35
Machinery and tools	48,126.58
Cash and deposits	6,933,364.35
Bills and accounts receivable	15,528,621.24
American Bell Telephone Company	22,110,400.00

CREDITORS.		
Capital stock	$114,946,500.00	
Capital instalments	11,172,472.00	
Surplus	3,493,290.23	
Bonds	28,000,000.00	
Reserves	6,079,262.23	
*Accounts payable	8,078,168.84	
Contingent	18,645,210.25	
	$190,414,903.55	$190,414,903.55

*Of this amount $1,976,312.25 is for the dividends payable January 15, 1903, to stockholders of record December 31, 1902.

The total earnings of 1902 were $13,277,457.33, the principal items being: Dividends received, $6,023,523.20; rental of instruments, $2,299,378.52; telephone traffic, $4,199,708.59. The total earnings for 1901 were $11,606,816.94. Total expenses in 1902 were $5,442,185.14, leaving the comfortable net revenue of $7,835,272.19. Dividends amounting to $6,584,403.75 were paid, leaving a balance of $1,250,868.44.

Telephone News from the Northwest.

The local telephone company at Hillsboro, N. D., will increase its capital stock to $50,000.

The Twin City Telephone Company has entered into a contract with the Zenith Telephone Company of Duluth, Minn., and the People's Telephone Company of West Superior, Wis., in which the former agrees to turn over its long-distance business during the next 25 years to the companies at the head of the lakes.

The Dakota Central Telephone Company of Aberdeen, S. D., has made traffic arrangements for long-distance connections to Fargo, N. D., and to Sioux Falls, S. D.

The Morning Sun (Iowa) Telephone Company has been sold to the Mutual Telephone Company of Yarmouth, Iowa. The latter was a recent applicant for a local franchise at Morning Sun, but was refused.

Plans have been prepared for the reorganization of the Mutual Telephone Company of Des Moines. The plans include the issue of $200,000 bonds and make extensive improvements to the system.

A company composed of a number of students of the Iowa State College at Ames, Iowa, has established a telephone exchange covering a portion of Ames. The system is independent of all companies and is on the central-energy system, all metallic. The switchboard was constructed by students who are members of the electrical engineering class, and has a self-restoring drop and power ringer.

The first annual meeting of the Corwith Rural Telephone Company was held at Corwith, Iowa, a few days ago, and a banquet was tendered stockholders and patrons. About 60 covers were laid. The company has 140 miles of farm lines, besides a town exchange.

The Jones County Telephone Company of Anamosa, Iowa, will increase its capital stock from $50,000 to $100,000, the additional capital to be used for extensions and improvements.

The council of Fort William, Ont., has refused an offer from the Bell Telephone Company to purchase the municipal telephone exchange. The company offered to pay the city the actual amount invested in the exchange and to maintain an efficient service. R.

Ohio Telephone Notes.

The Urbana Telephone Company, Urbana, has purchased a tract of land on East Market Street, upon which an exchange building will be erected. The lot is 99 by 170 feet in size.

The Fitzsimmons Telephone Company of Cincinnati has filed an amendment to its charter which will allow it to operate telephone exchanges and telegraph lines, both in Cincinnati and the towns of Hamilton County.

H. E. Spicer and Manager William F. Laubaugh, of the People's Telephone Company of Akron, have been appointed receivers of the Copley telephone lines.

N. Starkey and J. W. Creech have purchased the telephone system at London, Ky., paying $10,000 for it. Mr. Starkey also owns the exchange at Pineville and will manage it personally.

R. W. Irwin of Washington, Pa., has purchased the plant of the West Penn Telephone Company at Wellsburg, W. Va., which has been in the hands of a receiver for some time. The consideration was $20,000. The plant will be operated by Mr. Irwin.

The druggists of Cincinnati have made a proposition to the telephone company to look after the business that may be secured through instruments located in their stores at the following rates: Ten per cent. on collections up to $50; 30 per cent. on all collections between $75 and $100 and 40 per cent. on all amounts above $100. The company has not yet passed upon the proposition.

The Williams-Abbott Company of Cleveland has purchased the plant and goods of the Columbia Telephone Company of Ottawa, which failed some time ago. The machinery and goods purchased will be moved to Cleveland, Ohio. O. M. C.

Indiana Telephone Items.

At New Richmond, Montgomery County, the New Richmond Co-operative Telephone Company was organized and incorporated last week. This company will build an exchange at New Richmond and extend its lines throughout Montgomery and Tippecanoe Counties. M. L. Claypool, O. W. Mason and T. B. Miller are the directors and incorporators.

The United Telephone Company, which operates in the counties of Wabash, Huntington, Wells, Blackford and Jay, will issue $200,000 in five per cent. bonds. This company has over 4,000 telephones in service and is managed by Hugh Dougherty of Bluffton. This money is desired to make liberal improvements and meet the demands for extensions.

The Home Telephone Company's business at Elkhart outgrew its capacity, and it is now putting in a 2,400-line multiple switchboard at a cost of $24,000. The company has felt justified in announcing an advance of 25 cents a month in the rent of each telephone, beginning April 1st. Contrary to expectations, only two patrons have given notice of withdrawal on account of the advance. The company has nearly a thousand subscribers.

The Home Telephone Company of Wabash has issued and put on the market $15,000 worth of five per cent. bonds for the purpose of paying floating indebtedness incurred in building extensions and in making improvements in the local plant and toll lines.

A meeting was held by the Crawfordsville Co-operative Telephone Company on the 24th inst., at which it was decided to merge lines and establish a complete trunk-line system in Montgomery County. To this end a committee was appointed to confer with the co-operative and other companies elsewhere in the county, and make arrangements whereby all lines will merge and the county be supplied with a complete system. F.

TELEPHONE MEN.

Frank V. Newman will leave the employment of the Michigan Telephone Company (Bell) at Detroit to become assistant general manager of the Citizens' Telephone Company (Independent) of Grand Rapids.

J. D. Kamerer, manager of the Bell telephone interests at Warren, Niles and Girard, has resigned the position to become route agent for the company, and N. B. Tubbs of New Castle, Pa., has succeeded him in his old position.

Joseph Kavanagh, a well-known telephone man, died in New York city on March 25th, after an illness of several months. He was the assistant treasurer of the New York Telephone Company and of its predecessor, the Metropolitan Telephone and Telegraph Company, from the dates of their organization, and was treasurer of the East Jersey Telephone and Telegraph Company and the North Jersey Telephone and Telegraph Company. He left a widow and four children.

It is reported that J. Sitizenstratter of London has signed a contract with the federal government of Mexico to provide the City of Mexico with a modern system of telephones.

The Timemometer for Telephone Switchboards.

Many advantages may be gained by the employment of an accurate automatic time-recording and calculating machine in connection with the operation of telephone toll lines. A new invention for this purpose, called the timemometer, is being put upon the market by the Automatic Time Stamp Company of 160 Congress Street, Boston, Mass., which was the originator and first maker of automatic time-printing machines, especially of the kind in which a miniature time dial and hands are printed and which has had its greatest development in the well-known automatic time stamp in extensive use all over the world.

The timemometer is the invention of John C. Wilson of Boston, Mass., and is an adaptation of the automatic time stamp, to print the exact hour, minute, quarter minute or second, a. m. or p. m., and the date when a toll-line conversation begins and when it ends, and to calculate and print the elapsed or intervening time to a quarter of a minute, or to the exact second as required.

The timemometer is made in three forms, known at model No. 1, model No. 2, and model No. 3, as shown. Models No. 1 and No. 2 may be fitted with either wheel or type-dating devices, while model No. 3 is restricted to the use of the latter.

In timemometer model No. 1 the time is not visible, while models No. 2 and No. 3 are provided with visble clock dials and with hands which move in unison with the time-printing hands, these machines thus serving both as timepieces and stamps.

Timemometer model No. 2, although generally similar to model No. 1, is larger and has its visible clock dial placed perpendicularly in front, while model No. 3 is rectangular in shape and has a visible clock dial in a horizontal position on top.

Timemometer models No. 1 and No. 2 print upon the bottom of the toll ticket, and are operated by a blow, while model No. 3 prints upon the top of the toll ticket, and is operated noiselessly by a press lever, which moves the ink ribbon forward automatically at each operation. Either model may be used also as an automatic time stamp for time-stamping letters, telegrams, orders, etc.

Timemometer model No. 3 is especially adapted to be fitted into the telephone switchboard shelf, so that its base will be on a level with the shelf, the operating lever being underneath the same; or it may be placed upon a pedestal or other suitable support. Its ink ribbon is 24 feet in length and feeds automatically, and a new ink ribbon may be easily inserted at any time.

The machines are all strongly made and finely finished. The clocks are good timekeepers, are enclosed in dustproof cases, especially model No. 3, and are not interfered with in the slightest degree by the operation of printing.

Timemometer models No. 1 and No. 2 do not print seconds, but are arranged to print the actual time and the elapsed time to a quarter of a minute upon a toll-line slip or ticket, as shown in Fig. 4. Timemometer model No. 3 may be arranged to print a time record similar to that of models No. 1 and No. 2, or to print the actual time and the elapsed or intervening time to the exact seconds, as shown in Fig. 5. More detailed information may be obtained from the Automatic Time Stamp Company.

Model No. 1. Model No. 2.

Model No. 3.

Fig. 4.

Fig. 5.

THE TIMEMOMETER FOR TELEPHONE SWITCHBOARDS.

As stated last week, the Connecticut Telephone and Electric Company of Meriden, Conn., has been incorporated under the laws of Connecticut. The officers are: President, E. C. Wilcox; vice-president and treasurer, B. L. Lawton; secretary, B. C. Rogers. This company has heretofore been carried on as a partnership between E. C. Wilcox and B. L. Lawton. It recently built a new factory and says that it has the finest plant for the manufacture of telephone apparatus in the East, outside of New York city. The aim has been to keep up the standard that the best goods are the cheapest. The Connecticut Telephone and Electric Company was organized in 1895, and it has gained steadily since, until it has reached such proportions that it was thought advisable to incorporate.

Advantages of the Common-battery Telephone Switchboard.[1]

By S. P. Grace.

Mr. Lockwood, in his paper on the evolution of the telephone switchboard (see Western Electrician of January 31, 1903), has admirably described the manner in which the present perfected arrangement of switchboards developed from the crude switching devices of the early days of the telephone. Mr. Lockwood has also given a very complete description of a modern common-battery telephone switchboard, and has also shown and described the line of investigation which was pursued to attain this development. It is not necessary for me to add anything more on the evolution of the telephone switchboard, since Mr. Lockwood has covered this matter in such an admirable manner; so I shall simply call attention to a few of the great advantages that the common-battery system possesses.

We may subdivide the advantages accruing from the common-battery system into three general heads:

First—Improvements in operating.

Second—Economy of maintenance.

Third—Quality of service.

In discussing the question of operating, it is perhaps instructive to look back and see the difficulties under which the operator worked under the old arrangement of magnetic switchboards. The switchboard was arranged with a large number of annunciators or drops mounted on the face of the switchboard near the top. When a subscriber turned the crank at his telephone his annunciator was displayed in front of the operator, who had to look up at the annunciator, ascertain its number, and then hunt out the corresponding answering jack in which to plug. This kept the telephone operator's head tilted upward at an awkward and disagreeable angle.

In the common-battery system the subscriber merely removes the receiver from the hook, which act lights a small incandescent lamp immediately adjacent to the answering jack belonging to the calling subscriber. The operator in answering does not have to ascertain the particular number calling, but merely "plugs out" the light. This act alone increases the speed of operating from three to four seconds.

Another great disadvantage of the magneto system was the entire absence of supervisory signals, i. e., the operator had no means of knowing when the calling or called subscriber was at the telephone. The only arrangement for disconnecting was a clearing-out drop bridged across the cord circuit. It was necessary for the subscriber to ring off when through using the line.

Undoubtedly, many of you have run across the sign painted in large letters on the telephone "Ring off." But it is human nature to do as little as possible when once you receive the benefit you asked for; so, while all the subscribers would ring in to get central, but a very small percentage of them would remember the injunction to "ring off."

In the common-battery system there is placed a supervisory-lamp signal on each side of the cord circuit, which is used to connect together two subscribers' lines. When a subscriber is rung by the operator, one of these lamps remains lighted until he answers. When both subscribers are finished with the conversation the simple act of hanging the receiver upon the hook lights both of these supervisory lamps, which is a signal to the operator that that pair of cords, and consequently the connected lines, are no longer in use. She will therefore immediately remove the connection. If either one of the subscribers wishes to call in the operator during the course of a connection it can be done by simply working the hook up and down, which flashes the supervisory signal. It is thus seen that for all local connections the operator has complete supervision over the calls.

It is, however, in a multiple-office district, such as Pittsburg, where the advantages of the common-battery system are particularly in evidence. In such a district it is necessary to operate a number of offices and arrange for trunking connections between them.

In the magneto system there were provided no supervisory or disconnect signals on these trunk lines. This made the operation of them extremely difficult and also impaired the quality of the service rendered, since the operators would frequently make mistakes and take down the connection before the conversation was finished.

In the modern common-battery system, when a call is received for a line in a distant office the operator who receives the call cuts in directly on what is known as a calling-circuit wire to an operator who is located at the exchange which contains the line asked for. This operator assigns a trunk to be used and at the same time plugs the trunk which ends in a plug and cord into the line asked for. The originating operator, of course, plugs into the other end of the trunk line. When both subscribers are through talking the disconnect signals are received by the originating operator in the usual manner, who will take down the connection. The taking of the plug out of the trunk line automatically gives the trunk operator at the distant exchange a disconnect signal to show her that the trunk line is no longer in use. She will then remove the trunk line from the local subscriber's line. Similar automatic trunks are provided for use between the local boards and the long-distance boards. It will thus be seen that, from an operating standpoint, the common-battery system removes the necessity of the personal supervision of calls by the operator, automatic signals being the means of warning her of all stages of the connection.

The common-battery system also enables us to increase the operator's load, which means that an operator can answer more telephones than in the old-style systems. Our payrolls show that with a first-class common-battery system we can handle the same business with about 20 per cent. less operators. The common-battery system is therefore easier and cheaper to operate than the old-style system.

Let us now consider economy of maintenance. In the old-style systems each individual telephone was a small edition of a central-office power plant. We provided batteries for furnishing the direct transmitter current and a complicated magneto generator for furnishing alternating current for signaling the central office.

Anyone who has had experience in the maintenance of even a small central-office power plant will recognize the difficulty and the expense of maintaining these thousands of isolated power plants which were located in each telephone. The maintenance of this generating outfit cost from $2 to $3 a year a telephone. But in the common-battery system, all these isolated power plants are done away with, and a single central-office power plant suffices for the entire exchange. One large storage battery, consisting of 11 cells, is installed. This main battery is charged from motor-generators from off the lighting mains, and supplies all the current used in the telephone exchange. The cost of all current supply per telephone, including the fixed charges, probably does not exceed $1 a telephone a year in a modern common-battery system. The removal of the generators and batteries from the instrument has also cheapened its first cost and maintenance, and the instrument as it exists to-day contains the fewest possible number of parts.

It might be well to remark at this juncture that the successful operation of the common-battery system depended upon the evolution of the storage battery. We had to have at the central office a source of current of constant electromotive force, and which possessed practically no internal resistance. If the source of power were not constant or contained any internal resistance, all the lines connected with the exchange would be noisy or would have cross-talk on them. As is well known, the modern storage battery produces a current of constant electromotive force, and it besides possesses a very low internal resistance, these two features making possible the common-battery system of to-day.

In the common-battery system there is a pressure of 24 volts on every line all the time, and any poor or defective insulation will cause a leak of current and consequently the display of the signaling apparatus at the central office.

One of the great objections to the use of common battery by telephone engineers was the fact that it required superior outside-line construction, but this in reality has been a benefit, for with the common-battery system we must put our wires and cables underground and use as little open wire as possible in order to procure a good quality of service. Also the current being upon the lines at all times, it acts as a sort of watch dog to the entire system, and makes those in charge of the plant keep it in good repair.

From the above statement the economy of maintenance of the common-battery system is plainly apparent.

Turning now to the quality of service, we note that from the subscriber's point of view the common-battery system is eminently satisfactory. He is not required to grind a crank in order to signal central. All he has to do is to remove the telephone from the hook, which immediately displays the signal in front of the operator. This gives the subscriber practically nothing to do and transfers all work to the central office, where it can be taken care of by skilled operators. It is always possible for the subscriber to call in the operator by moving the hook, and the possibility of his being hung up and unable to get the central office is very remote.

That the subscriber is satisfied with the common-battery system is evidenced from the fact that in ordering a telephone or a private-branch exchange he will always tell you "that he wants that system where you take the receiver off the hook and it lights one of those little lamps."

I have stated above that in the old systems batteries were provided for each telephone for supplying the transmitter with current. When these batteries were new and in good condition the service from the telephone was good, but after they had been used for a short time or if the subscriber accidentally left the receiver off the hook and thus allowed the batteries to run down, the transmission from the telephone would be very poor. Therefore, from the magneto system with local batteries, we never could hope to obtain a uniform grade of service.

It is highly necessary that all of the instruments talk well over both local and long-distance lines, for it is our aim and ambition to produce a satisfactory volume of transmission between any telephones in the entire country. In the local-battery system, if we spent a large amount of money in battery maintenance and kept the batteries in first-class order, the transmission for all local connections would be entirely too strong, although it must be admitted that it would be excellent for the long-distance connections. In the common-battery system the source of current supply is from the central-office battery, and we can therefore regulate the amount of current for each connection; i. e., for all local service we will have our apparatus so wired that the instrument receives sufficient current for local transmission, but when a long-distance connection is put up we will triple or quadruple the amount of current given to the transmitter. Thus with the common-battery system, we are enabled to given an absolutely uniform grade of transmission for all local connections, and for long-distance connections we can give the transmitter the ultimate amount of battery power that it will stand. This, in my opinion, is one of the most important advantages of the common-battery system.

So successful has the common-battery system proved in large exchanges that it is now our intention to carry the work still further and make even the smallest exchanges in country towns work on the common-battery basis. We have plans prepared for a number of these small exchanges which will work on the common-battery basis, but which will be provided with no power plant. The necessary current for operating the transmitters and signals will be supplied over from 10 to 30 miles of toll line from the nearest large common-battery plant.

We have also been successful in operating toll-station lines of from 20 to 40 miles in length and equipped with from five to 10 stations on the common-battery basis.

In conclusion, at the risk of being considered too optimistic in my views, I will say that within the next 10 years the local-battery magneto-telephone instrument, with its associated magneto switchboard, will be considered as a rarity in the United States.

1. A paper read before the Pittsburg Section of the American Institute of Electrical Engineers, February 5, 1903.

Granular-carbon Transmitter Litigation.

Judge C. C. Kohlsaat, sitting in the United States Circuit Court for the Northern District of Illinois, handed down a decision on March 30th in the case of the Stromberg-Carlson Telephone Manufacturing Company against the American Electric Telephone Company and others, brought for alleged infringement of United States patent No. 580,434, for an improved form of transmitter of the granular-carbon type. By sheets of gauze and in other ways the complainants keep the carbon grains from packing. They allege that the defendants infringed, in their instruments, these non-packing devices. Judge Kohlsaat found for the defendants. After reciting the prior art, in his opinion, he said:

"Thus we find in the prior art practically all of the elements of the patent in suit. The most that complainant has done is to combine them into one operative device. The use of wire meshes to agitate the carbon particles is not new. Complainant, however, has brought these various elements together into what it claims is a co-operative relation.

"Defendants' device consists of a diaphragm having upon its inner face a roughened patch of carbon, pasted or glued thereon; a rear cup-shaped electrode made of a solid piece of brass, bored out on its front face to form a cavity for holding the granules, the bottom surface of which cup is roughened by a number of projecting circular ribs formed by turning concentric grooves in the metal. It also contains the intermediate sieve. Thus the arrangement of parts is similar to that of complainant's, but the faces of the electrodes are different.

* * * "I am of the opinion, in view of the prior art, that whatever of patentable novelty there is in complainant's device must be limited to the use of the gauze or perforated sheets, and therefore hold that defendants' device does not infringe.

"The bill is dismissed for want of equity."

GENERAL TELEPHONE NEWS.

The New England Telephone and Telegraph Company is to erect a brick telephone exchange building in Pittsfield, Mass., at a cost of $12,000.

The Cumberland Telephone and Telegraph Company of Kosciusko, Miss., has issued a statement of its business for the month of February, 1903, which shows an increase of 1,660 subscribers. The total number of subscribers at the end of the month is 94,782.

Eighteen suits were brought against the Chicago Telephone Company on March 30th before Justices Hurley and Prindiville of Chicago, to recover money claimed to have been collected by the company in excess of the rate authorized by the city ordinances. The complainants have organized the Chicago Telephone Adjustment Company, which will attend to the litigation for its members. Hundreds of similar suits will be brought later, which, it is said, will involve a total claim of nearly $1,000,000. The suits just begun are distinct from those on which an injunction was granted recently by Judge Tuley, restraining the company from charging more than $125 a year for its service. The present actions are brought by those who paid the excess and discontinued the use of the telephone, or whose rates are now reduced to the permitted $125, or who have introduced the switchboard system, and are now suing separately for the recovery of the amounts claimed to have been overpaid.

Annual Report of National Bureau of Standards.

The work of the new National Bureau of Standards since its organization is covered in the first annual report which has recently been submitted to the secretary of the treasury by Director S. W. Stratton. The scope of the bureau is shown to be research and testing in the domain of physics, extending into the field of chemistry on the one hand and of engineering on the other. Descriptions are given of the mechanical laboratory which is now under construction and of the physical laboratory which has been planned.

The work of the last year involved the verification of a large number of standards of length, mass and capacity for the Government and for chemists, engineers, state and city sealers, manufacturers and merchants. In addition to the work done for the public considerable attention was given to the improvements of comparators, balances and other apparatus used in the work of this character, the object being to design apparatus which will permit of the work being done with the required accuracy and the maximum speed.

Professor Stratton cites as the more urgent matters demanding attention, the verification and stamping of chemical glassware, such as flasks, burettes and graduates; the design and construction of a model set of weights and measures that shall be adapted to the needs of state, county and city sealers; standardizing of hydrometers. The work in thermometry is reviewed, and the bureau in the very near future will be able to undertake testing of all kinds of temperature-measuring instruments up to about 1,500 degrees Centigrade (2,700 degrees Fahrenheit) and as low as —190 degrees Centigrade (—130 degrees Fahrenheit).

"A considerable portion of the time during the last year," says the report, "was spent in planning the work to be undertaken and in the design of special apparatus. During the last year a considerable number of resistance standards have been verified for manufacturers, scientific institutions and the Government.

"Accurate measurements of electromotive force are as fundamental as the accurate measurement of resistance. A number of Clark standard cells, legalized by Congress as the standard of electromotive force in the United States, have been constructed from chemically-pure materials obtained from a number of different sources, and also from the same materials subjected to further purification. Although the agreement of the individual cells with each other is within two parts in 10,000, a further supply of materials for new cells has been purchased. This material will be analyzed and subjected to further purification in order that the standards of electromotive force may meet every requirement. The main source of the variation of the electromotive force of the Clark cell seems to be due to the differences in one of the ingredients used, and investigations should be directed to ascertain under what conditions this material can be obtained with uniform electromotive properties.

"When the unit of electromotive force was defined by the International Congress the best determinations of the value of the Clark cell in terms of that unit corresponded to the relation of one volt equals 1,000-1,434 electromotive force of the Clark standard cell at 15 degrees Centigrade. Subsequent work has indicated that the volt thus defined is too small by almost one part in a thousand. A different unit has therefore been adopted by Germany. Moreover, another type of standard cell, the Weston, has been found to possess some advantages over the Clark cell. A number of these cells have already been set up, and, in view of the possibility of its adoption as the official standard of reference, others are to be constructed and compared with each other and with the Clark standard cells. Although the measurement of electric currents will be based upon standards of resistance and electromotive force, the bureau should undertake the redetermination of the electrochemical equivalent of silver, upon which the legal definition of the unit is based, since the value adopted is not consistent with the definition of the two other fundamental electrical units—the ohm and the volt.

"One of the temporary laboratories has been fitted up for the calibration of voltmeters and ammeters, and while the range is at present limited to 150 volts and 50 amperes, apparatus will soon be installed for increasing these ranges to 2,000 volts and 1,500 amperes. The necessary galvanometers, resistance standards, resistance boxes, regulating rheostats and other accessory apparatus have been provided. A comparative study of the different makes of American instruments will be made after the working standards of the bureau have been calibrated. Facilities will also be provided for the measurement of ammeter shunts of high carrying capacity. A number of requests for work of this kind have already been made. With facilities for the measurement of high voltages and heavy currents the bureau will also be prepared for the verification of direct-current wattmeters and supply meters, and this work will be undertaken for the public as soon as an adequate force is provided. It is desirable that a portable apparatus be designed which will permit electric-light and power companies so disposed to have their switchboards and other apparatus tested in place."

In regard to the nature of the work to be undertaken in the immediate future, the bureau makes the following announcement:

"For the present the work of the bureau will be limited to the comparison of the following standards and measuring instruments, either for commercial or scientific purposes:

"Length Measurements.—Standard bars from one to 10 feet, or from one dm. to five m.; geodetic base bars, bench standards, leveling rods, graduated scales, stage micrometers, engineers' and surveyors' metal tapes from one to 300 feet, or from one to 100 m.; standard gauges, manufacturers' standard measuring bars and limit gauges.

"Weights.—Weights from 0.01 grain to 50 pounds, or from 0.1 mg. to 20 kg.

"Capacity Measurements.—Capacity measures from one fluid ounce to five gallons, or from one c.cm. to 10 liters; cubic-foot bottles; chemical glassware.

"Polariscopic Apparatus.—Scales of polariscopes, quartz control plates, etc.

"Hydrometers.—Alcoholometers, salimeters and saccharometers whose scales correspond to densities between 0.85 and 1.20.

"Thermometers.—The determination of the corrections of mercurial thermometers in the interval from —30 degrees Centigrade (about —25 degrees Fahrenheit) to 500 degrees Centigrade (about 900 degrees Fahrenheit), including the verification of clinical thermometers. After July 1, 1903, the bureau will be in a position to certify thermo-couples and electrical resistance thermometers extending to about 1,500 degrees Centigrade.

"Photometric Standards.—Hefner lamps and incandescent photometric standards.

"Electrical Resistances.—Verification of resistance standards and determination of temperature coefficients, of the following values; 1, 10, 100, 1,000, 10,000, 100,000 ohms; and the decimal subdivisions, 0.1, 0.01, 0.001, 0.0001, 0.00001; resistance boxes, potentimeters, ratio coils, and other resistance apparatus; resistance standards for current measurement; resistance above 0.00001 ohm; current-carrying capacity below 1,000 amperes; determination of electrical properties of materials, conductivity, temperature coefficients, thermo-electro power.

"Standards of Electromotive Force.—Clark, Weston and other standard cells.

"Direct-current Measuring Apparatus.—Millivoltmeters; voltmeters up to 2,000 volts; ammeters up to 1,000 amperes; wattmeters up to 500 volts and 500 amperes; energy-meters up to 500 volts and 500 amperes.

"Alternating-current Measuring Instruments.—Voltmeters and ammeters; range limited to 100 volts and 200 amperes.

"Condensers.—Measuring capacities and testing insulation.

"Standard Inductances.—Measurements and tests."

Automobile Combination Formed.

The organization of the Association of Licensed Automobile Manufacturers has been formally announced, the combination having been effected by George H. Day, president of the Electric Vehicle Company. The association, according to Henry D. Macdona, counsel for the new concern, secures to its members the use of the Selden patent, the suit over which was decided recently in favor of the Electric Vehicle Company against the Winton Company and the firm of Smith & Mabley. Four hundred other patents are secured by the association, it is said.

The Selden patent, the establishment of the validity of which by the courts made this association possible, was granted to George B. Selden of Rochester, N. Y., on November 5, 1895, and is numbered 549,160. It was applied for in 1879. The Electric Vehicle Company, in November, 1899, took from Mr. Selden, under this patent, an exclusive license, and shortly thereafter commenced a suit against the Winton Motor Carriage Company. The most important claim in this patent, and the one which it is asserted all makers of gasoline automobiles must infringe, reads as follows: "The combination of a road locomotive provided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydrocarbon-gas engine of the compression type, comprising one or more power cylinders, a suitable liquid-fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, and a suitable carriage body adapted to the conveyance of persons and goods, substantially as described."

In the trust are included about 30 concerns, among them being the Winton, Olds, Mobile, Packard, Peerless, Searchmont, Haynes-Apperson, Apperson Brothers, Locomobile, Knox, Auto-Car, Pierce, Pan-American, International, United States, Long Distance, Pope-Robinson, Waltham, Stevens-Duryea, and Franklin Companies. Litigation falling upon any member is undertaken by the association.

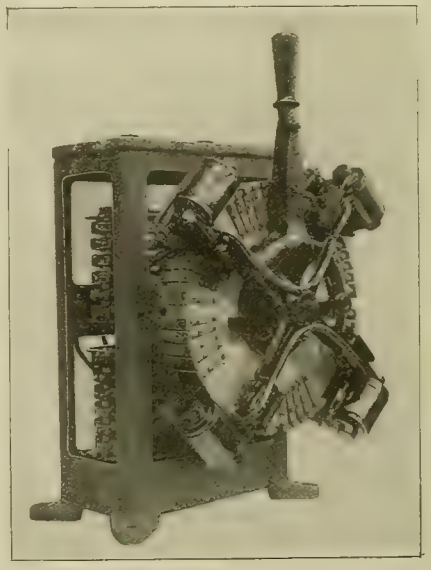
The Little Rock (Ark.) Traction and Electric Company has been changed by the new management to the Little Rock Railway and Electric Company, the capital being $2,250,000. D. H. Cantrell is president of the company. The new arrangement is due to the recent purchase of a controlling interest by Isadore Newman & Son of New York and New Orleans from the United Securities and Electric Company.

Regulating and Reversing Controller for Direct-current Motors.

For the control of direct-current motors operating cranes, hoists, etc., and similar appliances requiring variations in speed and frequent stops and reversals, the Westinghouse Electric and Manufacturing Company has placed upon the market an improved controller of the commutator type which has been designed especially for this class of work.

This controller is similar to the well-known Westinghouse commutator-type controller which has been in general use for some years, but embodies several changes and improvements. The necessary resistance is mounted inside of a cast-iron frame, on the outside of which is attached the commutator, or contact dial, for regulating the amount of resistance in circuit and for reversing the motor.

In the smaller sizes the resistance is of the ventilated-cell type as shown in the accompanying illustration. This construction is the same as that used in the Westinghouse standard railway-controller resistance, a service where its efficiency and durability have been proven by years of the hardest usage. The resistance in the larger sizes consists of cast-iron grids of very durable construction. These grids are capable of withstanding very severe use, it being practically impossible to burn out or otherwise injure them. They are also the same as those used in railway service.



REGULATING AND REVERSING CONTROLLER FOR DIRECT-CURRENT MOTORS.

The contact dial is made up of copper contacts which are fastened to the periphery of a circular stone of good mechanical strength and toughness, affording a firm support and giving excellent insulation for the parts. The contacts are simple and so made that they may be easily renewed when injured by wear or any possible arcing. Their total makes possible a correspondingly large number of steps of resistance, giving a very gradual regulation to the motor.

The brush-holder is fitted with four contact arms, which, when the circuit is opened, divide the arc into four breaks. Each contact arm is provided with a powerful blow-out magnet which reduces the arcing to a minimum and makes the maintenance of an arc impossible.

The whole construction has been made as compact as possible, every care being used to make this controller peculiarly applicable to crane use, while it answers equally well for the operation of elevators, hoists and other classes of work where series motors are used intermittently.

Electric Rat Exterminator.

Superintendent Stephan of the Cincinnati, Ohio, Zoölogical Garden has contrived a device which has proved of considerable satisfaction to him. For some time recently large rats and stray cats have been making frequent trips to the "Zoo," and by gaining entrance to the yard in which the pheasants, quail and other small birds are kept, have helped themselves to some of the finest birds. How to put a stop to this nuisance caused Mr. Stephan much worry. He had noticed that to gain entrance to the enclosure the rats would climb over the fence. The superintendent did some thinking, with the result that a wire was stretched along the top of the fence and connected with an electric-light circuit. When the garden was closed for the night the current was turned on and the superintendent went to bed. At daybreak several large dead rats were discovered on the outside of the fence, where they had fallen after coming in contact with the live wire.

A bill has been approved authorizing the city of Huntsville, Ala., to issue bonds to the amount of $20,000 for the erection of an electric-light plant.

Street Lighting in Chicago and St. Louis.

On December 24, 1902, the city of Chicago completed its fifteenth year of municipal ownership and operation of the electric street-lighting system of the city, and on December 31st last there were 4,640 arc lamps in service. Statistics relating to the growth of and expenditures for the municipal lighting system are given in the annual report of the Department of Electricity of Chicago, prepared by Edward B. Ellicott, city electrician, for the year ended December 31, 1902. He states that during 1902, $274,357.48 was expended for construction and operation and that for the whole 15 years the total amount expended on account of the plants was $3,400,663.05. If the city had rented the lights during the 15 years, it is asserted that they would have cost $3,535,875.50, which is given as a proof that the operation of the system has been a source of profit to the city. "If the city had not engaged in the operation of its lighting service," says Mr. Ellicott, "it would have expended as much or more in renting lamps from private companies and had nothing to show for the money expended, while under the existing circumstances the city has its complete electric-lighting system, capable of saving each year in the future a sum approximately equal to the amount saved this year, which was $283,628.49."

During the year 213 new lamps were erected and 35 discontinued, leaving a total of 4,640 lamps in operation on December 31st. Fifty-five new poles were set and 15.07 miles of new aerial wire was placed. The cost of lighting the city for 1902 is put down as follows: Gas lamps, $474,381.38 for 13,895 plain-burner and 11,172 mantle lamps, giving 998,000 estimated candlepower; gasoline lamps, $148,352.46 for 6,975 lamps with mantles, giving 334,000 candlepower; rented electric lights, $62,233.98, for 668 lamps, giving 1,252,000 candlepower; municipal electric lights, $241,208.51 for 4,640 lamps, giving 9,016,000 candlepower; gas office, $10,002.85, making a total of $936,179.18, with a total estimated candlepower of 11,600,000.

The cost of operating the municipal lighting plants for the year was substantially reduced from that of 1901, notwithstanding a material increase in wages paid to employes and the general higher prices of supplies. Mr. Ellicott asserts that the total cost per lamp was $53.51, or $3.97 less than for 1901. The total amount expended for replacement of worn-out and bettering the existing apparatus was $8,614, and $12,000 was spent in rebuilding arc lamps, renewing lampposts, fittings and many minor items "that ordinarily are termed depreciation." The cost of material for the three lighting stations was $153,909.89 and the cost of labor was $82,970.94, making a total cost for these two items of $236,880.83. The total number of lamp-hours was 18,103,968, the average lamp-hours per lamp 4,016, and the average cost per lamp per hour $0.013325, according to Mr. Ellicott's figures.

The annual report of the City Lighting Department of St. Louis, Mo., for the year ended April 7, 1902, prepared by Andrew J. O'Reilly, supervisor of city lighting, contains some interesting data. During the year the lighting, telephone, telegraph and street-railway companes constructed 22,519 duct-feet of underground work, laying 38.889 miles of cable. The total of work underground from March 5, 1897, to April 1, 1902, was 3,864,024 duct-feet and 388.157 miles of cables. The average number of arc lamps for lighting the streets, alleys, parks and public places for the year was 950, while 730 incandescents were used. For lighting public buildings 22 arcs and 7,358 incandescents were used. The cost per 100 square feet of building lighting varied from $1.84 to $6.94. There were received 3,749 complaints relative to poles and wires. Permits were granted to the electric-light and power company for stringing 283.212 miles of wires and to the street-railway companies, 156.322 miles.

The extent of pole lines along streets and alleys for electric-light, power, telegraph and telephone purposes is shown by the following figures: American Telephone and Telegraph Company, 7.991 miles; Bell Telephone Company of Missouri, 215.932 miles; Kinlock Telephone Company, 169.675 miles; Western Union Telegraph Company, 22.397 miles; Postal Telegraph-cable Company, 10.018 miles; Missouri-Edison Electric Company, 225.422 miles; Laclede Gas Light Company, 124.879; Edison Electric Illuminating Company of Carondelet, 10.447; Seckner Contracting Company, 31.423; Carondelet Electric Light and Power Company, 4.586; Fire and Police Telegraph Department, 65.153. The St. Louis Transit Company operated by electricity 325.821 miles of track, the St. Louis and Suburban Railway Company 21.72 miles and the St. Louis and Meramec River Railroad Company 14.355 miles, a total of 361.896 miles of track.

The cost of electric light for the year was $99,547.81, and the prices paid were $23.77 per arc lamp per 1,000 hours and $4.79 per 30-candlepower incandescent per 1,000 hours to the Seckner Contracting Company, and eight and six cents for electric power per kilowatt-hour for buildings, respectively, to the Laclede and Missouri-Edison Companies. The actual cost of lighting the streets, including gas, for the year, was $498,729.92 and for lighting buildings $66,285.62.

Question Box of Ohio Gas Light Association.

Much valuable information is brought out in the question boxes that are important features of most large conventions. An excellent example of the value of the question box is shown in a recent report of the questions asked and answered at the nineteenth convention of the Ohio Gas Light Association. Over 400 questions were asked, and as some of the answers are of interest to central-station men and electrical engineers, they are reproduced here. This particular question box was ably edited by Henry L. Doherty, who did so much to make the question box of the last convention of the National Electric Light Association so successful.

In answer to the question: "What would be the advantage or disadvantage of running a 150-kilowatt generator with a gas engine in a combination plant where the maximum output of the gas plant is 50,000 cubic feet per day?" Mr. Doherty answers as follows:

"The advantage or disadvantage of running a 150-kilowatt generator with a gas engine would depend entirely upon local conditions which would affect the total cost. A gas engine costs more per horsepower than a steam engine, and this is especially true when both are rated on their maximum capacity. A gas engine, as a rule, is rated upon its maximum capacity, while a steam engine is rated upon its most economical capacity. With a higher cost for a gas engine the saving must be considerable to compensate for the increased fixed charges if the output of the engine is a small amount. Another disadvantage of the gas engine is its low efficiency at light loads. On the engines suitable for running generators the friction amounts to about 25 per cent. of the rated capacity of the engine. Therefore a gas-engine station should be fitted up with a number of units of different sizes which would enable them to be operated at practically their rated load when operated at all."

The question whether English gas engines are superior to American gas engines or not, brought out the following from Walter Thomas, superintendent of the Vancouver Gas Company, Vancouver, B. C.: "With one or two exceptions, they are; which I have proven by six years' actual experience, using English engines exclusively and watching results of American engines in neighboring towns. One American town of 50,000 inhabitants has no engines running; a Canadian town on the same coast, 25,000 people, has 30 running profitably for the gas company and successfully for the consumer. The repair bill for the 30 engines did not average $5 each per year in the five years that they were put up against the most arduous work, some under trying conditions, running foundries, machine shops, sash and door factories, stone-sawing, wood-sawing, cold storage, electric light, etc., successfully competing and supplanting the cheapest electrical power on the Pacific Coast. They are the result of 40 years' experience and experiment, are splendidly designed and proportioned to stand the work. No fickle electrical appliances are depended upon for the most vital part, viz., the ignition. Great pains have been taken to put up a tube which operates successfully and economically. The valves are all positive, accurately proportioned. The proportion of air and gas is a known quantity; no taps to monkey with and try, and get disgusted with. The engine will start when it is needed and a boy can start a 20-horsepower by hand."

O. B. Kohl and C. H. Williams of the Madison (Wis.) Gas and Electric Company answer the same question as follows: "To admit that they were, would be to admit that the English gas engineer is a superior of the American, which is not a fact. One thing which is misleading is a statement of the results obtained by the English-built machines, when operated on blast-furnace gas. The English engineers obtain some results which look remarkable to the American engineer at first glance, but an analysis will disclose the fact that Yankee ingenuity has so perfected the metal-working machinery, that the gas available at the American blast furnace has done its useful work, and is, consequently, but a lean product when compared with the partially used product of the English furnace."

In answer to the question: "Why are not electric gas lighters in more general use?" Irwin Butterworth, manager of the Denver (Colo.) Gas and Electric Company, said the reasons were the decreasing use of open gas jets and the relative difficulty, expense, unsightliness and unreliability of electric gas lighting as applied to Welsbach burners (although considerable progress has been made toward improving same), as compared with the lighting of electric lamps. Other answers to the question were "Cost and likelihood of getting out of repair;" "because of the short life of the battery and their comparative high cost in comparison with matches;" "because they are so unreliable, get out of order frequently and require an endless amount of attention."

One question was, "Why do gas companies have all the small consumers and the electric companies the large ones?" This elicited, among others, the following replies: "There is no reason, with the lighting appliances that are at hand these days, for any such state of affairs in any gas company not operating an electric-light plant;" "They do not in Freeport, Ill.;" "In large institutions it is more convenient to have electric light even though the expense is greater—pay your money and take your choice;" "The gas companies do not have all the small consumers and the electric companies all the large ones in San Francisco;" "This condition does not exist at all where gas companies are active in looking after the lighting business, and need not exist in any case. There are many cities where the reverse of the condition stated is true, also many cities where gas companies having an electric department, are pushing gas arc lamps."

"What special policy should be outlined for a combined gas and electric company?" drew forth the following from Irwin Butterworth: "This is a much more difficult question to answer than would at first appear. In a general way, I would say study carefully the costs entering into the various branches of your service, make an exact analysis of them and so ascertain what each class of service costs you. Then consider in connection with these costs the prices received, or that could be obtained, from each branch of the service, and push those that promise from these considerations the greatest amount of net earnings. This is easier said than done! Ordinarily, and except under exceptional circumstances, I believe that a combined company can make more money by lighting its city's streets with gas instead of electricity; by cultivating the use of motors for short-hour service or variable loads, and gas engines for long-hour service at full loads; and, other things being equal, by cultivating the use of gas engines near the gas works and of motors near the electric station, when the two are remote from each other. In making extensions into new territory, the gas-distribution system should ordinarily be introduced first, postponing the extension of the electric-distribution system as long as possible."

T. R. Beal, general manager of the Poughkeepsie (N. Y.) Light, Heat and Power Company, said the two departments should be run as separate companies, and each worked against the other in competition for all new business. Existing business should be carefully guarded by its department, so as to avoid the desire on the part of the customer to change, and this can only be accomplished by good service stimulating both departments to best efforts. J. J. Knight, secretary of the General Gas Light Company of Kalamazoo, Mich., replied that this special policy for such companies, and a policy important above all others, should be to see to it, that their consumers are given the opportunity to avail themselves of the latest and best appliances for the use of either gas or electricity, and on as favorable terms as are given where the combination does not exist.

Polarization of Roentgen Rays.

During the course of a recent lecture in London, Lord Rayleigh, professor of natural philosophy at the Royal Institution, announced that Blondelot, a well-known French experimenter, had adduced additional evidence to prove that Roentgen rays are susceptible of polarization and can therefore be traced to the spectrum. If this is true, and the rays are transversal, as Blondelot thinks, it follows that they are a species of ordinary light, but of extremely short wave-lengths, perhaps a hundred times shorter than waves of light. Lord Rayleigh said he saw no reason to question the discovery, which is of importance, as it helps to determine the nature of Roentgen rays.

In another part of the lecture Lord Rayleigh dealt with the coast lights and questioned the use of the extreme high candlepower employed at some lighthouses. He said a single candle is visible three miles on a dark night if the air is absolutely clear, but as the air is never so, great candlepower is necessary to allow for diffusion, but even when this allowance is made he doubts if anything is gained by such illumination as is produced by the electric arc at St. Catherines on the Isle of Wight, which is equal to millions of candles. It is probable, he declared, that for practical purposes 100,000 candlepower would be as effective as 30,000,000. It would be more valuable, he said, to repeat moderate flashlights more frequently than to employ extremely high-power fixed lights.

The Biloxi Street Railway and Power Company of Biloxi, Miss., will build an electric-lighting and power plant of brick, 50 by 100 feet, to have three 150-horsepower boilers, 300-horsepower engine, 200-kilowatt generator, 225-horsepower engine and other machinery. Plans and specifications have been prepared by George W. Knox and James Z. George of Chicago.

Some Facts About Electric Cables.[1]

By H. W. Fisher.

While the manufacture of submarine cables was developing very rapidly about a half century ago, it was not till the end of the '70's and early '80's that definite steps were being made to construct different types of cables to meet the requirements of the then infant electrical industries which have later grown to such giant proportions. Since that time the cable business has developed rapidly until now, when it can be considered one of our great electrical enterprises.

In substantiation of this some general figures relating to the history of the Standard Underground Cable Company may be of interest.

About 10 years ago our business amounted to about $500,000 per annum. This year [1902] it will be close to $5,000,000, and from the general indications it will probably be $7,000,000 or $8,000,000 next year. Lately we have been using at the rate of 2,000,000 pounds of lead and 750,000 pounds of copper per month.

On account of the great difficulty of getting copper wire on time, and in view of the great amount which we require for our business and the large demand there is for copper wire, we have recently put up one of the finest copper rolling mills and wire drawing plants in the country. The mill has a capacity of 75 tons per day of wire rods, and the new wire drawing plant when completed will be capable of drawing 100,000 pounds of different sizes per day.

After this brief statistical summary it may be of interest to trace the development of the more important types of cables.

Telephone Cables.

In the early days wires for this purpose were insulated with cotton and were formed into cables without pairing, after which the core was impregnated with an insulating compound, and either directly lead-covered or pulled into a lead pipe. About this time it was found that paper possessed many desirable qualities as an insulating medium, and hence it began to be used. No. 18 (Brown & Sharpe) conductor was generally specified, and the electrostatic capacity per mile was about 0.18 microfarad. As the telephone exchanges became larger it was found necessary to form the conductors into twisted pairs so as to eliminate cross-talk and also to reduce the electrostatic capacity so as to improve articulation.

Then came the celebrated Bell Telephone Conference specifications in which an electrostatic capacity of 0.08 microfarad per mile for No. 19 wire was required. In order to meet these seemingly rigid specifications paper had to be formed so as to include as much air as possible, no insulating compound could be employed, and the cable core had to be directly baked out at a temperature above the boiling point of water just previous to the application of the lead cover. For a long time this form of cable remained a kind of standard with the Bell Telephone Company, but after the long-distance telephone circuits began to come into use it was found desirable from an economic standpoint to use cheaper cables consisting of smaller conductors for local work and proportionately larger cables and larger conductors for long-distance distribution through trunk lines. In explanation of this I might say that a large capacity interferes with articulation, while a large resistance diminishes the volume of sound, hence for long-distance work—where the resistance is almost sure to be high—it is desirable to make the electrostatic capacity and conductor resistance of cables as low as possible.

There is a limit to the size of conductor that can be used, because the electrostatic capacity increases rapidly with the size of conductor. Conductors as large as No. 11 have been used, but Nos. 18, 16 and 14 are more often employed for long-distance distribution, and Nos. 19, 20 and 22 for local lines. For long-distance distribution work we have made cables consisting of No. 14 wire, which had as low an electrostatic capacity as 0.0055 microfarad per mile.

In the construction of this kind of cables the method of applying the paper is very important for economic reasons, in order that the cables may be made as small as possible and yet meet the requirements of the specifications. This work has grown to such large proportions that from our factories we have shipped the equivalent of over 120,000 feet of 100-pair cable in one week. This means 24,000,000 feet of wire covered in one week.

Electric-light Cables.

In the early days the large proportion of cables employed were insulatd with rubber, and many of these did not have any lead cover. As this form of cable was expensive, and when not lead covered did not resist very well the action of temperature and atmospheric moisture, rains, etc., cables covered with cotton and jute and saturated with insulating compound and lead covered began to be used, and gave very good satisfaction until the requirements demanded the use of a more dense and compact material, when paper saturated with insulating compound was employed. In the old days 2,000 volts was considered very high indeed. At this date the processes are so much improved that the manufacture of cables for 10,000 volts is an everyday occurrence, such cables being tested to 25,000 or 30,000 volts at the factory and occasionally cables for much higher voltages are supplied. In the manufacture of electric-light cables it has been found necessary to use a large factor of safety, because in the operation of electric-light and power plants there are apt to be sudden impulsive rises of voltage due to the phenomenon of resonance.

To insure flexibility large-size conductors are made up of a number of smaller wires in the form of a strand or wire rope. Some of these weigh as much as six or seven pounds per foot. In the manufacture of electric-light cables large quantities of Para rubber are employed. A given thickness of vulcanized rubber resists a given voltage better than the same thickness of paper, but on account of the great expense of rubber compounds, paper cables for the same voltage are cheaper than those insulated with rubber, and just as satisfactory.

1. A paper recently read before the Engineers' Society of Western Pennsylvania at Pittsburg.

Rules Governing Electrical Supply at St. Louis Exposition.

The following rules relating to the supply of electricity to exhibitors and others have been promulgated by the Division of Works of the St. Louis Exposition:

1. Application for light and power service shall be made on a blank, which will be furnished for that purpose by the exposition, and in no case will either service be given except under authority of written contract executed between the applicant and the exposition.

Plans and specifications for all light and power service must be submitted to the director of works for his approval at the time the application is made.

All electric wiring and electrical installations for light and power shall be under the supervision of the director of works.

2. The charges for electric current for light and power shall be paid monthly in advance, except in case of storage batteries, when the charges will be made from meters, and no system of wiring will be connected except on presentation of treasurer's receipt to the Department of Works.

3. The charges for light and power are flat-rate charges. No electric service will be furnished through meter except for storage batteries.

4. The prices and terms hereinafter given are for the period of the exposition, and do not contemplate pre-exposition or post-exhibition service. Such service as is furnished before the exposition's opening, or after its closing, will be charged for extra.

5. Electricity will be furnished in all of the exposition buildings. The exposition will not be responsible for stoppages or interruptions in the supply of electric service due to any reasonable cause, nor for any damages to the exhibitors by reason thereof; nor for any damages resulting from any light and power service whatsoever.

6. The exposition, or such persons as it may authorize, shall at all times have access to the space occupied by an exhibitor or concessionaire for the purpose of inspecting the installation of either lighting or power service; such installation must be put in according to the instructions and orders of the exposition. Such employes will be designated by a badge indicating their connection with the exposition.

7. All applicants for electric service must first have their wiring installed, as the exposition is not prepared to do wiring for either exhibitors or concessionaires.

8. All wire work on the exposition grounds shall be subject to inspection by the exposition, or such persons as it may authorize, and no connection will be made until such approval has been obtained in writing from the exposition. In each case where approval has been obtained a charge of $5 will be made by the exposition for "cut-in," covering the average cost of material and labor. This price is entirely independent of the charges for current and is payable in advance.

9. If, after the opening day of the exposition, the consumer contracts for electrical service, the charges therefor will be prorated, but the contract will include the remaining period of the exposition, and is payable in advance.

10. Discounts.—Certain discounts hereinafter mentioned will be allowed for incandescent service. Arc-light service or miscellaneous service is not subject to discount.

11. Incandescent Lights.—Electric service for incandescent lighting will be furnished at 110 volts, 25-cycle frequency, alternating current, at the following rates for the period of the exposition:

Current for 16-candlepower lamps, not exceeding 60 watts per lamp	$7.00
Current for 8-candlepower lamps, not exceeding 30 watts per lamp	4.00
Current for 4-candlepower lamps, not exceeding 22 watts per lamp	3.00

Smaller than 4 candlepower at the same watt rate as 4 candlepower.

Larger than 16 candlepower, at same watt rate as the 16-candlepower lamps.

Discounts—

On discounts amounting for the term of exposition to $175	5 per cent.
On discounts amounting for the term of exposition to $350	7½ per cent.
On discounts amounting for the term of exposition to $700	10 per cent.
On discounts amounting for the term of exposition to $1,050	12½ per cent.
On discounts amounting for the term of exposition to $1,400	15 per cent.

Payable only by deduction from the November bill when that bill, plus the monthly accounts previously paid, indicates a total warranting one of the above discounts.

On accounts amounting for term of exposition to $1,750	17 per cent.
On accounts amounting for term of exposition to $2,100	20 per cent.
On accounts amounting for term of exposition to $2,450	22½ per cent.
On accounts amounting for term of exposition to $2,800	25 per cent.
On accounts amounting for term of exposition to $3,150	28 per cent.

Payable only by receipting November, 1904, bill, and by deducting from October, 1904, bill any residue of discount at the proper rate for the total term not liquidated by the receipt for November.

The exposition reserves the right to determine the performance of any and all lamps placed.

Charges for Current for Motors—

12. A minimum charge for current for any motor for the exposition term will be $14.

Current for desk fans	$14.00
Current for ¼-horsepower motor	20.00
Current for ½-horsepower motor	40.00
Current for 1-horsepower motor	77.00

Motors larger than one-horsepower at the rate of $70 per horsepower for the exposition term, subject to the following discount:

With reference to term, accounts amounting to $140	10 per cent.
With reference to term, accounts amounting to $280	15 per cent.
With reference to term, accounts amounting to $560	20 per cent.
With reference to term, accounts amounting to $1,120	25 per cent.
With reference to term, accounts amounting to $2,240	28 per cent.

These discounts shall be allowed only on the bills for service in November, 1904, or October and November, 1904, the latest bill or bills always being availed of to the limit of its value.

In calculating the proper quantity discount for desk fans, they shall be counted as part either of the lighting circuit, or the motor circuit, whichever the fans may be connected with, but in no case shall desk fans be counted as part of both a lighting and power account. All fans requiring a motor of over one-eighth-horsepower capacity shall be charged for according to regular motor ratings. Where separate cut-ins are made for fans a charge of $5 per cut-in shall be made, but where fans are made part of a general light installation, or a general motor installation, there shall be no separate charge for a fan cut-in.

Charges for motor service are based upon the commercial rating marked on the name plate of the motor, except in such cases where such rating is manifestly incorrect.

Motors and necessary appurtenances shall be supplied and maintained by the consumer; the exposition will, however, assist the consumer in keeping his motor in good condition.

13. Arc Lights.—Only the aisles of the main exhibit buildings will be illuminated by the exposition. Such arc lighting as is necessary to the exhibitor's or concessionaire's premises will be furnished under the following conditions:

First—The consumer to obtain the arc lamp.

Second—The consumer to pay the cost of wiring from the nearest exposition main.

Third—The consumer agrees to pay $77 for current for any multiple arc lamp—not exceeding 450 watts—and $70 for series arc lamps, for the exposition term, payable in equal monthly payments in advance. The charges for arc lamps using more than 450 watts shall be prorated on the actual watt consumption of the lamp.

Fourth—The consumer to pay "cut-in" charges ($5 per cut-in).

The exposition agrees to maintain the consumer's arc lamps with carbons and ordinary attendance. Information as to the proper type of arc lamp for a given territory, and as to voltage, etc., will be furnished on application.

14. Special Lamps.—All incandescent lamps above 16-candlepower rating, special arc lamps and special lamps must be submitted to the director of works on or before January 1, 1904, and will be subjected to a test in order to determine their rating. These tests will be made at the expense of the manufacturer and under the supervision of the chief electrical and mechanical engineer of the exposition company. Based on results of these tests prices will be determined for current consumption of such apparatus.

15. Storage Batteries.—Users of storage batteries shall provide wiring and all material necessary, including registering wattmeter. When provision can be made for furnishing current for batteries such service will be furnished at the rate of seven (7) cents per kilowatt-hour.

16. Current for Special Purposes.—Current for moving-picture machines, projector arcs, electro-plating and miscellaneous service, will be subject to special agreement to be entered into at the time the application is granted. Rates will be based on those for light or power, according to the class of work performed and the quantity used.

17. Any exhibitor desiring to contract for service of electricity must make application to the chief of the department in which his exhibits are installed. No application for service will be entertained unless made upon a blank furnished by the director of works, which may be obtained from the chief of a department, and when an application for service has been approved by the director of exhibits the contract will be executed on the part of the Louisiana Purchase Exposition Company, by the director of works, on terms and conditions that will be stated in each case. The director of works and the director of exhibits in their discretion are authorized to furnish gratuitously to exhibitors a limited amount of power for the operation of machines and processes. The character of the exhibit requiring power for its operation will determine the amount of power that will be furnished gratuitously.

18. The above rules may be changed in the discretion of the exposition company.

Are Nerve Force and Electricity Identical?

A Dr. O'Brien recently addressed the American Medical Association on the supposed identity of nerve force and electricity. Dr. O'Brien claims that progress both in medical and electrical science tends to confirm the electrical concept of nerve force advanced by him three years ago. Summarizing his views on this question in the light of our present knowledge, he says:

"The construction of nerves has been closely, though unconsciously, imitated in electric cables. Experiments on nerves should be interpreted according to the electrical peculiarities of cables, and not as if they were bare conductors. Nerves are insulated, distributed and arranged like fine electric conductors. Their purpose and use are the same as the purpose and use of electric conductors, namely, communication from point to point. They convey some form of force, and there is not such a gulf between its velocity and that of electricity as has been supposed. This force must be electricity, because:

"1. Electricity is always present when the nervous system acts.

"2. Electricity is the form of force that would do the work required. It is the form of force that would work with such construction.

"3. Because the terminal and central mechanisms connected with the nerves correspond to the terminal and central mechanisms connected with electric systems of communication and do similar work in sending, receiving, relaying, switching, transforming, accumulating, retarding, distributing, and translating impressions.

"4. Finally, because electricity, with such construction of conductors and of terminal mechanisms is the only form of force that we know of that would do all the work required.

"I therefore maintain that nerve force is electricity, and that it would advance knowlege of the nervous system and its functions to accept this proposition."

CORRESPONDENCE.

London Letter.

London, England, March 21.—The Royal Commission which is inquiring into the congestion in London traffic and the best means of meeting the difficulties occasioned thereby, met for the first time last week, and will continue its sittings weekly hereafter. So far, two leading officials of the Board of Trade have been examined, and their view is that whereas at present there are no less than four modes of procedure of which promoters of tramway and railway projects may avail themselves, much more facility and expedition would follow if one central authority were to be appointed, endowed with all the powers of a parliamentary committee, before whom all such proposals would have to come, and which could also make suggestions as to suitable routes. Lieutenant-colonel Yorke, who has paid more than one visit to America, favors a similar tribunal to the New York and Boston rapid-transit commissions, and also advocated a system of locomotion by which the cars could run from the surface into shallow subway tunnels, and, if necessary, also into deep-level tunnels. He contended that tramways were a hindrance to traffic on narrow streets, and under such circumstances should be abolished, and that the only adequate method of dealing with the problem in London was to formulate a general scheme of surface and underground locomotion, taking into account what is already in existence. Any future schemes would then have to fall into line with the set plans. He did not think there was much room for many more tubes, and altogether seemed strongly in favor of subway tramways. He was also partial to motor omnibuses.

An official return by the British Postoffice authorities shows that there are now seven exchanges open in connection with the government telephone system. The largest of these, of course, is the city or central exchange, which was opened on March 1, 1902, and now has 6,110 subscribers connected. In addition, the switchboard is to be considerably extended. Since the publication of the return in question another exchange has been put into operation; two more are nearly completed, and it is expected that two others will be opened this year. Yet others are well forward.

The tramways on the Isle of Man, which were recently brought into liquidation, are about to be reconstructed on more up-to-date lines. The original equipment was put in some years back, when the electric-traction industry in Great Britain was nothing to what it is at the present day. The order for the re-equipment of the tramways includes 300-kilowatt, 25-cycle generators, working at 7,000 volts, static transformers and rotary converters for one great power house which will effect economies over the several small ones hitherto employed. The Isle of Man is a favorite holiday resort, and the original lines, even with their somewhat antiquated equipment, easily made a dividend.

In connection with the bills which have been deposited for "tube" railways, this year, the London County Council proposed to send a deputation to the Board of Trade, urging that all these schemes should be shelved until the Royal Commission, now sitting to inquire into London traffic, shall have presented its report. I believe that something of the sort is contemplated in Parliament, but the president of the Board of Trade refused to allow the London County Council's deputation to wait upon him.

The Baker Street and Waterloo "tube" railway, a concern which was nearly permanently crippled through the financial operations for which Whitaker Wright is now in custody in New York, is now rapidly approaching completion. Eighty per cent. of the tunneling has been completed, and all the station tunnels have been driven, with the exception of one. A bill has been deposited by which it is sought to lease the undertaking to Mr. Yerkes' Underground Electric Railways Company of London.

Another link in the chain of communication in the suburbs of London was opened on Saturday last. This was the electric-tramway service owned by the Ilford municipality, which runs in three different directions to outlying districts. The system meets that of the East Ham municipality, which has been open for some time, and the network of electric lines in the eastern suburbs of London is gradually becoming an extensive one.

The quarrel between the British Postoffice and the Marconi company has been ended by the former granting the latter a wire between Falmouth and Poldhu, which latter is the Marconi company's station.

The new electricity works which have just been officially opened at Eastbourne, are characteristic of what has taken place in more than one of the older power houses in Great Britain. The undertaking started in a galvanized-iron structure in 1882 with an old Brush arc-lighting dynamo and combined boiler with engine underneath. Then the company which owned the undertaking removed to another site, and gradually accumulated a variety of plant, very little of which was up-to-date. Finally, however, direct-coupled sets were employed. In 1899 the local authority acquired the undertaking and immediately set about extending the system and building new premises, and the plant now consists of 400-kilowatt Ferranti engines and alternators, as well as 200-kilowatt, 150-kilowatt and 50-kilowatt generating sets of various makes. Generation takes place at 2,200 volts and 50 cycles, and over 700 house connections had to be changed to this pressure from 1,800 volts at 83 cycles. W.

New York Notes.

New York, March 28.—The International Mercantile Marine Company has arranged to install a Marconi space-telegraph system at a station to be located on the American Line pier, North River, at the foot of Fulton Street. This will enable communication to be held with ships compelled by fog to lie at anchor off Sandy Hook and in the lower bay. Sometimes ships are held this way for hours, and even days, and during such periods practically are isolated, as the other Marconi stations are at Babylon, L. I., and Nantucket, Mass. The use of the new station will not be restricted to vessels of the International Mercantile Marine Company, but will be available to all steamers equipped with the Marconi system apparatus.

An unusual placing of responsibility for a fatal accident has been furnished by the Essex County grand jury indicting the officials and members of the executive board of the North Jersey Street Railway Company, charging each with manslaughter in being responsible for the Clinton Avenue grade-crossing disaster of February 19th last, when nine pupils of the Newark High School were killed and a score or more injured. The indicted officers include President E. F. C. Young, Vice-president and General Manager David Young, General Superintendent Charles M. Shipman, Roadmaster Arthur W. Pratt, Superintendent James Smith, and Assistant Superintendent Richard Eick of the Bloomfield division, and A. J. Cassatt of Philadelphia, John D. Crimmins of New York, and J. Roosevelt Shanley, Elias B. Gaddis and Dr. Leslie D. Ward of New York.

The employes of the Manhattan Railroad Company, who recently organized a union, unanimously refused, early in the week, to accept a proposition made by the officials of the road looking to a settlement of the grievances of the men. A sub-committee of the executive committee of the union has been in conference during the week with the officers of the company, and the matter has been left entirely in the committee's hands, so no strike is threatened at present.

President A. J. Cassatt of the Pennsylvania Railroad Company gave testimony for an hour and a half on Tuesday before the special commission appointed by the Appellate Division of the Supreme Court to hear complaints of property owners and to pass on the plans of the Pennsylvania road for tunnels under the North River, Manhattan Island and the East River. He told of the inception of the project, its scope and detail plan; confessed to the difficulties that were sure to arise in its execution, but declared his belief that none would be insurmountable. He pointed out what, in his opinion, would be the advantages to be gained by the traveling public by the proposed improvements and extensions.

Mayor Low has submitted to the Board of Estimate plans for the construction of a large municipal building and terminal station for surface, elevated and subway trains, to cost $20,000,000. Controller Grout and the other officials approved the suggestion made by Mayor Low, and Bridge Commissioner Lindenthal was instructed to prepare plans. Mayor Low proposes to purchase the building of the Staats-Zeitung and the other property on the irregular block bounded by Center Street, Chambers Street, Tryon Row, and Park Row; also other property in the vicinity.

E. P. Bryan, general manager of the Interborough Rapid Transit Company, has announced his policy in connection with the management of the Manhattan elevated system that will come under his control on April 1st. Auditor E. F. J. Gaynor, Treasurer D. McWilliams, and Vice-president Alfred Skitt will continue their work for the company until 1906. This is in accordance with the terms of Mr. Belmont's lease. Mr. Skitt's work will be largely advisory. Frank Hedley, formerly of Chicago and now secretary of the Interborough company, will direct the operation of the road. He and Mr. Bryan will have offices in the Western Union Building, the present headquarters of the Manhattan Elevated Railroad. Other employes of the company will be retained upon the merit system.

A complete telephone system is to be installed on the elevated lines of the Brooklyn Rapid Transit Company. An instrument will be placed in each station. By this means it is expected to enable agents to communicate with the police in case of trouble and to keep the officials of the company informed of conditions along the line in the event of delay or accident.

A permit has been granted for a line of electric stages to run from the Central Park Plaza northward on Fifth Avenue, to Seventy-second Street, and then across the park to Riverside Drive. The vehicles are to be operated by the owners of the Fifth Avenue stages, but are to be run independently, without transfers. The fare is to be five cents, and the service is to be begun immediately.

The Kings County (N. Y.) Electric Light and Power Company's directors have decided to issue $1,250,000 of new stock at par. Books close April 16th and 50 per cent. of all subscriptions must be paid by May 1st, the balance by November 1st. The new stock will be issued May 7th.

The New York Electric Maintenance Company of New York has been incorporated with a capital of $25,000. The directors are H. D. Davy, Helmuth Moerchen and A. P. Nevin, New York. O.

New England News.

Boston, March 28.—The Horse Neck Beach Street Railway Company has been organized. The capital is $200,000, half of which is owned by B. W. Carlow of Worcester. The company proposes to build an electric railway connecting the Union Street Railway of New Bedford, Mass., and Horse Neck Beach a distance of 19 miles. The Tiverton, Seaconnet and Horse Neck Beach Street Railway is to be organized in Rhode Island for the purpose of building a connecting electric railway between Horse Neck Beach and the Fall River (Mass.) electric-railway system. This company is also to have a capital of $200,000 and eventually the two companies will probably consolidate.

About 1,000 employes of the Boston Elevated Railway Company met at the Dudley Street Opera House in Roxbury, Wednesday night, and unanimously adopted resolutions thanking the company for selling them coal last winter at a reasonable price, also for the recent increase in wages and the establishment of a pension system. Employes of the company who belong to the new union state that the meeting was arranged by the company. They also held a meeting the same night and criticized the company for the employment of spotters to watch the union's meetings and the discharge of some 200 men suspected of being interested in the formation of the union.

Engineers are making surveys for a large dam on the Farmington River near Cold Spring, Mass. This dam will give a fall of 300 feet and develop 6,000 horsepower. It is proposed to use the power to generate electricity to furnish power for the contemplated electric railway between Winsted, Conn., and Lee, Mass.

The connecting link between the Stamford Street Railroad Company's system and the Greenwich Tramway Company's lines, has been completed, making a continuous electric railway between New York and New Haven, Conn. When a gap of four miles between Cheshire and Milldale, Conn., has been built, the continuous line will extend to Springfield, Mass. This gap will be closed by the Connecticut Railway and Lighting Company during the coming summer.

It is reported that C. L. Edgar has bought all the stock of the Blue Hill Electric, the Dedham (Mass.) Electric, the Framingham (Mass.) Electric, the Milton (Mass.) Light and Power, and the Natick (Mass.) Gas and Electric Companies, and that these companies will be transferred to the Edison Electric Illuminating Company of Boston, which will apply for authority to issue sufficient new stock to capitalize these purchases. The company will dismantle the plants and will supply electricity in the towns covered by them from its Boston plants. The aggregate lamp capacity of these plants is 28,695 lamps and the cost of connecting them with Boston will be about $60,000. Framingham, the farthest point reached, is about 25 miles from Boston.

R. W. King of Dayton, Ohio, a director of the New Milford Power Company, says that the company has contracted to furnish electric power to the Connecticut Railway and Lighting Company at Bull's Bridge and Boardman's Bridge for a period of 30 years at a guaranteed dividend of five per cent. on the New Milford Company's stock. The contract will become effective on July 1st. Mr. King says it will cost $650,000 to complete the two plants.

The New York, New Haven and Hartford Railroad Company has announced its intention of electrically equipping its Meriden division, between Waterbury and Middletown, Conn. The company owns the Meriden Electric Railroad Company and will obtain its electric power therefrom. B.

West Virginia and Kentucky.

Lexington, Ky., March 28.—The Bluegrass Traction Company has begun the construction work on the line which will connect Lexington, Versailles and Frankfort, and it is the intention to complete it by late fall if possible.

It is stated that the southern terminus of the proposed electric railway from Vincennes, Ind., will be Owensboro, Ky., and that the Owensboro-Green River Traction Company will build a branch line connecting that city with Iceland, opposite Rockport, where a ferry will connect the road with others by which connection may be made for Chicago, South Bend and other cities and towns.

The Rowlesburg Improvement Company of Rowlesburg, W. Va., has been incorporated with a capital stock of $25,000 for the purpose of constructing and operating electric-light plants, telephone systems and other industries. George Hayes, M. H. Proudfoot and others are the incorporators.

The applications of C. A. Smith and J. G. Lee for an electric-railway franchise in Hancock county, W. Va., has been refused by the commissioners.

The Williamstown and Moundsville Railway Company has secured the franchises for a portion of its route between the two West Virginia towns.

The town of Guthrie, Ky., has offered a bonus of

$1,000, the free use of ground for a plant for 20 years, a 25-year franchise and release from municipal taxes for five years for the location of an electric-light plant in the town.

It is said that construction work has been commenced on the electric road which is to be built between Morgantown and Buckhannon, W. Va. The company has planned to combine roads and build in the gaps, making a system from Morgantown to Pittsburg, a distance of 200 miles. C.

Texas and Mexico.

Austin, Texas, March 26.—The report is current that Stone & Webster, the Boston capitalists who financed the Metropolitan Street Railway Company of Dallas with a capital stock of $4,500,000, are negotiating for the purchase of the Northern Texas Traction Company's interests. The latter company operates the street-railway lines of Fort Worth and the electric interurban road between Fort Worth and Dallas.

The Mitchell Mining and Smelting Company, which operates large copper properties at La Dicha, in the state of Guerrero, Mexico, has completed the survey for a railroad which will probably be operated by electricity between the mines and the port of Acapulco, a distance of 65 miles.

The property of the Empresa Street Railway Company in Monterey, Mexico, has been transferred to the Monterey Electric Street Railway Company. The latter company was recently organized with a capital stock of $5,000,000. It is composed of Baltimore (Md.) capitalists.

The interurban railway that is being constructed between the city of Queretaro, Mexico, and the town of Pueblitos will soon be completed. The distance is about five miles. The engineer in charge of the construction work is Jose Antonio Seption.

Citizens of Caldwell, Texas, are trying to organize a local company to install an electric-light plant at that place.

An electric-light plant is to be established at Jacksonville, Texas, by the Jacksonville Electric Company, which was recently organized with a capital stock of $20,000. The incorporators of the company are J. D. Gibbs, R. T. Gibbs, A. D. Sawyer and J. C. Brasher.

The Center Point Electric Light, Power and Irrigation Company has been formed with a capital stock of $6,000 for the purpose of installing an electric-light plant at Center Point, Texas.

The Mount Pleasant Electric Company of Mount Pleasant, Texas, which was recently organized with a capital stock of $10,000, will establish an electric-light plant at that place. The incorporators are W. A. Turner, W. C. Julian and W. J. Mize.

The special committee of the City Council of Austin appointed to investigate ways and means for rebuilding the great dam across the Colorado River at this place, and thus afford power for the city's electric-light and power and waterworks plant, has made a report, recommending that the dam be rebuilt by popular subscription. It is estimated that it will require $500,000 to replace the structure. Many wealthy citizens of Austin have expressed a willingness to take stock in the proposed enterprise.

J. C. Hickenlopher of Columbus, Ohio, who recently visited Mexico, is investigating the question of building and operating an electric line between the city of Oaxaca, Mexico, and the ruins of Mitla. The latter place is visited by thousands of tourists each year.

The Terrenates Consolidated Mining Company of Parral, state of Chihuahua, Mexico, is installing a plant for the transmission of 600 horsepower to be used for the operation of hoisting and pumping machinery at its mines. Frank B. Rae, consulting engineer of the company, is in charge of the work. H.

Michigan.

Detroit, March 28.—The Detroit United Railway has just awarded a $25 prize for a trademark and now offers a $50 prize for the best advertising idea showing the advantages of interurban travel, to be placed on a card 11 by 21 inches.

J. E. Lockwood of the Michigan Electric Company, appeared before the Public Lighting Commission a few days since and read a paper on the municipal-ownership lighting plant of Detroit. Within two years the plant will have paid for itself, it is said. Mr. Lockwood recommended to the members of the commission the doing away of 1,800 direct-current open arcs which have been in use for the last seven years and substituting the enclosed-arc lamp, like the latest ones to be installed.

The current from the new power house at Buchanan on the St. Joseph River has been turned on, and South Bend, Ind., supplied with power via Niles. The village of Buchanan was unsuccessful in its attempt to obtain an injunction restraining Chas. Chapin from transmitting the power outside of the town.

The new cars for the Detroit, Monroe and Toledo Short Line will be 55 feet long and equipped with motors aggregating 304 horsepower. Between Monroe and Detroit 27 bridges must be built and the total cost of the extension will not be less than $1,000,000.

It is understood that the differences of the Michigan Traction Company and the Jackson and Battle Creek Traction Company have been settled, and that an understanding as to use of streets in Battle Creek has been arrived at.

The Toledo and Michigan Electric Railway Company capitalized at $450,000 has been incorporated at Adrian. It is announced that Coldwater and Adrian will be connected this season by paralleling the Lake Shore steam road. The objective point of this road is Elkhart, Ind.

The West Michigan Interurban Railway Company has been organized at Muskegon with a capital of $100,000. The proposed line will be 100 miles long and will touch at many thriving towns, both north and south of Muskegon. C. G. W.

From the Buckeye State.

Cleveland, Ohio, March 28.—Cleveland has a new corporation which is exciting no little interest among those on the outside and which is something of a mystery as yet all around. It is known as the Cuyahoga Electric Traction Company and it starts with a capital of $10,000 and J. E. Morley, F. H. Goff, Reuben Hitchcock, C. H. Gale and E. A. Foote as incorporators. Its purpose is to build an electric line from Rocky River to Collinwood, which means the full length of Cleveland east and west and taking in all the suburbs in those directions.

Ten thousand tons of steel rails have been shipped from Germany to Toledo, but it is not known what road they are intended for other than to the owners.

The Cincinnati and Columbus Traction Company has decided to locate its power station at Perinton and it is said that it will cost about $200,000 complete. There will be four sub-stations to cost $25,000 each.

The Hegener Electric Company of Cleveland, has been incorporated with a capital stock of $10,000 to manufacture electrical apparatus. The incorporators are James F. Beranek, Frank C. Hegener, James F. Kitchen and others.

The Dayton, Springfield and Urbana Railway Company has been granted a heating franchise at Urbana.

The Mansfield Railway Light and Power Company of Mansfield, has been incorporated with a capital stock of $1,000,000 to build an electric line from Mansfield to Shelby. The incorporators are George Kochler, W. D. Breed, and others.

Harry G. Hamilton and J. J. McNally have made application to the city of Youngstown for a franchise to build an electric line from the center of the town to the plant of the National Steel Company, with fares at the following rates: single, 4 cents; 33 tickets for a dollar; 15 tickets for fifty cents, and 75 tickets for two dollars. John Stambaugh and S. D. Jackson have applied for a franchise over the same route and propose a five-cent fare.

Ohio railroad men are greatly interested in the Toledo and Chicago Interurban Railroad Company which was incorporated at Indianapolis a few days ago with a capital stock of $500,000. A line connecting the two cities seems to be feasible and will, no doubt, be built.

F. E. Gibbon of Cleveland, has been awarded the contract for the erection of a power house 150 feet long and 75 feet wide for the Zanesville Railway, Light and Power Company. The material will be brick, and a portion of the building will be two stories in height.

A New York dispatch states that the General Electric interests have been buying National Carbon stock until they have a controlling interest. It is stated that those interested feel that the property is one of the best industrials in the United States. O. M. C.

Southern Developments.

Charlotte, N. C., March 28.—News from Murphy, N. C., says that Capt. Alfred Emerson and others will organize the Cherokee Power and Lighting Company to develop the waterpower of Hiawassee River near Murphy and transmit the same to nearby points.

The Memphis (Tenn.) Consolidated Gas and Electric Company has filed an abstract of its charter which provides for a merger of the Memphis Light and Power Company and the Equitable Gas Light Company. The authorized capital is $4,000,000. New York and Chicago capital is interested.

A party of English and eastern capitalists has visited Knoxville, Tenn., in the interests of the proposed Knoxville Power Company whose purpose is to develop Little Tennessee River, 35 miles from Knoxville, at a point where 20,000 horsepower is available.

The Birmingham (Ala.) Railway, Light and Power Company, which has, either completed or under construction, $1,500,000 worth of improvements, will issue this amount of additional capital stock and make still greater improvements. The total capital now under issue is $5,000,000.

The Nashville (Tenn.) Railway Company, which has been in the hands of a receiver for two years, will be sold by order of the courts within 40 days. It is believed that the Newmans, bankers of New York and New Orleans, will purchase the property.

Ladshaw and Ladshaw of Spartanburg, S. C., have made a survey of an undeveloped waterpower on the French Broad River, near Asheville, N. C., which may be developed electrically.

B. S. Drake, of the United States Geological Survey, has been detailed to make a survey of certain water courses in South Carolina where he thinks enough power is available to operate every industry in the state. L.

Information from Indiana.

Indianapolis, March 30.—Increasing activity was shown last week in electric-railway enterprises. There are a greater number of surveyors at work in Indiana than ever before in the history of the state. New lines are being run and estimates made, and work is being commenced on some of them. The work of completing old lines and power houses progressed rapidly during the week. A new power-house site was surveyed and located at Richmond by Sargent & Lundy of Chicago for the Indianapolis and Cincinnati Traction Company. It is estimated that the building, with its equipment, will cost over $200,000. A force of 350 men is working on the Evansville-Princeton line, and the last spike will soon be driven. The company has had the material on the ground all winter, but bad weather prevented the road's completion. The boilers were installed in the power house last week and the Westinghouse company is well along with the installation of the electrical work and machinery. The line will be open the first of May and will be the first interurban line for southwestern Indiana.

The Wabash-Logansport line was opened for business during the week. This event has been retarded by high water and lack of machinery for the power plant. The first car over the line carried the officials and many business men. Four other lines are now building into Logansport.

Four new interurban companies were incorporated last week. The Indiana Western Railway Company (capital stock, $1,000,000) is to build and operate street and interurban lines in and connecting South Bend, New Carlisle, Laporte and Michigan City. D. D. Bates, H. F. Wurzer and others of South Bend are the directors. The St. Joseph Valley Traction Company (capital stock, $200,000) proposes to build and operate a line through Steuben, Lagrange, Elkhart and St. Joseph Counties and connecting Lagrange, Elkhart, South Bend and intermediate cities. Rollin Ellison and M. V. Beiger are directors. The Indiana Central Electric Railway Company (capital stock, $20,000) will build a line from Columbus to West Baden and French Lick Springs. John B. Burrell and John Stout of Paoli are directors. The Toledo and Chicago Interurban Railway Company (capital stock, $500,000) will build from the east boundary of DeKalb County, across DeKalb, Steuben, Allen, Elkhart and Kosciusco Counties, connecting Butler, Waterloo, Auburn, Garrett, Altonia, Hamilton, Huntertown, Fort Wayne, Avilla, Albion, Goshen, Syracuse, Fish Lake and Turkey Lake. J. E. Rove of Auburn will furnish desired information.

The Indianapolis and Shelbyville company has entered upon the work of extending its line to Greensburg and has filed condemnation proceedings against property holders in Fairland, seeking to run its line through several residences, a business house and a hotel.

The announcement by the Union Traction Company that it will soon advance the rate to two cents a mile has made patrons indignant, and they protest that the company was given special advantages during its organization and construction on the promise that rates would be and continue low.

Thomas Griffin has obtained a franchise to put in an electric plant at Noblesville. Mr. Griffin will locate his power plant four miles north of the city and erect a 16-foot dam across White River to furnish power to generate electricity.

The privilege of selling electric power in Elkhart has been awarded to the National Manufacturing Company, which proposes to erect a big power plant at Bristol, 10 miles above where a good waterpower will generate the electricity. F.

Northwestern Notations.

Minneapolis, March 28.—A temporary injunction has been granted at Mankato, Minn., restraining the city from entering into contract for the construction of a municipal electric-light plant.

The Sheboygan (Wis.) Light, Power and Railway Company has increased its capital stock from $200,000 to $750,000, and has let contracts for the extension of its line to Plymouth and Elkhart Lake, Wis.

The I. Stephenson Company of Marinette, Wis., has engaged C. B. Pride of Appleton, Wis., to furnish plans and specifications for the establishment of an electric power plant on the Escanaba River at Chandler's Falls. Electric power will be transmitted to Escanaba, Mich. The plant will cost about $200,000.

There are over 500 miles of electric interurban railway projected in the state of Iowa. Twelve electric companies have been formed for this work, and the lines range in length from 10 to 130 miles, as planned. Contracts are let for some of the work.

The Railway and Light Company of Winona, Minn., announces plans for great improvements to its railway and light system. The plans include new dynamos, engines and other equipment to cost $100,000. The building will be made fireproof.

Extensive improvements are planned to the Electric Light and Power Company of Eau Claire, Wis. The interests controlling the Chippewa Valley Electric Railway Company have just secured a controlling interest in the Electric Light and Power Company.

Charles C. Parmalee has been granted a franchise at Plattsmouth, Neb., for an electric-light plant.

The Burlington Railway will extend its electric line between Deadwood and Lead, S. D., through the latter city. Ultimately the trolley line will be extended from Lead to Terry. A storage-battery system has been ordered for Lead.

The three corporations at Great Falls, Mont.—the Great Falls Street Railway Company, the Boston and Great Falls Electric Light Company, and the Great Falls Land Company—all under the Daly interests, are to be consolidated into one company. A new franchise is asked, as the present one for the light and railway companies runs but seven or eight years. The owners propose extensive improvements. The light plant is to be practically rebuilt and the street-railway lines are to be extended and improved, at a total cost of about $90,000.

The council of Winnipeg, Man., has applications before it for three franchises from power companies. None of them asks exclusive rights. The Great Falls Power Company proposes to furnish the city with water and power for a period of 10 years for $50 per horsepower per year, on condition that it receive franchise rights for 50 years. The Lac du Bonnet Company offers to furnish the city with 3,000 horsepower at $40 per horsepower per year, and asks a franchise running for 30 years. It also offers to sell out the property from which its power is drawn, so that the city may establish a municipal plant. The third offer is from the Keewatin Company.

A bill is before the Minnesota state Legislature which creates a board of seven electrical examiners. The electrical workers are to be divided into four classes—master electricians, special contracting electricians, journeymen and special electricians. No workman may work out of his class and none may work at all until he takes a successful examination. The bill applies only to Minneapolis, St. Paul and Duluth. R.

PERSONAL.

Joseph Jefferson, the veteran actor, is president of an electric-light and power company organized at West Palm Beach, Fla.

Alex Dow, general manager of the Detroit Edison Company, has returned from New York, accompanied by W. S. Austin, engineer for Westinghouse, Church, Kerr & Co., who will construct the new plant.

C. F. Harding, chief electrician for the Worcester and Southbridge Street Railway Company, addressed the Worcester (Mass.) Polytechnic Institute's Electrical Society on "Some Novel Features of Street Railway Work," on March 27th.

Bentley W. Warren, who has been prominent as legislative counsel for electric-railway companies in Massachusetts, notably the Old Colony and Boston and Northern Companies, has been appointed a member of the Massachusetts Civil Service Commission.

Edwin C. Faber, formerly general superintendent of the Big Consolidated lines of Cleveland, has been made general manager of the Elgin, Aurora and Southern Traction Company. Mr. Faber left the Big Consolidated when the Andrews-Stanley faction obtained control, and since that time has been connected with the New York Central Railway and the General Electric Company.

Dr. Lee De Forest of the De Forest Wireless Telegraph Company, New York city, well known in Chicago, has been spending a few days in this city in the interests of his space-telegraph system and is now on his way to Seattle, Wash., from which point wireless communication may be established for the Northwestern Commercial Company with its stations in Eastern Siberia. Stations would be placed along the Alaskan coast and on the Aleutian Islands, the greatest distance to be spanned being over 2,000 miles.

The St. Louis Star of March 27th prints a large picture of Colonel E. J. Spencer, who is to be marshal of the civic parade at the dedication of the exposition on May 2d, as mentioned in last week's Western Electrician. Colonel Spencer is at present vice-president and secretary of the Granite City and St. Louis Suburban railway and president of the Texarkana Light and Traction Company. He has held many prominent positions, mostly of an electrical nature, and was in charge of the General Electric Company's exhibit at the Chicago Exposition of 1893.

John C. Barclay, electrical engineer of the Western Union Telegraph Company, has been appointed assistant general manager of the company, entering upon his duties on April 1st. Mr. Barclay has been employed by the Western Union company for the last 25 years, having started as messenger boy. He was stationed in Chicago for several years as electrical engineer of the western division of the company, and removed to New York a year ago after Colonel Clowry's succession to the presidency of the company. Mr. Barclay's many western friends will rejoice at his deserved promotion.

ELECTRIC LIGHTING.

Watervliet, Mich., is to have a municipal electric-light plant and waterworks.

The town commissioners of Henderson, N. C., will receive bids for lighting the town by electricity for a period of 10 years, beginning December 1, 1903. The present contract will expire November 1st.

J. M. Billingsly and associates have been granted a franchise to erect an electric-light plant to be operated by waterpower at Richfield, Utah.

The City Council of Plattsmouth, Neb., has given a 20-year franchise to Charles C. Parmele to erect and operate an electric-light plant in that city.

A new light and power company has been organized at St. Regis Falls, N. Y., to be known as the St. Regis Light and Power Company. The capital stock is $50,000 and the directors are W. T. O'Neil, H. E. O'Neil and W. B. Babcock.

Buffalo Gas Company interests have formed the Frontier Electric Lighting Company at Buffalo, N. Y. The directors are Alexander C. Humphries, Frederick Strauss and Stephen Peabody, New York; Howard L. Clark, Providence, R. I.; Franklin D. Locke, Buffalo. The capital is $800,000.

W. T. Algera, C. E. Pringle, D. H. Miller and others are interested in the Pocahontas Light, Water and Manufacturing Company of Pocahontas, Ark., incorporated with a capital stock of $50,000. The company will operate an electric-light plant, water distillery and an ice and cold-storage plant.

In a statement issued by the St. Joseph Railway, Light, Heat and Power Company of St. Joseph, Mo., the net earnings of the company for 1902 show an increase of $39,596 over those of the previous year. In 1902 the net earnings, according to the statement, were $200,193, as against $220,597 in 1901. The plant, property and franchise is valued at $9,274,458.

The Merchants' Heat and Light Company's steam heating plant, located in Indianapolis, Ind., which was installed by W. H. Schott of Chicago, is now in full operation. This plant has a capacity of 500,000 feet of steam radiation and 2,000 horsepower of electric load. The plant contains several new features in which electric-lighting and steam engineers are particularly interested. It is said to be the first central station using the regulator feature, the heat on customers' premises being controlled by compressed air at the power house. Mr. Schott asserts that the tests made have shown that the regulation saves more in operating expenses than was claimed by him prior to the installation.

ELECTRIC RAILWAYS.

A bill requiring that street cars be provided with storm vestibules during the winter months has passed the Senate of the Texas state Legislature.

A power house to cost $300,000 will be erected by the Metropolitan Street Railway Company at the corner of Second and Grand Avenues, Kansas City, Mo.

It is understood that a movement is on foot to merge a number of Indiana urban and interurban electric-traction lines to form a big system covering a large portion of the state. The first move in this direction was made when the Fort Wayne Traction Company of Fort Wayne, Ind., capitalized at $2,000,000, was sold by Cleveland men to a syndicate composed of George F. McCulloch of Indianapolis, Henry Paul, State Senator Fleming of Fort Wayne and Levering Jones of Philadelphia.

The Dixon, Rock Falls and Southwestern Electric Railway Company was incorporated on March 23d. The main office of the company, which is capitalized at $50,000, will be at Rock Falls, Ill. O. E. Maxson, A. S. Goodell, A. J. McNeil, R. L. Leitch and H. L. Sheldon, all of Rock Falls, are the incorporators and first board of directors. The company will construct an electric railway through Lee, Rock Island and Whiteside Counties, Ill., to connect the cities of Dixon and Rock Island via Rock Falls.

A street-railway bill introduced into the Missouri Legislature by Senator Jewell, providing that children between the ages of six and 16 years of age shall be allowed to ride for half-fare, has passed the Senate but is meeting with some obstacles in the House. Mr. Jewell declares that the bill appeals directly to parents who have children in school and more particularly to those who, by reason of adverse circumstances, have to keep children out of school in order that they may work. Many of these live in the suburbs, miles away from their places of employment, and the proposed reduction would be of great benefit to a most worthy class, he says.

SOCIETIES AND SCHOOLS.

The second general meeting of the Central Association of Physics Teachers will be held in Chicago beginning April 9th. Business meetings will be held at the Great Northern Hotel and discussions of various topics will be given at the Armour Institute of Technology.

The fourth annual meeting of the American Railway Engineering and Maintenance of Way Association was held at the Auditorium in Chicago on March 17th, 18th and 19th. The convention was very well attended by railroad engineers and superintendents from all over the United States. President G. W. Kittredge presided, and reports on yards and terminals, masonry, ties, records and reports, water service, signs and fences, ballasting, track, buildings, signaling and interlocking, iron and steel structures, etc., were made. Hunter McDonald, chief engineer of the Nashville, Chattanooga and St. Louis Railroad Company was elected president of the association for the ensuing year. A large number of exhibits were shown, including some by the Stromberg-Carlson Telephone Manufacturing Company and the Edison Manufacturing Company.

The first annual report of the Electric Club of Pittsburg, Pa., is issued in the form of an attractive booklet, under date of March 19, 1903, the anniversary of the club's organization. A feature of this work which has proven valuable is the formation of classes for the study of technical subjects under the instruction of various engineers of the Westinghouse company.

The Worcester Polytechnic Alumni Association of New York held a well-attended and enthusiastic meeting at the Hotel Albert, Eleventh Street and University Place, on Tuesday evening, March 17th. The association includes 75 graduates of the Institute. The next meeting will be held at the same hotel on April 28th, and all Worcester "grads" in the vicinity are cordially invited to be present.

POWER TRANSMISSION.

Anent the suggestion that the stupendous Victoria Falls of the Zambese River in Southern Africa be utilized for power, it is stated that the entire width of the falls is about a mile, the height is from 400 to 420 feet, as against 167 feet of Niagara Falls, and when the river is in flood, it is estimated that the volume of water is about double that of Niagara, giving about 35,000,000 horsepower as running to waste. During the dry season this is much reduced; but, even in the driest years, the volume passing over the brink is very large.

Isham Randolph, chief engineer of the Chicago Drainage Canal, discussed "The Commercial Phases of the Sanitary District" at a recent gathering of real-estate men in Chicago. Concerning the 27,000 horsepower available by the water at Lockport and the 17,000 horsepower at Joliet, he emphasized the importance of keeping the ownership unimpaired in the Chicago Sanitary District. He valued the power at $1,100,000 per year, enough to operate the canal after completion and promptly retire the bonded debt. As an illustration, he remarked that 16,000 horsepower would furnish the municipal lighting, leaving the balance for private industries.

TELEGRAPH.

The Postal Telegraph-cable Company will construct a new line between Birmingham, Ala., and Memphis, Tenn. E. T. Irwin is manager at Birmingham.

A certificate of condition of the Commercial Cable Company filed with the Massachusetts Commissioners of Corporations, March 1, 1903, shows the company's assets to be $43,671,655. The liabilities include, extension of cables and plant, $3,621,334; capital stock, $13,333,300; debts, bonds, etc., $20,774,771; reserves, $5,794,719; balance, profit and loss, $147,529.

Work will again be taken up soon by the Western Union Telegraph Company and the Great Northwestern Telegraph Company to join New York and Montreal with heavy wires to meet the increasing business between the two points. The Western Union recently ran a line from New York city to Whitehall, a distance of 228 miles. At Whitehall it connects with the line of the Great Northwestern, which will stretch a wire a distance of 163 miles to Montreal.

The second link of the cable which is to connect the United States with the Philippine Islands will be from Honolulu to Midway Islands. Work preliminary to laying the cable has been commenced. The Pacific Commercial Cable Company has chartered the steamer Grace Dollar and on April 10th she will depart from San Francisco carrying supplies and material for the construction of the cable station on Midway Island. The British steamers Anglia and Colonia are at present in London being loaded with the cable.

Argument was begun in the United States Court of Appeals in Philadelphia last week on the appeal of the Pennsylvania Railroad Company from the decision of the New Jersey United States Circuit Court, restraining the company from removing the poles and wires of the Western Union Telegraph Company from along its lines. Counsel for the telegraph company argued that the company had a clear right to maintain its poles and wires upon the lines of the railroad and was entitled to the injunction pending the final determination of the case in a suit of equity. These contentions were combated by counsel for the railroad company.

PUBLICATIONS.

Recent bulletins issued by the Peerless Electric Company of Warren, Ohio, through its western distributer, the Western Electrical Supply Company of St. Louis, Mo., describe and illustrate the Peerless direct and alternating-current desk and direct-current ceiling fans.

Westinghouse fan motors for alternating and direct-current circuits are described in a catalogue and also a folder distributed by the Westinghouse Electric and Manufacturing Company. The bracket,

swivel and trunnion and desk types are illustrated and described and several views illustrate typical adaptations of electric fans.

Two new 48-page bulletins of the Sprague Electric Company, New York city, describe its iron-armored conduit and its flexible conduit, conductors and cord. The first bulletin also illustrates tools for handling the iron-armored conduit, such as stocks and dies, pipe cutters, vises, tongs and saws, and also shows junction, splicing, outlet and terminal boxes. Tools for working the flexible conduit, junction and outlet boxes and plates, couplings and other accessories are treated in the other bulletin.

An attractive catalogue issued by the Western Electric Company of Chicago illustrates the W. E. fan motors for 1903, for both alternating and direct-current circuits. The different types shown include desk, ceiling and bracket fans, and also ventilating-fan outfits. Special mention is made of the ball-and-socket-joint bracket type and the combined ceiling fan and chandelier. Battery fans and accessories, such as plugs and receptacles, are also treated. Views are given of fan installations.

A second edition has been issued of the alternating-current calculating device and its book of description and instructions, that has been prepared by F. G. Baum of Stanford University, Cal., for the use of electrical engineers. The device is to be used in calculating the regulation of a generator, transformer, or transmission line, or any combination of these, for any load and any power factor; also for making any synchronous-motor calculation. In the new edition some improvements have been made to extend the range of the device, and two of the celluloid charts are included.

TRADE NEWS.

The Cleveland Woolen Mills, Cleveland, Tenn., is open for immediate delivery of a 100-kilowatt direct-current dynamo (second-hand preferred).

The plant of the Flint-Lomax Electric Manufacturing Company of Denver, Colo., was almost totally destroyed by fire recently. The loss is estimated at $40,000, said to be covered by insurance.

Edward Joy of Syracuse, N. Y., is reported to have secured the contract for installing the electric wires and constructing the conduit system in the new postoffice building at Jamestown, N. Y. The contract price is $16,200.

The Nernst Lamp Company of Pittsburg, Pa., has opened an office in the National Life Building, Chicago. A stock sufficiently large to supply the trade and consumers promptly will be carried. The rapidly increasing popularity of this lamp promises to be an important factor in the illuminating field.

The assets of the Reliable Electric Company, bankrupt, Chicago, consisting of an assortment of electrical appliances and apparatus, were sold at public auction on March 30th at 144 Franklin Street, Chicago, by James Wolff, receiver in bankruptcy.

Sealed proposals are being invited until April 27th for furnishing the Bureau of Engraving and Printing with electrical supplies during the next fiscal year. Blank forms with specifications for proposals and full information will be furnished intending bidders upon application to Wm. M. Meredith, director of the bureau, Washington, D. C.

The Commutator Company of Minneapolis, Minn., owing to its constantly increasing business, has opened a branch factory in Milwaukee to handle the business coming from the territory east of Milwaukee. The Milwaukee factory will be three stories high and will have a frontage of 177 feet. This building will be occupied exclusively by the Commutator Company. The company's business has increased so rapidly that the Minneapolis factory is too small, and in order to give its customers the best service the above move was necessary. The Milwaukee factory is located at Nineteenth Street and St. Paul Avenue.

The electrical display at the dedication of the Louisiana Purchase Exposition in St. Louis, on April 30th, will be a large one, completely outlining and decorating the large Administration Building, which will be surmounted by a waving, flexible electric flag, the flag design being that adopted by the exposition. The Elblight system will be used for this decoration. In August last, the Elblight Company of America, New York city, made up a sample outfit of the Elblight system for lighting one of the tunnels of the Pennsylvania Railroad. This installation has been in steady operation ever since, and of all the lighting systems which have been tried in the tunnel, the Elblight system is said to have been found to be the only one that could last, owing to the sulphuric acid in the moisture on the walls of the tunnel and the disintegrating influences of the gases emitted by the steam locomotives. This instance should be of interest to those requiring a system of lighting that is gas-proof and acid-proof, as well as water-proof.

BUSINESS.

The Carolina Locust Pin and Mica Company, Franklin, N. C., announces that it has increased its capacity recently and is in better position than ever to take care of its customers promptly. The best variety of locust is used and its pins are said to be of superior workmanship. The company carries large stocks ready for immediate shipment.

The Electric Appliance Company, Chicago, western agent for Gutmann wattmeters and Adams-Bagnall arc lamps, states that its sales on lamps and meters for the last three months have surpassed those of any similar period in or out of season. Both of these factories have enlarged their facilities, so that the increased business is promptly taken care of.

The Western Electric Company of Chicago has issued circular letters to present and prospective customers, calling their attention to the economies derived from the application of electric motors for power purposes. For over 15 years the company has been manufacturing and installing in some of the largest plants throughout the world direct-current motors and generators, and it offers the benefit of advice derived from this long experience. The company manufactures direct-current motors ranging in sizes from one-thirty-sixth horsepower up to 500 horsepower, and has issued two new power-motor bulletins in order to help its customers decide on their requirements.

Diamond special commutator compound is not a grease, but a combination of chemicals that act as a lubricant, and which is said to stop sparking, put a hard, glossy finish on the commutator, and, therefore, prevent excessive wear of both commutator and brushes, and increase conductivity of brushes by removing dirt and keeping clean contact. The Central Electric Company of Chicago carries a large stock of this compound, which it offers at reasonable prices.

Since the enlargement of its works at Sandusky, Ohio, the Warren Electric Manufacturing Company has made great strides in the alternating-current field. Machines for the following-named places are among the recent orders booked by this enterprising concern: Louisiana Purchase Exposition Company, St. Louis, Mo.; St. Louis Insane Asylum, St. Louis, Mo. (two); North Baltimore, Ohio; Knoxville, Ill.; Southern Pines, N. C. (two); Milton, Pa.; Chardon, Ohio; Wallaceburg, Ont. (two); Burlingame, Kan.; Avondale, Pa.; Junction City, Ohio; Los Angeles, Cal.; North Amherst, Ohio; Manchester, Ohio; Sellersville, Pa.; Dublin, Texas; Troupe, Texas; Cape May, N. J. (three); Manchester, Vt.; Marietta, Ohio; Spring City, Utah; Nephi, Utah.

The American District Steam Company of Lockport, N. Y., installed some 35 steam-heating plants for electric-light companies last year, besides making additions to a number of others previously installed. The company is now installing large plants at Baltimore, Md., Birmingham, Ala., Paducah, Ky., and Rockford, Ill., and has just received an order for a large additional installation to the steam-heating plant at Atlanta, Ga. Owing to the unprecedented demand for its product, the company has had to double the capacity of its shops in Lockport and North Tonawanda, N. Y. The American District Steam Company is the only company in its line of business that manufactures all the material and devices used in the installation of the work. It is also the pioneer in the business and has had years of experience in installing steam-heating plants in connection with a central supply.

Armour & Co. are making tests at the Union Stock Yards, Chicago, of the Nernst lamp, manufactured by the Nernst Lamp Company of Pittsburg, preparatory, it is understood, to an extensive installation of this lamp in their offices and works. The town of Rouses Point, N. Y., has lately adopted three-glower Nernst lamps for street lighting, and the completing of the installation was made the occasion for a local demonstration. Deere & Co. of Moline, Ill., have, at the end of a seven months' trial of the Nernst lamp, found this illuminant so superior to the arc and incandescent lights, that the latter are being displaced as rapidly as is consistent with shop practice. It is the intention to light the entire establishment with Nernst lamps. Another Deere interest, the Velie Carriage Company of Moline, Ill., was led, by observing the above trial, to install in its plant a complete Nernst system, using a hundred lamps of the three and six-glower types.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 24, 1903.

723,240. Passenger Conveyor. Dominique A. Casalonga, Paris, France. Application filed October 10, 1902.

The conveyer comprises a number of stages drawn at different speeds by electric motors. Electomagnetic clutches are arranged to engage the driving pulley. (See cut on next page.)

723,253. Telegraph Key. William E. Duncan, Macon, Ga. Application filed November 11, 1902.

The base and lever are formed of a single piece of spring metal, with the lever disposed above and movable vertically toward and from the base.

723,259. Electric Signaling Device. William Fraser, New London, Conn. Application filed August 12, 1902.

Combined with an electric circuit and a signaling device are an expansible annulus and adjacent contacts secured to the terminals of the electric circuit the contacts being connected with the annulus in such manner as to be brought together by the expansion thereof.

723,261. Automatic Release Device for Rheostats and Heaters. Clarence E. Freeman, Chicago, Ill., assignor to Max C. Krueger and the McGuire Manufacturing Company, Chicago, Ill. Application filed December 12, 1901.

The release comprises a magnet coil and a headed pin arranged to project loosely through the coil, the head of the pin forming a support for the pin and constituting the armature for the magnet coil, the projecting end of the pin being arranged to engage the rheostat arm directly. (See cut on next page.)

723,309. Telephone Attachment. Jacob P. Riedinger, Oberlin, Ohio. Application filed September 13, 1902.

An attachment to rotate the bell-ringing shaft of a telephone comprises a receiver arm adapted to be raised and lowered, and positive engaging and operating mechanism between the arm and shaft constructed to rotate the shaft when the arm is raised and to continue the rotation in the same direction when the arm is lowered.

723,320. Electric Burglar Alarm. Solomon Schwarzschild, Rochester, N. Y. Application filed September 3, 1901. Renewed June 23, 1902.

In the alarm are a telephone circuit, a subscriber's instrument connected therein, a local house-alarm circuit, and means operated by the alarm circuit and operating the telephone-hook switch of the instrument for sending an alarm signal over the telephone circuit.

723,321. Electric Display Sign. Francis M. Sheridan and Eugene Behrendt, New York, N. Y., assignors of fifty-five one-hundredths to Max Schey, New York, N. Y. Application filed May 6, 1902.

The sign comprises electric lamps, electric circuits for the same, an insulated plate carrying the spaced terminals of the circuits for the lamps, a contact plate having a return wire for the circuits and formed with apertures in alinement with the terminals on the insulated plate, and a circuit-closer having pins arranged to form a predetermined design and adapted to pass through sundry of the apertures in the contact plate.

723,326. Armored Element for Electric Batteries. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Cleveland, Ohio, and Jersey City, N. J. Application filed May 25, 1901.

An armored-battery element comprises a plate or grid, active material, and a fabric which is attached to and incorporated with the active material, the active material extending through the interstices of the fabric and forming substantially the surface of the electrode.

723,727. Storage Battery. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Cleveland, Ohio, and Jersey City, N. J. Application filed August 12, 1901.

A composition for storage-battery elements consists of a finely divided metallic lead moistened with a mixture of a neutral liquid and ammonium hydroxide.

723,328. Storage Battery. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Cleveland, Ohio, and Jersey City, N. J. Application filed August 12, 1901.

The composition described consists of active material, ammonium sulphate, and a catalytic agent.

723,329. Manufacture of Envelopes for Storage Batteries. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Cleveland, Ohio, and Jersey City, N. J. Application filed August 12, 1901.

The process of preparing fiber or fabric for storage-battery envelopes consists in subjecting the fiber or fabric to a nitrating mixture composed of about 113½ parts of nitric acid of 1.42 degrees gravity and about 150 parts of sulphuric acid of 1.84 degrees gravity at a maximum temperature of about 78 degrees Fahrenheit, whereby the carbohydrates other than the starchy carbohydrates are nitrated and the starchy carbohydrates are not nitrated, and subsequently washing out the fiber or fabric.

723,360. Trolley Reverser. Francis H. Burnham, Essex, Mass. Application filed March 10, 1902.

A trolley-rope controller consists of an inclosed case having a coiled spring, has one end secured to a stud and the opposite end secured to the journal upon which is secured a rope pulley, and the exterior of the case is provided with pockets adapted to catch the dripping water from the trolley.

723,369. Apparatus for Measuring Electrical Resistances. Roger W. Conant, Cambridge, Mass. Application filed September 29, 1902.

In the apparatus are two independent metallic circuits having a conductor common to both, a source of current for the circuits, a telephone receiver in the common conductor, a rheostat having its resistance coils connected with one side of one circuit and with the common conductor around or in shunt with the telephone receiver, and a rheostat switch co-operating with the coils.

723,385. Trolley Wheel. Nathan T. Hazen, Newburyport, Mass., assignor of one-fifth to John W. Coffin, Newburyport, Mass. Application filed February 5, 1902.

Spring-retracted guides are arranged at opposite sides of the wheel.

723,398. Art of Operating Electrolytic Cells. Ernest A. Le Sueur, Sault Ste. Marie, Canada. Application filed April 24, 1901.

The improved art of operating electrolytic cells having porous diaphragms separating bodies of liquid on the anode and cathode sides, respectively, is described. It consists in feeding solution to be decomposed to the anode compartment, maintaining a greater fluid pressure on the anode side of the diaphragm than on the cathode side, whereby movement occurs of solution from the anode compartment, through the diaphragm to the cathode compartment, and feeding water to the cathode compartment in such a manner as to displace an equivalent volume of the alkaline solution from the cathode compartment. (See cut.)

723,399. Device for Filing Commutators for Dynamos or Motors. Joseph B. MacIntosh, Lexington, Mass. Application filed July 10, 1902.

A device for filing commutators while still in place in a motor or dynamo comprises a file holder having means adapted to be engaged by the yielding brush-holding fingers of the dynamo or motor, and a file yieldingly carried by the file holder.

723,413. Engine-controlling Apparatus. Robert J. Sheehy, New York, N. Y. Application filed June 7, 1901.

Combined with the governing devices of a marine engine are an auxiliary engine adapted to move the devices, means whereby a change in the draft of the ship will admit pressure to the engine, a retarding device opposing the movement of the engine, and electric means whereby a further change in the draft of the ship will control the retarding device.

723,441. Means for Operating the Points of Overhead Wires on Electric Railways. Henry Collins and Charles W. Collins, Manchester, England, assignors to Albert Henry Collins, Manchester, England, and Ernest Worth Collins, Arthur Collins and Sidney Herbert Hyde, Salford, Manchester, England. Application filed June 9, 1902.

An overhead switch-plate with curved under face pivotally supported at the junction of the overhead wires is combined with a central swiveling road-lever and means intermediate for transmitting the motion of the lever to the overhead switch-plate and thereby raising and lowering the same, and means on the tram-car for operating the road-lever.

723,449. Electrode for Storage Batteries. Thomas A. Edison, Llewellyn Park, N. J. Application filed November 28, 1902.

For this and succeeding patent see page 264.

723,450. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J. Application filed November 28, 1902.

723,451. Storage Battery. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed August 28, 1900.

A plate has a hook-like terminal that extends opposite the face of the plate, whereby the wall of the compartment is clamped between the bill of the hook and the face of the plate so that the latter is held to place in respect to the walls.

723,471. Holder for Telephone Receivers. Sigmund Konigstein, San Francisco, Cal. Application filed December 19, 1901.

Means are provided by which a receiver may be engaged and held in a substantially horizontal position.

723,478. Burglar Alarm. George W. Mills, Elizabeth, N. J. Application filed April 15, 1902.

A combined door-stop and alarm comprising a housing or casting provided with means for engaging the floor, and supports a battery, electromagnet and bell, and means for closing the circuit and sounding the bell.

723,510. Edison Screw Switch-holder for Incandescent Lamps. Oscar Zielinski, Berlin, Germany. Application filed May 17, 1902.

An improved socket is described.

723,540. Igniter-operating Mechanism for Explosive Engines. Theodore C. Menges, Waterloo, Iowa, assignor to the Cascaden Manufacturing Company, Waterloo, Iowa. Application filed August 29, 1902.

An oscillating electrode is part of the mechanism.

723,592. Electric Railway. Harold Edwards, Boston, Mass. Application filed June 16, 1902.

Parts of the system are a trolley rail having a number of insulated sections; a normally broken connection between each section and the main feed-wire; a normally open switch for controlling each of the connections; a circuit for operating each of the normally open switches; a normally closed switch in each of the operating circuits; and means to cause a trolley upon entering a section to close automatically the operating circuit of the open switch of the section and thereby close the switch, and means to open automatically the normally closed switch of a section to the rear, and thereby open the normally open switch of the rear section.

723,607. Sectional Electrical Switchboard. Thomas W. Jardine, Englewood, N. J. Application filed August 8, 1902.

The switchboard comprises a number of sections each having a plurality of conducting elements for connection with a circuit, and adjustable means for connecting the corresponding conducting elements of the several sections together.

723,632. Heat-controller Stand for Electric Smoothing Irons. James I. Ayer, Malden, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed January 9, 1902.

The apparatus comprises a tool to be heated, an electric circuit in series with the tool for supplying heating current thereto, a stand for receiving the tool, the stand being provided with a resistance adapted to heat the stand, and means for introducing the resistance into series circuit with the tool.

723,633. Heat-controller Stand for Electric Smoothing Irons. James I. Ayer, Malden, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed January 6, 1902.

The device comprises a stand, a tool normally occupying the stand when not in use, an electric circuit for heating the tool, the stand being included in series with the tool in the circuit, a short-circuit device across the circuit between the stand and the tool, and a circuit-breaker for cooperating with the short-circuit device to break the short-circuit.

723,634. Electric Soldering-iron Stand. James I. Ayer, Cambridgeport, Mass., assignor to the Simplex Electric Heating Company, Boston, Mass. Application filed November 13, 1902.

The stand has a movable tool carrier, provided with resistance, a shunt for cutting out the resistance, and make-and-break contacts for the shunt, the tool carrier being movable by the placing of the tool thereon to break the shunt contacts.

723,635. Adjustable Support for Telephone Receivers. Frank J. Becker, Hamilton, Ohio, assignor to Addison Bybee, Indianapolis, Ind. Application filed August 8, 1901.

A latch pivotally is mounted on the arm and a bell-crank lever is pivoted on the bracket to be engaged by the latch and connected with the circuit-controller of a telephone.

723,643. Electric Furnace. Charles S. Bradley, New York, N. Y. Application filed June 19, 1900.

The furnace consists of a rotary wheel or annulus forming the receptacle for the material under treatment, the annulus having sides and bottom each formed of sectional plates, each of the plates consisting of a metal backing provided with a suitable lining secured thereon, and means for passing the current through the material within the furnace.

723,646. Trolley. Harry H. Bryant, Allegheny, and John B. McGaw, Pittsburg, Pa., assignors of one-third to Oliver A. MacVay, Pittsburg, Pa. Application filed November 26, 1902.

Spring-held guard disks are provided on the shaft of the wheel.

723,690. Switch for Electric Railways. George W. Linder, Baltimore, Md. Application filed October 18, 1902.

The switch has grooved arms, in the side walls of which are slots, and clamps are arranged on the ends of the respective arms for engagement with the trolley wires.

723,694. Telephone Toll Register. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed November 21, 1901.

In the device are a gong, a register, a rotary tumbler for operating the register, a hammer-lever and hammer operatively connected with the tumbler, and a gong muffler operatively connected with the tumbler and adapted to muffle the gong during a predetermined rotation of the tumbler.

723,717. Electric Conductor. John D. Nicholson, Pittsburg, Pa., assignor to the Pittsburg Reduction Company, Pittsburg, Pa. Application filed August 17, 1900.

A compound electrical conductor is composed of a core and a shell of different metal drawn into wire, one metal being aluminum and the other copper.

723,727. Car or Vehicle Propulsion. Philip Pfeil, Chicago, Ill. Application filed October 14, 1902.

One claim reads: In car or vehicle propulsion, the combination of a main storage battery, a secondary storage battery, a motor, a dynamo, switching devices for throwing the dynamo into circuit with either battery, switching devices for throwing the motor into circuit with either battery, and a mechanically operated device for cutting out the dynamo when its voltage is lower than the voltage of the battery it is charging.

723,732. Electric Switch. Charles W. Rogers, Newmarket N. H. Application filed January 15, 1902.

The switch has a series of contact sockets secured to the base around the shaft, movable contact pieces, fusible wires connecting the contact pieces in pairs, a frame slidable on the shaft and supporting the contact pieces over the contact sockets, guides for the frame, and a cam revolving with the shaft and operating to depress the frame.

723,742. Telephone-receiver Support. Daniel W. Shiek, Chicago, Ill., assignor to Addison Bybee, Chicago, Ill. Application filed October 21, 1901.

In the device are an arm pivotally supported to oscillate in a horizontal plane and constructed to support a telephone receiver, and means for resiliently holding the arm in its normal position, in combination with a stop carried by the arm and arranged to hold the arm temporarily against the tension of its holding means.

723,766. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed June 4, 1902.

In the lamp are a magnet coil, a casing therefor, an armature movable in such coil, a clutch for engaging one of the carbons, and a non-magnetic base supporting the casing and having arms designed to rest on the support and to be held by the ears.

723,786. Alternating-current Motor. Adolph W. Schramm, Philadelphia, Pa., assignor of one-half to Edward B. Wilford, Philadelphia, Pa. Application filed July 26, 1902.

An electric motor having an armature of the direct-current type is combined with a transformer, the field-coils of the motor being connected to the supply mains in series with the primary winding of the transformer, and the brushes or sets of brushes of the motor having means whereby they are connected to the secondary winding of the transformer. These means include contact pieces connected at intervals to the secondary winding and an arm placed to operate upon the contact pieces, the connections being so made to the secondary winding that the armature will rotate in one direction when the arm contacts with certain of the contact pieces and will rotate in the opposite direction when the arm contacts with others of the pieces.

723,788. Resistance Box. Samuel S. Wales, Munhall, Pa. Application filed November 29, 1902.

The box contains a plurality of resistance units removably hung therein, each unit consisting of a series of grids supported between side plates and being supported and removable from the box independently of the other units.

723,791. Connector for Accumulator Plates. George A. Washburn, Cleveland, Ohio, assignor to the American Motor Carriage Company, Cleveland, Ohio. Original application filed July 28, 1902. Divided and this application filed October 6, 1902.

The connector consists of a member adapted to rest upon the adjacent edges of abutting cells and having downward extensions within the cells adapted to connect with the plates of the cells, and means carried by the connector for maintaining adjoining cells in a fixed relation.

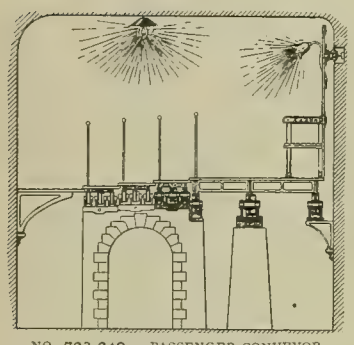
723,797. Electric Terminal Therapeutic Blanket. William E. Williams, Springfield, Ohio, assignor of one-half to A. Phillips Ludlow, Springfield, Ohio. Application filed November 3, 1902.

An electric therapeutic blanket consists of a main body portion divided into sections and a head portion formed with side pieces and a top piece adapted to be folded over and envelop the head of the patient, electric heating devices in each of the sections and in the head portion, means to control the current in all of the devices uniformly, and means to control the current in each of the devices separately. (See cut.)

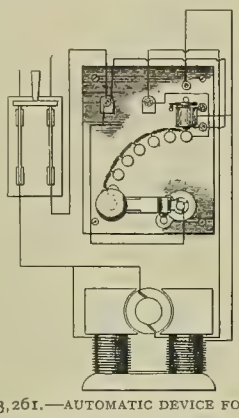
REISSUE.

12,103. Telephonic Apparatus. Charles G. Burke, Brooklyn, N. Y., assignor of one-half to John Q. A. Whittemore, Boston, Mass. Application filed February 28, 1903. Original No. 719,432, dated February 3, 1903.

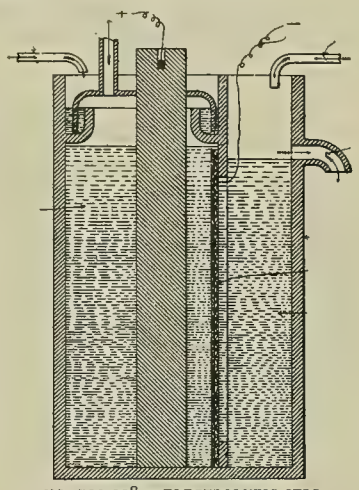
In the system are a line, a local circuit, a plurality of independent induction coils composed of long fine-wire and short coarse-wire coils, the first-named coils being connected with the line circuit and the others being connected up in the local circuit, and a telephone receiver in the local circuit.



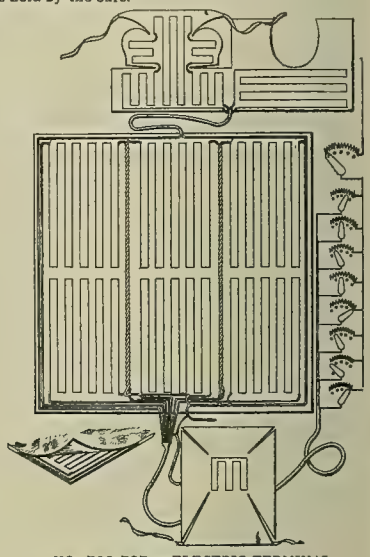
NO. 723,240.—PASSENGER CONVEYOR.



723,261.—AUTOMATIC DEVICE FOR RHEOSTATS AND HEATERS.



NO. 723,398.—ELECTROLYTIC CELL.



NO. 723,797.—ELECTRIC TERMINAL THERAPEUTIC BLANKET.

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White River Power Transmission for The Dalles.

The Dalles, Ore., situated on the Columbia River, is a thriving village of 4,000 population, 86 miles from Portland. It was founded in 1857 and derived its name from the fierce rapids in the Columbia River, a few miles from the town, which were named by the earlier Canadian voyagers of the Hudson Bay Company. Being the head of navigation until the year of 1881, it was the only shipping point to the interior of Oregon. In that year the first railroad was completed to the East. At once large numbers of eastern people settled in the country south of there, engaging in wool and wheat growing. The population increased rapidly, and in the following year a small electric-light plant was installed. In 1890 it was reorganized as The Dalles Electric Light and Power Company. The new company increased the plant each year as it was needed.

On September 11, 1883, a corporation was formed under the name of the Wasco Warehouse Company to handle wool and grain, trade in which had increased surprisingly. In 1901 this corporation was reorganized into the Wasco Warehouse Milling Company, having a capital of $300,000, and composed of the leading business men and bankers. It having been decided to build a flouring mill at The Dalles of a capacity of 700 barrels a day, the question of power supply was taken up. It was quickly decided that electricity was the most feasible. Shortly afterward the new company purchased all the holdings of The Dalles Electric Light and Power Company, but as that plant was running to its full capacity, it was soon decided to examine the numerous waterpowers within a few miles of the city, among which may be mentioned one at Hood River, 22 miles west; another at Klicitat River in Washington, 20 miles west; the Celilo Falls in the Columbia River, with a fall of 34 feet, about 12 miles east; the Des Chutes River, 18 miles east, and the White River, a branch of the Des Chutes, 27 miles south. After careful examination of all, it was decided that the last named offered the most advantages, including lowest cost for development, and in 1901 a contract was let to the Pacific Bridge Company of Portland to develop the power and build the plant. Work was started in August, 1901, and the plant was to have been completed before November 15, 1901, but through unforeseen delays it was not ready for operation until January 5, 1902. During this time the flouring mill was built and waited its power.

The power plant is situated, as a bird flies, 27 miles south of The Dalles, at White River Falls, on White River. Its source of water is at the foot of Mount Hood, which is about 40 miles distant, and there is sufficient water at all times of the year from melting snow. There are two falls in the river at the head of the works, and the power station, which is of stone, 30 by 60 feet, is at the bottom of the second fall. The accompanying illustrations give an indication of the roughness of the country in that region and of the difficulties in building a plant where there are no railway facilities and only a rough mountain road. The White River Falls are shown in Fig. 5 on the next page. The station is 75 feet lower on the right side, and its general location in the canyon may be judged from Fig. 4. The river runs through a gorge worn by time in the solid basalt rock, and as there is a bend in the river at that point, it is impossible to obtain a view showing the power house and falls together.

The power house is built of stone and is placed 10 feet above the level of the river. It utilizes a head of 131 feet, the elevation of 10 feet above the river insuring freedom from any interference that might be caused through freshets in the river. At the head of the falls there is a concrete dam eight feet high, from which the water is carried in a wooden flume, 54 inches in diameter and 1,200 feet long, laid one foot fall to a hundred, and delivering a head of 119 feet at the waterwheel pit. Fig. 3 is a view of the head of the intake for the pipe line, showing the dam across the river.

There are at present three waterwheels, two of which are direct-connected to two three-phase, 500-kilowatt, 2,300-volt generators, operating at 60 cycles, with a current capacity of 126 amperes each. The other wheel is direct-connected to a 30-kilowatt exciter. This wheel is also in reserve for another generating machine in case business requires its output. The waterwheels were made by the Knight Waterwheel Company of Sudder Creek, Cal., and the electrical apparatus by the General Electric Company. The current is led through three 400-kilowatt step-up transformers of the air-blast type, in which its voltage is raised to 22,000 volts. The transformers are connected in delta, and are cooled by air furnished by a motor-driven blower, a second blower being held in reserve. The switchboard is made of blue Vermont marble and has three oil-break switches. Fig. 1 illustrates the interior of the power house, showing on the right the two 500-kilowatt alternators and on the left one blower, the two blower motors, the transformers and, near the door, the switchboard.

The transmission line is 27 miles long, and is composed of No. 6 B. & S. bare copper wires, placed on glass insulators. The conductors are transposed every mile. The main-line poles are 35 feet high, and those in The Dalles are 60 feet high, all being cedar, with eight-inch tops. They are set 40 to a mile, without any treating to the butts. A telephone line is carried six feet below the high-potential line, and is transposed every five poles. No inductive effect whatever has been noticed in telephone transmission.

The sub-station at The Dalles (Fig. 2) is built of brick, the dimensions being 27 by 45 feet. It contains three transformers, each of 375-kilowatt capacity, air-cooled under a pressure of five-eighths ounce by a blower, a second blower being held in reserve. The voltage is here reduced to 1,100 volts

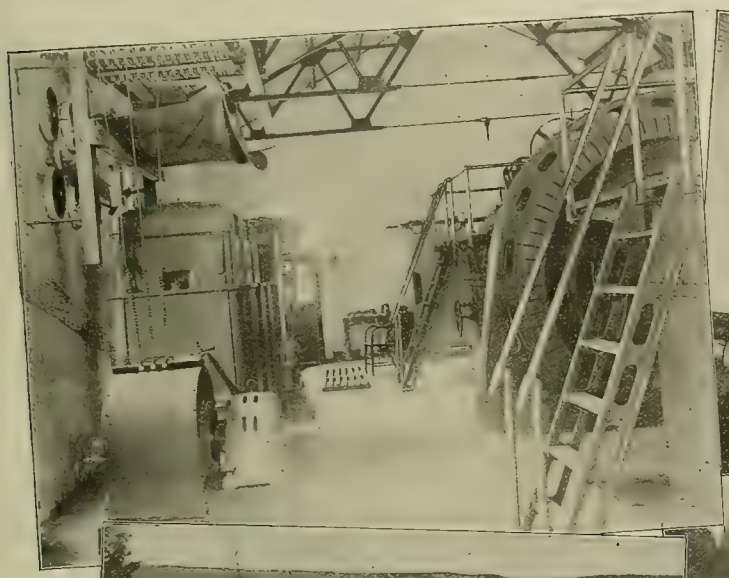


Fig. 1. Interior of Power House.
Fig. 3. Head of the Intake for Pipe Line, Showing Dam.

Fig. 2. Sub-station and Old Steam Plant at The Dalles.
Fig. 4. Power House Located in the Canyon of the White River.

WHITE RIVER POWER TRANSMISSION FOR THE DALLES.

for distribution. There is also one 35-light, constant-current, 6.6-ampere transformer. The high-potential switches are of the oil-break type, mounted in a brick vault. There are also two oil-break switches on the low-potential circuit. The switchboard is of blue Vermont marble.

The 35-light transformer is for street lighting, the arc lamps used being of the enclosed type and of 1,200 candlepower, all connected in series. The lamps consume about 72 volts at the arc.

The current being used at present is divided as follows: The company's flour mill has two 200-horsepower General Electric induction motors, one of 50 horsepower, operating at 1,040 volts. Another flour mill has a Westinghouse 100-horsepower induction motor, operating at 1,040 volts; this plant used steam for 12 years. A saw mill which used steam for five years installed last month one General Electric 30-horsepower induction motor, operating at 220 volts.

The lighting circuit has a voltage of 1,040 volts, which is stepped down in the residence district for incandescent lighting to 104 volts, while in the business district it is stepped down to 115 volts. The city is lighted on a flat rate, no meters being used.

At present there are 3,000 lights on the incandescent circuit, 29 enclosed arcs, 29 street arc lights, two three-horsepower motors in blacksmith shops and one five-horsepower motor in a marble works, the latter taking 110 volts.

The old steam plant, which was shut down as soon as the new one was completed, can be seen

FIG. 5. WHITE RIVER POWER TRANSMISSION FOR THE DALLES.—WHITE RIVER FALLS.

in the picture (Fig. 2), back of the new sub-station. The capacity of this plant was 375 horsepower.

The new electric plant has so far not shut down once since starting, which is somewhat over a year ago. The plant is said to be the best of its kind to be found on the Pacific Coast. The company intends shortly to build about 30 miles of line into Sherman County and light the towns of Morrow, Grass Valley and Wasco, the populations of which are 500, 300 and 1,000, respectively. This new project will use about 400 horsepower for lighting and running four flouring mills. It will tap the line about midway between The Dalles and White River, and the line voltage will be the same, 22,000 volts.

Demand for Steel Castings in Ireland.

Consul William T. Touvelle at Belfast, Ireland, says that from recent investigations and from numerous inquiries received from different firms in that city, he is satisfied that a good market is open to American manufacturers who can supply steel castings of high permeability for electrical works. Castings of magnetic steel, for field magnets of electric motors and dynamos, and magnetic steel or iron-sheet stampings, of high permeability and low hysteresis, for armature cores, are mentioned. L. B. Mollan & Co., Alexander Street West, Falls Road, electrical and mechanical engineers and contractors, and Millin & Co., Ultonia Works, 59 Victoria Street, are desirous that their names may be brought to the attention of steel manufacturers of the United States, as they are large users of the castings described. Two lines of ocean steamers run direct from the United States to Belfast, Ireland—the Lord Line from Baltimore and Newport News and the Head Line from New Orleans.

Suspended Electric Railways in Europe.

At a meeting of the St. Louis chapter of the American Institute of Electrical Engineers on April 3d, some interesting data regarding the Langen suspended electric-railway system, erected between Barmen and Elberfeld, Germany, was presented by Franz Welz. Mr. Welz said:

"In October, 1902, this system was proposed to solve the problem then confronting the Berlin authorities. It was estimated that the cost of such a road would be about $400,000 per mile; that is very much cheaper than the cost of installing an ordinary elevated railroad of the same capacity. In this case an average speed of about 20 miles per hour was provided for.

"I believe you are all more or less familiar with the construction details of the Barmen-Elberfeld suspended railroad, and I will only state briefly a few general facts. This railroad is characterized by the employment of only one rail carried by a light girder, which is supported by iron trusses, the construction of which varies with the conditions. These trusses are placed about 105 feet apart. The cost of this construction for double track, including the 22 stations, the suspended car houses, the foundations and licenses was only $200,000 a mile. The motor cars will accommodate 64 persons and weigh 13.4 tons; that is, less than 600 pounds per person. This small weight results from the simple arrangement of the wheels; only two wheels instead of four for each truck and with no long axles. The fact that the vertical parts of the car withstand a tensile strain instead of being in compression, and the lack of lateral torsion effects allow a light construction of the car.

"The trucks are placed on 26-foot five-inch centers, and the two wheels of the truck are on 44-inch centers. These trucks are connected to a frame on which the car is suspended by means of a curved bracket, so that the center of gravity is far below the supporting girder. This bracket is U-shaped, with a gap of one-fourth of an inch between it and the girder. This does not prevent the car from swinging, but limits the swinging to this extent. The wheels are each provided with two flanges, 1 3-16 inches deep, so that there is no possibility of the wheel leaving the track. Another arrangement prevents the car from falling in case a tire breaks. This new system is said to have many great advantages over the two-rail, ordinary system and the elevated railroad of the same capacity. With this system, sharper curves can be taken at high velocity. In the Elberfeld-Vohwinkel line, the sharpest curve has a radius of 270 feet. In terminal stations, a radius of 90 feet is employed, and for sidings 24-foot curves are permitted. These curves are well constructed, and all who have traveled on the road speak of its easy riding qualities, notwithstanding that full speed is maintained.

"In order to compensate for the centrifugal forces in the ordinary railroad, the outer rail must be raised from six to eight inches on curves, but this elevation is not sufficient for very high velocities and sharp curves. If this elevation is increased, it may happen that the car, when running at low speed, will tip towards the center of the curve.

"In the case of a suspended road, the conditions are far more favorable, and a limit exists only in the space for the passing of a car under the supporting structure.

"A declination of 35 degrees is produced by a radius of 270 feet, with a speed of 56 miles per hour. Supposing a speed of 125 miles, the same declination requires only a curve radius of 1,500 feet. In the ordinary railroad, a radius of not less than 1½ miles would be required. The inexactness in the parallel positions of the two rails in the case of the ordinary railroad, produces disagreeable lateral shocks. In a suspended railroad such shocks are avoided, as there is only one rail, and the horizontal inequalities produce only a slight oscillation which cannot be noticed by the passenger. As these lateral shocks increase with the square of the velocity, the difficulties in the case of the common railroad for high speed become nearly insurmountable and the superiority of the suspended railroad over the common for high-speed work is marked.

"The suspended railroad further shows a very low consumption of current. The maximum speed of the Barmen-Elberfeld railroad is 32 miles per hour. Under this condition the current consumption is 1.1 kilowatt-hours per car-mile, and the consumption per ton-mile 0.08 kilowatt-hour. It must be taken into consideration that there is a station about every 2,200 feet. These figures for current consumption are lower than those of many ordinary railroads of lower speed. The reasons for this high economy are the facts that the mono-rail system has a considerably lower traction coefficient than ordinary railroads. The number of wheels is two instead of four for each truck, and the whole weight of the car is utilized for adherence. There is no doubt that coupling the wheels mechanically by means of two rails losses of energy are produced which are avoided in the case of the mono-rail system. Again, it has been proved by tests that by employing only one wheel for each truck instead of two the current consumption can be reduced to 0.05 kilowatt-hour per ton-mile.

"The experts who made these tests therefore recommended the construction of cars in the future with only one wheel for each truck. These favorable conditions permit an acceleration of 170 feet per minute when starting time is limited to 40 seconds, and the effective speed of 32 miles per hour must be obtained without shocks."

The czar of Russia has caused to be built a short length of electric suspended railway from his palace to the Gatchina railroad station, in order to demonstrate its adaptability for long interurban routes. The system adopted is the invention of H. W. Romanoff, and possesses several points of interest to the American electric-railway man who is unfamiliar with this type of electric car. The railway is only 2,100 feet in length, and the permanent structure consists of steel girders, cross-joined, holding the rail, strengthened by an iron belt, serving as a foundation for the rail. The construction can be changed

FIG. 1. SUSPENDED ELECTRIC RAILWAYS IN EUROPE.—CURVE ON ROMANOFF RAILWAYS.

to meet local conditions. At present Romanoff uses fixed T-shaped standards, supporting a double track, but it is possible to make a single track with switches or passing places. The greatest incline on the short railway in Gatchina is 0.018 per cent. and the smallest curve has a radius of 35 feet. The structure at this curve is illustrated in Fig. 1, while Fig. 2 gives a view of a car stopping at the station in Gatchina.

The weight of the railway depends, of course, on the weight of the car; for military purposes 75 tons per mile is said to be sufficient; but for passenger purposes it is from 260 to 400 tons per mile. This system is divided by Romanoff into different types as follows: (1) The main-line railway for heavy traffic and high speed, i. e., 120 miles and over; (2) for high-level city traffic without impeding the ordinary street traffic; (3) for military portable railways, or for other purposes, such as mining and light freight traffic; (4) for postage purposes, light parcel and express-letter cars, which require a very cheap and very light line, and travel at 150 miles per hour.

An estimate has been made of the cost of a railway such as that proposed from St. Petersburg to Moscow, 345 miles long, with 66 trains traveling simultaneously, with a speed from 90 to 108 miles per hour, including the cost of construction of permanent way, installation of block-signal system, rolling stock of 400 cars for 35 passengers each, workshops and carriage sheds for repairs, 40 generating stations of 1,500 horsepower each, signaling apparatus, cottages for employes, 80 high-level platforms,

FIG. 2. SUSPENDED ELECTRIC RAILWAYS IN EUROPE.—STATION ON ROMANOFF RAILWAYS.

all foundations for standards, etc. The total cost, according to the report of the Imperial Russian Technical Institute, is £23,800 (about $116,000) per mile. The London Electrical Review says that the Russian minister of interior has appointed a commission to inquire into the suitability of such a system for a high-speed line between St. Petersburg and Moscow.

During the coming summer overland telegraph wires will be put up from St. Michaels to Nome, Alaska, it having been demonstrated that the cable between those points is a failure owing to the great depth of the ice. According to news from Dawson, the last stretch of temporary wire required to connect Seattle, Wash., with St. Michaels, Alaska, approximately 4,000 miles, is completed. Several weeks will elapse before the permanent wire is up.

Electrical Towage on Canals.

Much interest has been created from time to time over propositions to establish electric haulage systems on the canals of this country and abroad. Such a system should consist of a track alongside of the canal that would be simple and not too expensive and along which electrically driven motors or tractors might be driven independently in either direction, each tractor being connected by a towline to a boat or tow of boats. The details of a system, such as outlined and one which will not interfere with animal towage, have been worked out by Stephen W. Wood of New York city and are covered by four patents issued last week. Mr. Wood speaks of his system as follows:

"The average speed of a boat towed by animals on a canal is probably more than one and less than two miles per hour. My tractors are intended to make a speed of four to six miles per hour, and might travel much faster but for the fact that as canals are usually constructed fast travel is prohibited, owing to the danger of washing the banks. As my tractors are not intended for very high speed, much complication in mechanism and electrical connections is avoided.

"The limit of height to which a traction way of this kind may safely extend is about eight feet above the towpath, as canal bridges are generally built of a height to permit about eight feet in the clear. Consequently in my traction way I have endeavored to make the entire structure so compact that the tractors as a rule, shall not exceed four feet in height, so

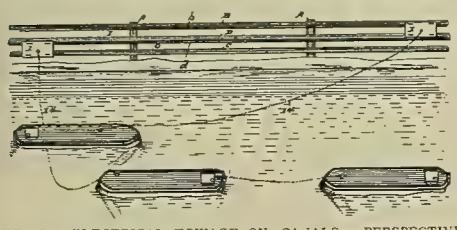


FIG. 1. ELECTRICAL TOWAGE ON CANALS.—PERSPECTIVE VIEW.

as to pass each other within the above-named limit of height.

"Canal traction is now largely accomplished by animal power. It is one of the features of my improvement that the traction by animal power need not be interfered with by my towage system, so that boats may be towed by animals, as usual, without obstruction from the towing way or mechanism of my device."

In the drawings, Fig. 1 is a perspective view supposed to represent a short section of a canal with boats thereon, showing an electrical traction way along the canal. Fig. 2 is a cross-section of a possible canal with boats thereon, showing a traction way at both sides back from the water side of the towpath and indicating connection to passing boats. Fig. 3 is a section through the traction way, showing rails of the way supported on brackets and showing tractors in section in operative position on the rails of the way. Fig. 4 is a broken elevation of the way, showing two tractors, each partly in section, on the two traction rails of the way.

At (A) are indicated posts or supports arranged on the bank of a canal and preferably far enough removed to permit of a towpath for animal traction between the traction way and the margin of the canal. Three rails supported from the posts (A) on brackets (E) are indicated at (B), (C) and (D). The projection of the brackets from the posts is as small as is consistent with the size of the motors or tractors employed. The middle rail (D) projects both above and below the faces of its supporting brackets, so that its outer and inner faces near either edge may both be engaged by grippers on the tractors. The lower rail projects upwardly and the upper rail projects downwardly from the respective supporting brackets, so that the grippers on the brackets will have room to embrace the faces of these rails for a little distance from the edge without interfering with the movement of the tractors along the rails, the tractors moving substantially in the horizontal plane of the spaces (I) (O) between the rails.

The numeral (1) indicates the frame of a tractor. This frame extends both without and within the towing way, preferably to an equal distance. The front and rear plates or bars (2) (2) are connected by tie bars (3) (3), which connect through the space or opening (I) or (O) between the track rails (B) (D) or (C) (D). The upper tractor has its weight on the middle rail. The lower tractor has its weight on the lower rail. Each tractor frame contains an electrical engine (4) of any usual or suitable form or construction. As shown in Fig. 3, the engine is mounted on the shaft or axle (5) of the driving wheel (6) and in such a manner that a shifting clutch (7), of usual construction, may engage the shaft or axle with the driving wheel or may permit the shaft or axle to run free.

The track rails (B) and (D) support trolley wires (b) and (d). These wires are shown directly beneath the track rails, and a trolley (10), of usual construction, runs along the trolley wire. A trolley pole (11) is connected to the tractor and has the usual connections for supporting the trolley wheel in contact with the wire and for conducting electricity therefrom to the driving engine (4). The cir-

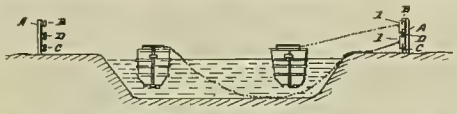


FIG. 2. ELECTRICAL TOWAGE ON CANALS.—CROSS-SECTION OF CANAL.

cuit is supposed to be completed through the track rails, as usual, although a separate trolley may be provided for that purpose. The wires (b) (d) are insulated from the track rails (B) (D), and these wires are supplied with electricity in any usual manner.

The tractor frame has any suitable means, as a lug (13), to which a towline or cable (14) may be attached, said cable extending to a boat or two in the canal. A lug (13) is shown on each face of the tractor, so that the connections may be made to a tow from that face of the tractor which is toward the canal, whichever face that may be.

The rails (B) (C) (D) are shown, except in Fig. 4, as rectangular bars having smooth faces. This is merely suggestive, as any suitable and approved form of rail may be used. The space or passageway (I) between the upper and middle rails should be of the same width as the space (O) between the middle and lower rails, and the projection of the tractor frame from the rails should be about the same at the front and rear of the track rails—that is, away from and toward the rail-supporting posts. Thus the motors can travel with equal facility in either passage (I) or (O).

The towpath is sometimes on one bank and sometimes on the other bank of the same canal. The traction way is similarly arranged. The tractors are so constructed that they can be passed from a traction way on one bank to a similar way on the other bank, and will fit either way without reversal of position. The tractors also fit either passage (I) (O)

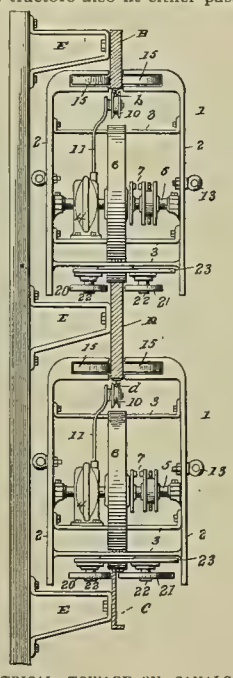


FIG. 3. ELECTRICAL TOWAGE ON CANALS.—SECTION OF TRACTION WAY AND TRACTORS.

between the rails, and may be switched from the middle to the lower rail, or vice versa, and run in either direction on either rail.

The tractor frame (1) bears guide wheels (15), Figs. 3 and 4, which guide wheels run on the outer and inner faces of the rail above which the tractor travels. These guide wheels are held to the faces of the track rail by any usual means.

The rail on which the tractor travels, being rail (D) or (C), supports the weight of the tractor, and the contact of the driving wheel (6) with this rail causes the tractor to move along the rail when the drive wheel is in coupling with the moving engine. To insure a sufficient contact under circumstances which might otherwise cause the driving wheel (6) to slip on the rail, the pairs of gripper wheels (20) (21) are arranged in the tractor frames so as to grip the outer and inner faces of the lower rail when desirable. (See Fig. 3.) Chains or cables (25) connect the ends of levers (23) to shaft (26) and on opposite sides thereof. By turning hand wheel (27) the levers (23) are drawn toward each other, as in setting a common brake on a railway car. Thus the wheels (20) (21) grip the rail, and so hold the tractor down to the rail. When so gripped, the engagement of the driving wheel with the track is much more intimate than would be due to the mere weight of the tractor. The grip of the tractor to the sides of the rail is seldom necessary except at starting a boat or tow into motion. When in motion, the driving power of the driving wheel on the track is generally sufficient to continue the movement.

In operating the traction way it is desirable that all the tractors in the passage (I) move in one direction and all those in passage (O) move in reverse direction. The towline (14) is so connected to each tractor that two boats or two tows of boats may move in one section of the canal and in opposite directions at the same time, passing each other side by side. In fact, each tractor corresponds nearly to a team of animals, except that the tractor has much more power and cannot be pulled from the

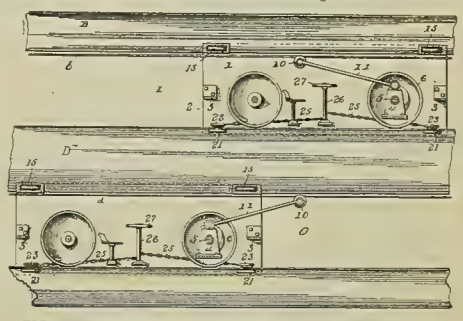


FIG. 4. ELECTRICAL TOWAGE ON CANALS.—BROKEN ELEVATION OF TRACTION WAY.

traction way by the resistance of the tow, except by breakage of the tractor or traction way. The towline is of such length that the strain on the traction way is largely backward and not greatly sidewise, so that great strength against side strains on the way is not likely to occur. When such is found to be needful, a system for bracing posts (A) can be easily devised. When one towboat or train of boats drawn by tractors desires to pass another similar tow, the lower tractor will be stopped or slackened and the slackened towline will sink, so that the other tow can pass over it. So in passing a tow drawn by animals the line may be slackened and the animals may walk over it.

Arnold Receives Award for Magnetic Clutches.

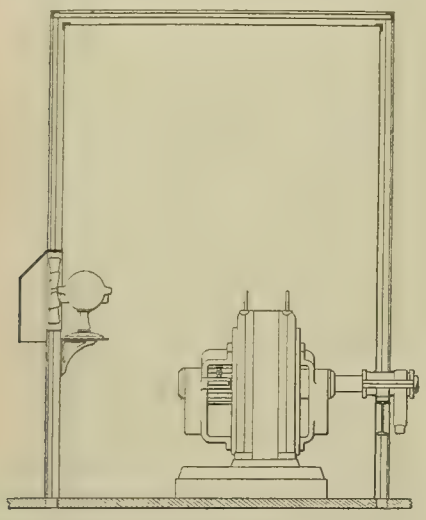
The Franklin Institute of Philadelphia, through its committee on science and the arts, at a recent meeting, awarded to Bion J. Arnold of Chicago the Edward Longstreth Medal of Merit for the originality and skill displayed in his invention of magnetic clutches. The report of the sub-committee, composed of Francis Head, Arthur Falkenau and Charles Day, proceeds to describe in detail the various applications of the system devised by Mr. Arnold, which has been planned with the view of building direct-connected electric power plants which should retain the flexibility of operation of the old-style belted plants, with the advantages of direct-connected construction. By flexibility of operation is meant, that in case of an accident to an engine the generator run by that engine can be run by another engine.

A Municipal Scheme to Purchase the Toronto Street Railway.

A Canadian correspondent of the Western Electrician writes that Alderman Spence of Toronto, Ont., is promoting a scheme whereby the revenue derived by the city from the Toronto electric street railway shall be put into a special fund for the purchase of the railway company's plant at the termination of the franchise, which has yet 18 years to run. The net revenue from the street railway this year will be $150,000; and after next year it will be over $200,000 per annum. At that rate an accumulation for 18 years hence will be $3,600,000. With that amount on hand it is considered that the purchase of the street railway would be a very simple matter.

Edison's Method of Operating Motors in Dust-laden Atmospheres.

In the operation of electric motors of various sorts in atmospheres which are heavily charged with dust —as in cement grinding establishments, flour mills, etc.—great care has to be exercised to protect the bearings and moving parts from the effect of the dust and particularly when the latter is of a hard gritty nature. "This has been generally accompanied," says Mr. Edison, " by the use of so-called 'dustproof' motors; but these are unsatisfactory and in time become seriously impaired, besides being relatively expensive. Furthermore, the closing in of the armature, commutator and brushes to make them dustproof interferes with the proper and desirable ventilation of the motors, which therefore become objectionably heated, and hence operate in-



EDISON'S METHOD OF OPERATING MOTORS IN DUST-LADEN ATMOSPHERES.

efficiently. As a matter of fact, the socalled 'dustproof' motors have only about one-half the efficiency per unit of weight of a properly designed open or non-dustproof motor."

By an invention of Mr. Edison, illustrated herewith, one is enabled to operate electric motors of the open type in atmospheres however heavily they may be charged with dust with the best efficiency at all times and with the complete exclusion of dust from all moving parts. To this end the invention consists in protecting the entire motor with a light casing formed for the most part of a porous textile material, such as gunny cloth, so as to act practically as a dust sieve, permitting the passage of air through its meshes, but excluding dust, and this casing is preferably, though not necessarily, constructed with double walls, so as better to serve its purpose. The chamber is provided with an outlet in which is placed an electric-motor fan, blowing air out of the chamber, such air being received through the textile walls of the chamber and freed from dust.

In operation the textile walls of the casing permit air to pass through them, but exclude dust, which adheres to the material and can be shaken off from time to time. The fan results in a constant circulation of air from the casing, fresh air entering through the textile walls, and in consequence the motor will be always kept perfectly cool, and hence will operate with the best efficiency. The area of the textile walls should be proportioned to permit sufficient air to pass through the same to admit of the desired covering effect. In actual practice Mr. Edison says he has secured excellent results with a five-horsepower electric motor by enclosing it in a casing four feet wide, four feet long, and six feet high on its interior, the outer wall being spaced two inches all around from the inner wall. Motors of greater power will require increased area of chamber.

Automobile Service Proposed for St. Louis.

Information comes from St. Louis that a company will be organized with a capital stock of $1,000,000 to operate an automobile line between the downtown section of St. Louis and the World's Fair grounds during the fair. A number of wealthy citizens, it is said, believe that the regular steam and electric railways will be unable to handle the traffic. If the machines can be secured the line will employ several hundred automobiles. The line, it is estimated, will make the trip in 30 minutes, one way, and the fare will be 25 cents each way.

Electric Lighting at the Delhi Durbar.

Probably the most interesting and impressive feature of the great imperial function, the Delhi durbar, as regards the engineering skill which was shown in the construction of the temporary city, was the electric-lighting plant, which so successfully illuminated the miles of streets and thousands of tents in the colossal camp. The government of India did not decide until about the first of April, 1902, to use electricity for light during the durbar. It was, however, considered the safest, healthiest and cheapest mode of illuminating the large area, and the work of constructing the plant was left to Kilburn & Co. of Calcutta. On April 1st there was no material of any description on the ground. The plant was ordered through the India office, and on December 7th light was switched on to all the camps, eight months being thus consumed in designing and completing the undertaking. Following is a description of the installation from the London Electrician, which will give some idea of its magnitude:

The boiler house was 125 by 38 feet, built of corrugated iron, and adjoined the engine house. Ten boilers were installed, all of the locomotive type and capable of evaporating 22,000 pounds of water per hour. The water for the boilers was pumped through three feed-water heaters, each raising the temperature of 9,000 pounds of water per hour from 32 degrees F. to 200 degrees F.

The engine house was 125 by 28 feet in size and was fitted with nine generating sets. Two 80-kilowatt and three 40-kilowatt sets were coupled to Allen engines working at a steam pressure of 140 pounds per square inch. Each dynamo generated the necessary current at 440 to 480 volts at a speed of 500 revolutions per minute. Four 40-kilowatt generating sets were connected to Peache high-speed engines running at a speed of 550 revolutions per minute. Two balancers were provided, each having their armatures coupled mechanically, and capable of dealing with 25 amperes in the center wire of the three-wire system. All the boilers and sets were erected on concrete foundations throughout.

The switchboard, some 30 feet in length, was of slate, built upon an iron frame, and consisted of 10 dynamo, 13 feeder and two balancer panels. The ammeters and voltmeters were of the Weston type, meters by Chamberlain & Hookham, and switches, plugs, bars and cut-outs of American design. The station lighting and auxiliary boards were made locally. Balancing was also effected by the station lights, which could be switched over on to either side as desired.

The feeders were led from the switchboard to two special overhead constructions which carried the wires over the main road, from whence they were divided into the various overhead feeders. These were carried overhead, and were composed of No. 0 bare copper wire. Over 600 poles of the Hamilton tube type and 60 miles of No. 0 copper wire were used. The distribution to the tents was composed of lead-covered wire laid underground from the feeder points to the respective tents, this distribution having a total length of 35 miles. The wiring of the tents was carried out in braided vulcanized rubber cable, of which some 50 miles was used. Ordinary opal shade pendants were used for general illumination and decorative fittings in special tents.

The materials used in the tent wiring consisted of some 15 miles of flexible wire, 5,000 switches and cut-outs, 9,500 incandescent lamps and some 9,500 lampholders, carriers, etc. The street lighting consisted of 100 Jandus enclosed-arc lamps and 380 incandescent lamps fitted upon the feeder and special poles.

The light was switched on to the camps on December 7, 1902, and discontinued on January 22, 1903. The whole plant ran without a hitch throughout the durbar, and gives great credit to the contractors and their engineers, considering that the entire work was carried out by native labor. The staff engaged upon the work consisted of 38 Europeans and 1,000 natives, special camps having been built for their accommodation. The plant is now being dismantled and dispatched to the various cantonments, where it will be re-erected and used for barrack lighting and punkah pulling.

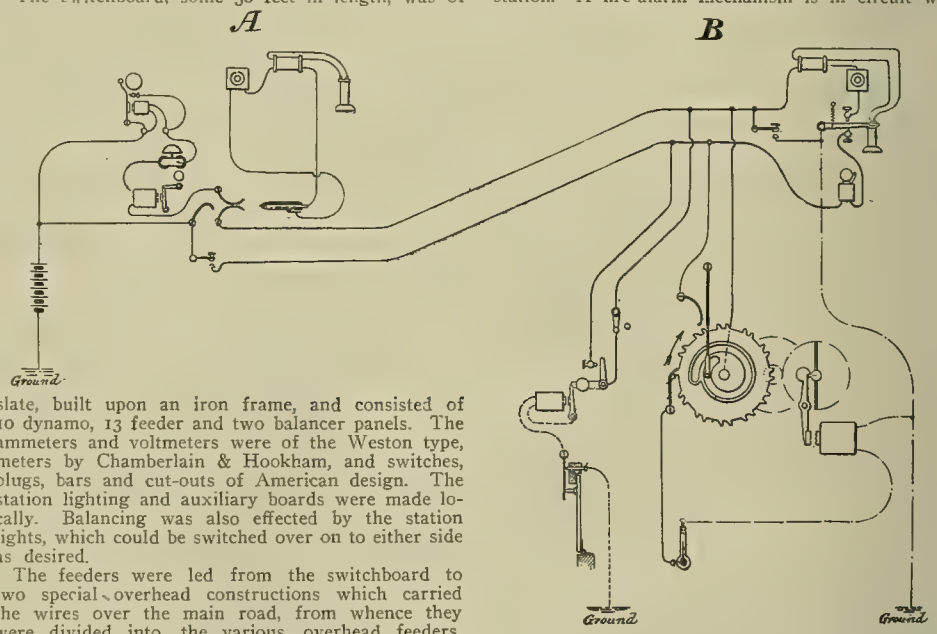
The work was designed and carried out by C. W. Nicholl, chief engineer to Kilburn & Co. of Calcutta, India, assisted by Mr. Atkinson on the overhead work and Mr. Blackley on the plant erection, under the direction of the Military Works Department, represented by Major Stuart and Captain Halliday.

The telegraphic and telephonic arrangements by which the department was able to deal successfully with the exceptional traffic which was thrown upon it during the whole of the durbar, required over 5,000 miles of wire to be erected throughout India, connecting Delhi with the principal cities, besides large, complete telegraph and telephone systems for local use. The building erected for this purpose was 160 feet long and provided accommodations for a signal office, telephone exchange and all necessary adjuncts. The staff attached to the office numbered about 300 men.

Combined Telephone, Signal, Burglar and Fire Alarm.

An invention which has for its object to provide a telephone, signal, burglar, and fire-alarm system which can all be operated upon two wires has been patented by Benjamin O. Fox of Milwaukee, Wis. The accompanying drawing is a diagram view illustrating a central station or office at (A) and at the other end of the wires a room (B) or subscriber's station equipped with the improved mechanism, the use of which is expressly applicable to hotels; but it may be used generally in connection with any two-wire system.

The subscriber's telephone is normally out of circuit with an annunciator. A fire-alarm gong and non-circuit-breaking bell are provided at the central station, and means are arranged for breaking the circuit and establishing a talking circuit between a central station and that of the subscriber's and simultaneously cutting out the annunciator and audible signals. A circuit-closer bridges the subscriber's telephone. There are a signal circuit, a circuit-closer at the central station and a bell at the subscriber's station. A fire-alarm mechanism is in circuit with



COMBINED TELEPHONE, SIGNAL, BURGLAR AND FIRE ALARM.

the telephone line and a thermostatic circuit-closer is provided for the same. Another circuit-closer connects the signal line and fire-alarm mechanism so that when the latter has completed its operation a permanent circuit is established through the subscriber's bell and signal mechanism at the central station. A burglar alarm in circuit with the telephone line consists of a normally open circuit, a spring-controlled circuit-closer and also an electric-magnetic controlled mechanism in the circuit, so that when the latter is closed the mechanism will establish a permanent circuit through the signal mechanism at central and subscriber's station.

Consolidation of Cleveland Railways.

There is little doubt that the Cleveland City Railway Company and the Cleveland Electric Railway Company of Cleveland, Ohio, will consolidate within a short time. In fact, the officers have admitted as much, and some preparations have been made to that end. They have been operating in harmony for some time, accepting each other's tickets and transfers. It has been said that they would sell seven tickets for a quarter after they are united, but that is denied. All the management will admit is that they will grant universal transfers, so as to make traveling on their lines as convenient as they can. They now have a five-cent fare, or 11 tickets for half a dollar.

Affairs of Marconi Companies.

A call has been issued for the annual meeting of the Marconi Wireless Telegraph Company of America, to be held at Jersey City, N. J., on April 20th. At this meeting it is expected that plans will be perfected for transmitting commercial messages across the Atlantic by the wireless system at rates considerably below those of the old cable companies. The prospect of this new competitor in the telegraph field has caused some nervousness in the stock of the Western Union Telegraph Company, a quotation from New York one day last week stating that a fall in Western Union stock from 86⅞ to 84¼ was chiefly due to the effect of the Marconi reports.

The following balance sheet of the American Marconi company, as of January 31, 1903, has just been given out and is of interest:

ASSETS.	
Patent rights	$5,286,494
Cost of stations and experimental work	139,939
Stock of apparatus on hand	31,244
Accounts receivable	18,382
Cash at bank and in hand	15,432
Furniture and fixtures	1,204
Treasury stock	700,000
Organization expenses	35,468
Total	$6,228,166
LIABILITIES.	
Capital stock issued	$6,190,000
Accounts payable	38,166
Total	$6,228,166

In regard to the details and the extent to which the system has been developed, the secretary of the company says: "The stations now belonging to the American company and being daily operated in commercial service in ship and shore work are located at Sagaponack, at the eastern end of Long Island; Babylon, Long Island; and Siasconset, Nantucket, Mass. The long-distance station at South Wellfleet, Mass., has been put in a high state of efficiency and will be ready for service upon the return of Mr. Marconi to America May 1st. The contract of the English Marconi company with Lloyds is regarded as one of the greatest exclusive privileges secured by the Marconi system. Official consent of the Cuban government has been obtained to install the Marconi apparatus in stations on that island. The station first to be erected in Havana will form part of a system connecting the United States with Cuba. Stations are in course of construction in Alaska for the United States signal service. These will be completed, it is expected, by next August."

At the recent annual meeting of the Marconi company in London it is said that Mr. Marconi attributed the criticism of his system chiefly to the "cable companies and the sections of the English technical press controlled by the cable companies." He announced that Lord Kelvin, Lord Rayleigh and Prof. J. A. Fleming, professor of engineering, University College, London, were shortly going to Poldhu, Cornwall, at his invitation, to examine thoroughly his transatlantic wireless system of telegraphy.

The Marconi Wireless Telegraph Company of Canada desires to sell its rights acquired in the province of Ontario to a new company, and to obtain rights to establish a cable, telegraphic and telephonic service over land and under the sea. It asks power from the Canadian parliament to acquire the property of other companies as well as the above powers.

The question of connecting all the lighthouses and lightships along the coast of England was discussed at a recent meeting of the Association of Chambers of Commerce in London, at which Mr. Marconi was present. The metallic nature of the rocks in the vicinity of some of the lighthouses was one of the obstacles which was considered. As a result of the meeting the Fastnet lighthouse and the Goodwin Sands lightship will probably be equipped with the wireless system at once. One of the advantages of the space telegraphy there is that it would overcome the great difficulty in the way of cable communication between lighthouses and the shore, due to the short life of cables, owing to their continued chafing against the rocks.

American Electrochemical Society.

A successful convention seems assured to the American Electrochemical Society when it assembles for its third general meeting in New York city, on April 16th. The convention will last through the 17th and 18th, and all meetings will be held in the large assembly hall of the Chemists' Club, 108 West One-hundred-and-fifty-fifth Street. The clubhouses of the German Liederkranz at 111 East Fifty-eighth Street and of the Chemists' Club will be open for the use of members and visitors during the convention. The hotel headquarters of the society will be at the Wellington, Seventh Avenue and Fifty-fifth Street, half block from the Chemists' Club. A number of excursions will be made to installations of special interest to electrochemists and also to places of general interest. An elaborate list of papers and discussions has been arranged for the day sessions, and in the evenings will be held the annual banquet and lectures. Special interest also attaches to the election of officers for the ensuing year, as a contest is possible. Dr. Joseph W. Richards is the present president and Charles J. Reed, 929 Chestnut Street, Philadelphia, is secretary.

Siloxicon, a New Electric-furnace Product.

By Orrin E. Dunlap.

A new refractory material, which is to be called "Siloxicon," has been discovered by E. G. Acheson of Niagara Falls. Mr. Acheson is the discoverer of the processes for the manufacture of carborundum and artificial graphite, but it is his opinion that his latest discovery is destined to be even more important to the industrial world than either of the processes referred to.

FIG. 1. ELECTRIC FURNACE FOR PRODUCTION OF SILOXICON.

Siloxicon is made in an electrical furnace, in a manner somewhat similar to carborundum and graphite. The raw materials are ground coke and sand, to which may be added sawdust, to increase the porosity of the mixture. The furnace in which siloxicon is manufactured at present is erected at the plant of the International Acheson Graphite Company. It is built of loose brick, no mortar being used. In length the furnace is about 30 feet, and it is eight feet wide and six feet high. One thousand electrical horsepower is used in its operation. It is Mr. Acheson's discovery that the manufacture of siloxicon requires that the temperature of the furnace be kept below that necessary for the manufacture of carborundum. Siloxicon forms when the temperature of the furnace is maintained at a heat ranging from 4,500 to 5,000 degrees Fahrenheit, while carborundum requires a heat verging on 7,000 degrees for its manufacture.

FIG. 2. SILOXICON, A NEW ELECTRIC-FURNACE PRODUCT.

In color, siloxicon is gray-green, and when it comes from the furnace it forms a loosely coherent mass. It is reduced to powder form, so that it will pass through a No. 40 sieve, by running it through a mill. In its powdered form it is shipped in barrels.

Siloxicon is a self-binding material, and when moistened with water it can be formed into any desired shape and fired. However, for many purposes, it will be mixed with about 25 per cent. of clay. The prospective field that will be occupied by siloxicon is in the manufacture of refractory linings for furnaces or converters, the manufacture of crucibles, firebrick, muffles, twyers, etc. In every way siloxicon is a substitute for refractory clays, magnesia, lime and graphite in their application to high temperatures. Siloxicon is insoluble in metals, infusible at high temperatures, and is inert toward both acid and basic slags. Crucibles made of siloxicon are found to be superior to the crucibles of clay or of graphite and clay in common use in that they are not acted upon by the molten metal or worn away externally by the action of fuel or furnace gases.

While Mr. Acheson considers it preferable to utilize the self-binding properties of siloxicon in its various applications to articles or linings, he realizes that in some instances it may be preferable to use a binding agent—such, for instance, as a hydrocarbon, as liquid tar, asphaltum or pitch; carbonaceous materials, as molasses or glue, or other agents mentioned above. When a permanent binding agent is used, like liquid tar, the ground siloxicon and sufficient tar to bind it together are mixed thoroughly in a hot condition, the resultant mass being then molded into the desired forms, which may then be burned, or they may be used without burning, in which cases they receive the necessary burning while in their permanent combination. It is pointed out that when siloxicon is used as a furnace lining it may be preferable to prepare the mixture, as when making articles, and tap or ram it into place.

The new Niagara furnace in which siloxicon is made is protected by recent patents granted to Mr. Acheson. It has a double flat core, but, as Mr. Acheson's patents cover a number of cores, it is likely that future furnaces will have three cores. Fig. 1 gives a perfect idea of the size and shape of the furnace, while Fig. 2 shows the form in which siloxicon comes from the furnace. In the latter picture two crucibles made of siloxicon are seen at the left.

Electrical Equipment of the Krupp Works.

Some data have been recently given out on the operation of the Krupp works at Essen, Germany, and the great number of machines employed in the different shops. It is of interest to note that the works possess a large electric plant and that current is used quite extensively, both for lighting and motors. The size of the Essen establishment may be remarked from the fact that on the first of April, 1902, it employed 24,536 hands, which formed a population of 83,658 persons; of these, 19,966 lived in houses which belong to the company. In the shops there are 141 hammers, varying from 200 pounds to 50 tons, besides 22 sets of rolls and 63 hydraulic presses. The plant includes 323 stationary boilers which furnish steam for 513 engines, some of which are used in the electric plant. Two of the engines give 3,500 horsepower, and the total capacity of the engines is 43,848 horsepower. The establishment has as many as 369 electric motors of different sizes. There are 591 cranes varying up to 150 tons, representing a total of 6,328 tons. The current needed for the arc and incandescent-lighting circuits, as well as for the motors, is produced by three main central stations, which send current to seven distributing stations. These supply the motors above mentioned and also 1,200 arcs and 10,000 incandescent lamps. In 1900 the stations produced more than 7,000,000 kilowatt-hours. The works have also an extensive telegraph and telephone system. During 1901 the number of telegrams exchanged between the works and the telegraph station of Essen was 19,589, and an average of 2,400 or 2,500 telephone conversations was held per day.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

American Electrochemical Society, Chemists' Club, 108 West One-hundred-and-fifty fifth Street, New York city, April 16th to 18th.

National Electric Light Association, Auditorium Hotel, Chicago, May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Detroit, Mich. July 15th to 17th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

The American Electrochemical Society will hold its third general meeting in New York city next week. An elaborate programme has been arranged, and will no doubt be carried out successfully. The organization is young—just about a year old—but its vigor is shown by the short intervals between its meetings and by the further fact that it has already plunged full tilt into the thrilling delights of society politics with a warmly contested campaign for the presidency. Well, it is no disgrace to aspire to be president of the American Electrochemical Society, even if it is but a yearling, and we hope that the best man may win. And as for the society itself, long life and more power to it!

WHOEVER would have suspected that space-telegraph stations are responsible for ether waves that hurtle? And yet we read of these rushing waves in a recent article entitled "Marconi at Cape Cod" and published in the New York Evening Sun. The language used is poetic. The writer observes for the first time, with awe, the Marconi towers. He records his emotions. It is like the "Ode on a Distant Prospect of Eton College." Here is what he says: "There is force there—force that sends ether waves hurtling across that great 3,000-mile stretch of gray water breasting the beach below in angry breakers. The appreciation of force, power, energy, you recognize among the exciting elements of your emotions, and coupled with them a distinct sense of admiration for the genius of the man who has unharnessed electricity from its wiry fetters and demonstrated that the fluid, or the influence of that fluid, may be sent through space." That is pretty fine, isn't it? And again: "Barren, dreary, mysterious—silence broken only by the booming of the surf or the rustle of the wind through the scrub oak and stunted Norway pine; here is just the place for the manifestation of all sorts of hidden things." But alas! that's just the trouble—the hidden things. They are still hidden after you have read a column about the "dull red of the bog cranberry" and old Bill Hatch, who stands guard at the gate of the stockade. One learns much of the beauties of nature as displayed on Cape Cod and something about Marconi's broad English accent, but of the apparatus in the power station not a thing. The article illustrates two things—first, a newspaper writer's cleverness in spinning out a fairly readable piece in default of the information he sought, and in which the reader would be interested, and, second, the continued reticence of the Marconi management, for the article was printed as late as last week.

PERHAPS the temporary electric-light plant erected on the occasion of the Delhi durbar may have a salutary effect as an object lesson to the better classes of the population in India of the advantages of electricity as an agent in the production of light and the transmission of power. Electric light and electric fans ought to be in great demand in India, owing to the heat, but, on looking into the subject a little, one is astounded at the insignificant extent to which the modern electrical adjuncts of civilization are used in Great Britain's greatest colony. We have consulted a well-known electrical directory, published in London last year, on this subject, and if it is to be believed there are but two central-station enterprises in all India—one at Agra, operated, or to be operated, by the municipality, and the other in Bombay. In both cases "no particulars" are given, simply the names. Although this is in a volume purporting to contain "a complete record of all the industries directly or indirectly connected with electricity and magnetism," and published in England, where accurate information about India ought to be obtainable, it is evident that there are glaring omissions in the case of India at least. A recent writer, for instance, relates that some time since negotiations were entered into with the municipal committee of Lahore for a concession for 30 years for a monopoly of the supplying of electric light and power. These proposals also included an electric railway. Lahore has a population of about 200,000. Electric lighting was introduced into Calcutta in 1900, and is rapidly increasing in popularity. A contract has been let for the changing of all the street railways in that city from animal to electric power. While this advance has been made in Calcutta, it should certainly be worthy of note among American capitalists and manufacturers that many of the largest and most important cities of India are, as yet, entirely devoid of any permanent central-station equipment, among others being Madras, with a population of 260,000; Delhi, with 115,000; Lucknow, 150,000; Allahabad, 100,000; Cawnpore, 120,000; Benares, 225,000. Even in Bombay, with its 750,000 people, the old horse cars are still in vogue. One advantage in seeking to place electrical machinery in India is that all such apparatus can be imported free of duty. American manufacturers have already sold a considerable amount of electrical machinery and appliances for use in India, and one great power-transmission plant largely composed of apparatus shipped from the United States has lately been put into service. But it is evident that, compared with the extent and resources of the country, only the smallest beginning has been made in electrical development. It would seem that India has been a neglected field and that the electrical manufacturers of the United States should devote more attention to its possibilities.

COL. H. A. YORKE, in his report to the British Board of Trade on railroading in the United States, is quite right in pointing out that train signaling in this country is in a confused and partially developed condition. "Signaling in America is in an inchoate condition," he says, "there being no uniformity of practice throughout the country. Some portions of the principal railroads are fully signaled, but on many others hardly any signals are used, and even where signals are used, their shapes, colors and meanings vary upon different lines. Only about 25,000 miles out of a total mileage (measured as single track) of 200,000 are at present worked in America on the block system, but its use is being gradually extended." Colonel Yorke is no great admirer of automatic signaling, although he admits that it may be exceedingly useful in "tubes," subways, tunnels, and especially on electrically operated railways on which speeds are uniform, junctions and sidings are few and far between, sections short, and which are self-contained. Some of the new London electric lines are adopting the system. In the opinion of Colonel Yorke, the experience gained in America in regard to electric interurban railways should be of great value to those engaged in the construction of similar lines, under the name of "light railways," in his own country. "American engineers," he adds, "have discovered that a modern first-class electric railway should have a location that will admit of the most direct route with as few curves as possible, and be so laid out as to curves as to have them as easy as possible. It has been found not only desirable but most economical to purchase private rights-of-way, to use heavy rails, large ties, and plenty of good ballast." The English light railways differ in every respect from the American interurban railways; they are almost invariably laid alongside the high roads, have light rails and insufficient ballast, while the cars employed on them are mostly double-decked, and have tramway wheels with small flanges. "Such lines," Colonel Yorke considers, "are nothing more than tramways, and quite unsuitable for high speeds." Like all other Englishmen, Colonel Yorke does not admire our elevated railroads, and thinks they are not likely to be imitated in any English town. Well, to tell the truth, the "L" roads do have their drawbacks, but their faults are less apparent in the comparatively wide, straight streets of American cities than they would be in the narrow, tortuous thoroughfares of English towns. But we do not blame our English friends very much for hesitating to put up the unsightly, noisy, light-obstructing—but useful—elevated structures. They have served their purpose in this country, but it is unlikely that many more will be built; subways or tunnels are better. On the whole, Colonel Yorke's conclusion seems to be that the United States has not much to teach England in steam railroading but considerable in electric-railway work. This is at least partially true.

Grounding the Neutral on Alternating Systems.

The second semi-social meeting of the Chicago Electrical Association was held at the Abion Café in the Pullman Building on the evening of April 3d. This departure from the regular form of meetings, which are held in the Monadnock Block and are more or less formal in nature, was introduced with success on March 6th. Last week's meeting surpassed in attendance and interest the one of the month before and in every way was a pronounced success. Over 100 members of the association and their electrical friends gathered at the meeting place about 6 p. m., and after a half hour spent informally in renewing acquaintances and making new ones, dinner was served at separate tables. After cigars were passed the gathering was called to order at 7:45 p. m. by Harold Almert, who was chairman of the entertainment committee in charge of the meeting and to whose efforts the large attendance and success of the evening were largely due. Mr. Almert made a few happy remarks on the success of this and the former semi-social meetings, and then introduced Prof. P. B. Woodworth, president of the association, who served as chairman of the evening in his usual pleasant and efficient manner.

The address of the evening was given by George M. Eastman, who is in charge of the testing laboratory of the Chicago Edison Company. His subject was "Effects Produced by Grounding the Neutral on an Alternating-current System." A little more than a year ago John D. Nies, instructor in electrical engineering at the Lewis Institute, gave a short but interesting paper before the association on "Grounding of High-potential Circuits." Mr. Nies took up the mathematical side of the question and worked out a graphical explanation of the effects produced by grounding the neutral or any phase wire of a three-phase circuit. Mr. Eastman discussed the practical side of the problem and gave a number of interesting and instructive examples taken from actual practice on the high-tension lines of the Chicago Edison and Commonwealth Electric Companies. He dwelt on the necessity of grounding the neutral of a three-phase circuit in order to eliminate the effect produced by partial grounds, and showed by the development of Mr. Nies' diagrams, how abnormal and injurious potentials might occur on such a system if the neutral were not grounded. With the neutral conductor grounded all the conditions were equalized, and it was impossible to raise the voltage of the system above the delta potential. He gave data on the condensance, reactance, charging current, charging energy, etc., of the underground and overhead high-tension lines in Chicago, and mentioned several interesting conditions that were possible on these systems.

Mr. Eastman's valuable address will be presented in full in an early issue of the Western Electrician. At the conclusion Mr. Nies was called upon to open the discussion. He drew attention to the fact that with a three-phase high-tension system which was not grounded it was possible to get abnormally high voltages, even 83 per cent. higher than the normal voltage of the system. This could not happen if the system were grounded. He discussed several of the points brought out by Mr. Eastman, stating that the increase in frequency which the latter mentioned in one instance as apt to occur counted virtually as an increase in capacity. He concluded by repeating with emphasis that it was always better to have the neutral grounded.

Professor Woodworth said the question was a very vital one, and referred to the attempts at legislation which had been made in Chicago and other cities to prevent the grounding of the neutral on account of the popular idea that it was dangerous to life.

D. W. Roper of the Missouri Edison Electric Company, St. Louis, was next introduced. His company operated a single-phase system with one side of all the five generators connected to a general bus bar, which was connected to ground through a resistance. This arrangement improved the conditions on the lines and in the station. Before, in case of lightning a phase line would be apt to be grounded through the arrester, burning off the ground wires. In the station severe arcs would occur on the switchboard, the most severe being between the general bus and ground. To obviate this the resistance was installed. It consisted of a water rheostat giving 20 ohms resistance on a 1,200-volt circuit. This was successful in removing serious ground potentials. An interesting use of the ground resistance was as a ground detector on the lines. A transformer was shunted across the rheostat with a 50-volt lamp in a 100-volt circuit. Under normal conditions when the bus potential was near to that of the ground, the lamp would burn low. With two machines running the lamp would vary slightly up and down, and with a number of machines the light was more irregular, but when a ground occurred on one line the lamp would burn brightly, on account of the high potential, and would thus attract attention. Swinging grounds could also be easily located by this means. A fuse in the primary circuit of the transformer would blow when there was a direct-current cross with a trolley wire, and thus the device enabled the attendant to discriminate between a wire falling to the ground or on a trolley wire.

H. B. Gear of the Chicago Edison Company then spoke of the conditions on the lines of the Telluride Power Company in Utah. The company operated two plants 105 miles apart and connected with a network of 300 miles of 40,000-volt aluminum wire. At the older station current is raised to 40,000 volts by transformers star-connected on both sides, the neutral being connected to ground by a copper wire. The 300 miles of line required a charging current of 860 apparent kilowatts. As the load on one plant at the time he was there was not up to its full capacity, the lagging current due to the motor load did not compensate for the leading current on the line, so in disconnecting one machine it was necessary to run another one as a motor to supplying the leading current. There had been more or less trouble on the 40,000-volt lines from burning the insulators and pins.

C. Schwartz of the engineering department of the Chicago Edison Company, who is familiar with the electrical development in Russia, stated that it was the practice in Moscow and St. Petersburg to connect the transformers and generators in delta, but in Baku, in a new power station, the transformers and generators were star-connected with the neutral grounded.

G. H. Lukes, general superintendent of the North Shore Electric Company, Evanston, Ill., spoke of the great advantages, if it was feasible, to be derived from connecting one side of a single-phase system to a general bus, as it would simplify the switching and wiring and reduce the expense in many ways.

W. A. Blanck of the Arnold Electric Power Station Company and an expert on high-tension work, said that in California the great advantage to be derived from grounding the neutral was fully appreciated, as it reduced the strain on the high-tension lines fully one half. The lines of the Bay Counties and Standard Companies were all grounded. In Germany the first three-phase plant had been installed at Magdeburg in 1894, and when it was first operated the neutral was grounded. This condition continued for only three days, when the government forbade it, and has since prohibited the grounding of the neutral, as the government telephone system is operated on single-wire grounded circuits and the interference is too great.

P. Junkersfeld of the Chicago Edison Company stated abroad there were instances of operating single-phase systems with one side connected to a general bus. In Chicago on the three-phase four-wire system it was customary now to install switches on the phases only and not on the neutral. The first three-phase four-wire system in Chicago was installed about 2½ years ago, and as there was no experience to be guided by, it was questioned whether the neutral should be grounded or not. It was finally decided to do so and the experiment was watched with great interest until it was proved that it met all expectations and also was of extreme importance as it was a valuable safeguard to the system.

Mr. Gear stated that grounding the neutral had no effect on telephone wires in Chicago, unless the ground occurred outside the station. With the city police and fire-alarm circuit, which were grounded, there was occasional trouble. J. G. Wray of the Chicago Telephone Company said the greatest trouble his company had from grounded circuits was from the street railways and Mr. Wheeler of the Chicago Union Traction Company answered that the trouble was only apt to occur in outlying districts where the telephones were few. In the closing of the discussion it was stated that the underwriters favored grounding on the low-potential systems, and Professor Woodworth said that S. P. Thompson was authority for the statement that all circuits should be grounded, and that in a steel-constructed building only one wire should be used, the other side of the circuit being grounded to the steel frame.

The next meeting of the Chicago Electrical Association will be held at 1740 Monadnock Block on April 17th, and H. B. Gear of the Chicago Edison Company will read a paper on "Overhead High-tension Construction of the Commonwealth Electric Company in Chicago."

Question Box for the Chicago Convention.

A preliminary list of 125 questions has already been tabulated by Mr. Hartman, editor of the Question Box for the twenty-sixth convention of the National Electric Light Association, from questions already received from members. New questions are coming in daily, and this feature of the programme will contribute greatly to the interest and importance of the meeting. Many of the questions relate to subjects that have never before been brought up for discussion at the conventions, and they are sure to bring out valuable information. The Central Passenger Association has granted a special rate of a fare and a third, on the certificate plan, from all points in its territory to Chicago and return, for delegates attending the convention, which will be held in Chicago May 26th, 27th and 28th.

Institute Meetings in Chicago and St. Louis.

A very interesting and well-attended meeting of the Chicago chapter of the American Institute of Electrical Engineers was held in Chicago on April 7th. R. H. Pierce, the retiring local honorary secretary, presided, and the discussions of the evening, which had been arranged by James Lyman, were on the subject "High-tension Transmission." The papers read at the New York meeting on March 27th were read in full, W. G. Carlton reading Mr. Mershon's paper, H. H. Wait that of Mr. Lincoln, J. R. Cravath that of Mr. Chesney and James Lyman that of Mr. Blackwell. A complete stenographic report of the comprehensive discussion on these papers, which was presented at the New York meeting, had been received and short abstracts were given of the more valuable portions of it. Then the general subject was briefly discussed by E. Gonzenbach, R. H. Pierce, W. G. Carlton, H. H. Wait and James Lyman. At a business meeting P. Junkersfeld, assistant to the mechanical engineer of the Chicago Edison Company, and an energetic and valuable member of the Institute, was nominated to succeed Mr. Pierce as local honorary secretary. Attractive programmes, with local papers and discussions, are being arranged for the next two meetings of the Chicago chapter. The meeting of May 5th will be devoted to "Tendencies of Central-station Development" and that of May 19th to telephone subjects.

Over 100 members and guests of the St. Louis Chapter of the American Institute of Electrical Engineers had the pleasure of hearing Mr. B. J. Arnold on Friday evening, April 3d. Mr. Arnold's talk consisted of a resumé of his report on the Chicago traction problem, illustrated with numerous lantern slides. Several officials of the St. Louis traction companies and other men of prominence in street-railway circles were present, and at the close of the paper a discussion was participated in by B. L. Hornsby, president of the City Council, Henry Humphrey and others. In view of the fact that very recently franchises have been asked for by promoters of elevated-railroad schemes, the St. Louis traction proposition has impressed its importance upon the City Council, and Mr. Hornsby, in his remarks, expressed himself as greatly enlightened by Mr. Arnold's concise and clean-cut analysis of the problem, and said that he believed it would become necessary before very long for St. Louis to follow Chicago's lead and employ an expert engineer to devise a more satisfactory service. Owing to the fact that the railroads entering St. Louis over the Eads' Bridge reach the station through a tunnel running north and south on Eighth Street, it is impossible to extend a subway east of this point, although plans have been considered for the installation of a subway running as far downtown as Ninth Street. This, however, would not entirely be satisfactory as the main retail district of the city and nearly all of the business buildings lie several blocks east of Ninth Street. The through-trunk system suggested by Mr. Arnold has been adopted in several instances in St. Louis, but has not proved entirely successful. At the close of the meeting a unanimous vote of thanks was tendered Mr. Arnold by the local chapter. The next meeting of the chapter will be held on Wednesday, May 13th.

Susquehanna Power Plant at York Haven.

The York Haven Water and Power Company will soon have its great plant, on the Susquehanna River, at York Haven, Pa., in operation, and power will be transmitted to York, Harrisburg, Lancaster, Columbia, Steelton and other southern Pennsylvania towns at a cost so cheap that the use of steam will be discontinued by many manufacturers. The plant will furnish current for lighting and general power purposes to both corporations and private industries.

The plant will consist of two main buildings, a generating station and the transmission station at York Haven and a sub-station at York. As the plant expands its system other sub-stations will be established. The generating-station equipment consists of 20 750-kilowatt alternating-current generators and two 240-kilowatt direct-current generators, driven by water turbines. On the second floor of the building is the switchboard gallery, with all the instruments and necessary recording devices. In the transformer house there are 12 1,400-kilowatt step-up transformers. When completed the plant will cost over $1,000,000.

The officers of the company are: President, H. L. Carter, New York; vice-president, Hon. W. F. Bay Stewart, York; secretary, Samuel Mason, Philadelphia; treasurer, H. L. Stokes, New York; superintendent of hydraulic construction, Thomas Green, York Haven, and electrical engineer, T. A. W. Shock, York.

Power Transmission on High-tension Lines.

Part II.

Discussion of P. M. Lincoln's Paper.

M. H. Gerry, Jr.: There is no especial difficulty in installing a successful telephone circuit, which will give satisfactory service and reasonable safety in operation, on a pole line carrying from 50,000 to 60,000 volts.

Mr. Lincoln: A telephone line ought to be so made that it will at all times operate, even if one leg of the power line is dead-grounded. If it is made to operate under these conditions, it will operate under the normal conditions of an untransposed power line, because the normal static potential induced in the telephone line by an untransposed power line is vastly less than that which will be induced in the telephone line by grounding the power line so that if the telephone line is installed so as to run under grounded conditions, that is, with the power line grounded, it will certainly run with an untransposed power line.

Mr. Mershon: Electrostatically, each telephone wire is a plate of a condenser, the power wires being the other plate. These two condensers are in series through the telephones and have impressed upon them a constant electromotive force. The condition here is similar to that for the electromagnetic action, in that if the current in the telephones be such as will convey a charge approximating that which the impressed electromotive force can impose upon the condensers, there will be a tendency towards constant current; if not, as seems to me is usually the case, there will be a tendency toward constant voltage.

There is another method of accomplishing this desired end of having the telephone lines as nearly as possible at the same potential as the earth, which seems preferable for the use of a grounded wire, first, on the score of simplicity, and second, because it may also be a means of protection against loss of life or fire. This method is that of using auto-transformers connected across the telephone line at a number of points, preferably at each of the telephone stations, each having its middle point connected at ground. Each transformer should be designed so as to take a very small amount of the telephonic current, but should have wires sufficiently heavy to enable it to take, in case of a cross with a high-voltage wire, a current heavy enough to operate the circuit-opening devices in the power station or else to blow a suitable fuse in the telephone circuit itself. Such a device would protect the users of the telephones from disagreeable or dangerous shocks whether due to crosses, leakage, or in electrostatic induction and would also help to minimize disturbances due to grounds, etc.

P. H. Thomas, New York: Assuming both telephone wires are going to reach high potential above the earth, there is only one thing to do to get service at all times, and that is to eliminate the baneful effects of the high potential. I will make a suggestion for accomplishing this purpose which may not have much practical value, but may be worth trying. For instance, it is possible we may be able to insulate the telephone wires, perhaps for 30,000 or 40,000 volts in an extreme case, and at the end of the line put the primary of a transformer, and from the telephone the secondary, making very high insulation between the primary and secondary. Thus, it would be possible to protect the operator, and since static disturbances do not induce potential between the two wires, it should not disturb the speech. The same result may possibly be accomplished with condensers, by connecting two condensers in series between the two pair of wires and putting the telephone in between the condensers not connected with the line. In this case it will probably be necessary to put a choke coil between the condensers and ground its middle point. The charging current of the condensers will be neutralized by going through the two halves of the coil in opposite directions and a telephone winding could be taken from the same core.

Mr. Lincoln suggested carrying the ground wires in close proximity to the telephone wires. This should help much and would be a good method to try, but it would probably be necessary to use insulated wire for the telephone circuit, otherwise there would be trouble from repeated grounding. One method, which would be effective, but perhaps not practicable, would be to use for each side of the telephone wire a twisted pair; one wire of the pair for the telephone circuit and the other of the pair grounded. This method would make a large capacity between the telephone wire and ground, but would not actually ground the telephone wire itself.

There is another interesting possibility for those who like to speculate. Can we not use the power transmission wires themselves for sending signals? If not for telephoning, at least for general signaling?

C. E. Skinner, Pittsburg: The insulation of the workman is important, and it is not difficult to make arrangements so that he will be as well insulated, so that even a cross between a high-potential line and a telephone line will not do serious harm. It is usually painful to receive a shock of this character, but not particularly dangerous.

C. O. Mailloux, New York: I would like to mention a phenomenon in connection with the charging of lines which, while not exactly within the scope of this paper, is still interesting, especially as it represents a phenomenon which has puzzled me and which has puzzled others to whom I have mentioned it. I have observed the fact that the transmission line will become spontaneously charged electrostatically without being connected to any operating machinery. About a year ago, in Arizona, we were starting a 25 or 26-mile line, and repeatedly observed that the three wires would become charged to a considerable potential under various conditions. In Phœnix, Ariz., at this time of the year, the weather is very much the same as it would be here in June or July, except that there is no rain. The weather is usually very pleasant, quite warm in the daytime—you can wear your summer clothes—and it cools but very little in the evening. I have repeatedly observed during the daytime that the three lines became charged electrostatically. They could be discharged by making a connection to earth, but if you left them alone they would charge again. They would always charge at approximately the same potential with respect to earth, and the potential varied. On one occasion the potential was so high that we got sparks half an inch in the ground through spark gaps. I have repeatedly observed cases where the spark was one-sixteenth to one-eighth of an inch between sparking points. There were no indications of lightning or storm. There have been cases where the phenomenon was observed when it was raining at the time, or shortly after it had rained, somewhere on the line; but the phenomenon was repeatedly observed when there was no indication of rain whatsoever, the sun shining brightly, but there was some wind or slight breeze somewhere on the line. I have mentioned the matter to several physicists, but have not succeeded in getting any satisfactory explanation.

Mr. Lincoln: The point has been brought up about the use of series telephone versus the bridge telephone. I know by bitter experience that the series telephone does not give very good satisfaction. Another point that has been brought up is to reduce the potential between telephone wires and ground, and to introduce there auto-transformers, or regular transformers, or condensers, or something of that kind, or possibly resistance, although the latter was not mentioned directly. The objection to that method, it occurs to me, is that it takes off the charging current at points. The remedy which I propose is to produce a distributed capacity along the whole length of the line, to run a ground wire along the whole length of the telephone wire, producing a distributed capacity which will take off the distributed induced effect most effectively.

Mr. Mershon: With regard to the use of condensers on telephone lines, it seems to me we want to keep the capacity of the telephone lines as low as possible to get good operation of the telephone In regard to the signaling with the power lines themselves, if anyone wanted to signal with the power lines, it would be better to signal from neutral to ground, and receive messages at corresponding places at the end of the line. If you have an auto-transformer for each telephone, it is bound to equalize any trouble at the telephone by putting the telephone wires in ground. The objection Mr. Lincoln made that the current would be drawn off at certain points, whereas it is introduced uniformly along the telephone line, would not hold, as the current is flowing in the same direction in both lines, and the electromotive force induced would be induced in each wire, and neutralize the current as far as the telephone is concerned.

The Testing of Insulators.

By F. O. Blackwell.

Insulators must be obtained which will not fail in service and this can only be assured by the thorough testing of each one that goes on the electric lines. The potential that can be employed safely for the transmission of power is now limited by the pressure the insulators will bear. Transformers that are reliable and not excessive in cost can be built for twice the voltage that any line yet constructed will withstand. As the distance over which power can be transmitted with a fixed cost of conductor varies with the potential, the length of transmission lines is to a great extent limited by the insulator.

The design of new and improved types of insulators is, therefore, most important, and these can only be developed by experiment with adequate testing facilities. In order to ascertain the value of such insulators, no method of testing can equal a practical trial under conditions of actual service. Placing new insulators on power-transmission lines in commercial operation is impracticable in most cases and should only be permitted after they have successfully withstood tests to demonstrate their ability to stand operating conditions. These tests should duplicate as nearly as possible the electrical and mechanical strains set up in the insulators under the most severe conditions that would ever be met with on a transmission line.

There are certain facts which must be considered if correct deductions are to be made from insulator tests. For instance, we cannot test each insulator with a given number of volts continuously as it would be in service. As is well known, all insulating materials are most apt to break down on long applied electric stress. The prepared cloth wrappings used on the windings of electrical machinery will stand instantaneously two or three times the potential that they will carry continuously. Glass and porcelain are not affected by time to the same extent as organic materials, but we know that both are punctured by long continued applications of lower pressures than they have withstood in test.

The shape of the potential wave also has a pronounced effect in breaking down insulation. Insulating materials being more affected by time than air, show in their ability to resist puncture that the average potential of the wave is more important than the maximum.

It is not safe to assume the potential either by the voltmeter or air gap as the true potential for determining the insulating value as it is somewhere between the two. Moisture in the atmosphere also effects the arcing distance. In steam, a given potential will jump twice as far and in a fog 25 per cent. farther than under ordinary conditions. Of course, if the altitude is high and the air more rarefied, the arc will also jump a greater distance.

The alternators generally used for long-distance transmission plants give very nearly a sine wave and therefore the testing generator should be one which will give a sine wave under all conditions. It is not sufficient to do so at full potential and no load, as tests are made with all degrees of excitation and with both leading and lagging currents.

The armature reaction should be as small as possible, which means that the generator should be much larger than would ordinarily be thought necessary. It is also desirable to have a high reluctance in the magnetic circuit to secure stability when running with weak fields and permit of control with a reasonable amount of field resistance.

There should be but one transformer used to step up to the highest potential required and its reactance should be as low as possible. A number of transformers in series is particularly bad, as it gives poor regulation and leads to great uncertainty as to the actual potential to which an insulator is being subjected.

Assuming that insulators are to be passed upon for a specific transmission plant, they should first be inspected to see that they are free from cracks, bubbles or pits that will impair their strength or in which moisture can lodge. If of porcelain, the glaze should cover all the outer surfaces. The glaze is of no insulating value in itself, but dirt sticks to unglazed surfaces. Experience has shown that porcelain insulators which are not absolutely non-absorbent are worthless. The best porcelain shows a polished fracture like glass. If there is any doubt about the quality of the porcelain in this respect, it should be broken into small pieces, kept in a hot dry place for some time, weighed and immersed in water for a day. When taken out of the water the weight should be the same as at first. A puncture test should be made by setting the insulator in a cup of salt water, filling the pin hole also with water and slowly increasing the potential between the top and bottom until the desired test potential is reached or the insulator either punctures or arcs over the surface.

If an insulator is built up of several parts, each part should be able to withstand a pressure greater than it will have to sustain when the complete insulator is tested. If it is to be tested for 100,000 volts and is made in two parts, each part might, for instance, be tested with 70,000 volts. The object of this is to have the weak parts rejected before they are assembled. A fair puncture test for an insulator is twice the potential for which it is to be employed, applied between the head and the interior for one minute. In a wet arcing test, a stream of water from a sprinkler nozzle under a pressure of at least 50 pounds to the inch should be played on the insulator at an angle of say 30 degrees from the horizontal. This will be similar to the condition which exists in a rain and windstorm. The insulator should not arc over from the wire to the pin at less than the potential which will exist in service between any two conductors.

In no case should wooden pins be relied on for insulation, as their value is only temporary. All wooden pins in time become dirty and absorb moisture. Eventually they burn off unless the insulator is good enough to be used with an iron pin. If an insulator is going to fail, it is better to have it do so at the start and not interrupt the service by breaking down perhaps years afterwards.

In addition to the electrical tests, it is well (if the insulator is of a type that seems to require it) to try samples for mechanical strength. When mounted on pins the insulator should stand a side strain of at least 10 times the pressure exerted by the air on the conductor with a wind velocity of, say, 100 miles an hour. It should also be able to slip the conductor through the tie wire should the former break.

These tests are particularly desirable with built-up insulators in order to be certain that the parts will not separate. With such insulators, it would also be well to test them in tension along the axis of the pin. In transmission lines crossing depressions, such an upward pull is not infrequently exerted on the insulator.

Discussion.

M. H. Gerry: Insulators are tested for two purposes: First, to determine the design, shape, material and dimensions best suited for a given voltage and set of conditions; secondly, insulators are tested as a matter of routine, to determine whether manu-

facturers have complied with specifications regarding material and workmanship.

There can be no complete set of tests to cover the first purpose, as it is not only a matter of experiment, but of skill and judgment in properly interpreting the results of many tests in relation to service conditions. The testing of insulators for the second purpose is comparatively simple.

P. M. Lincoln, Pittsburg: I would take issue with Mr. Gerry, who made a statement that glass insulators did not need testing beyond visual inspection. I know of a certain line which was put up, the insulators of which were not given a voltage test, but were simply tapped with a mallet in order to eliminate, if possible, any which had undue internal strain, but after the insulators were up and the normal voltage applied, quite a number of them broke down in actual service, which probably would not have occurred if they had been tested with the voltage strain before being erected. I do not think there is much danger of breaking down of an insulator from lightning strains which have double normal potential of steady potential.

Mr. Mershon: As between glass and porcelain, it seems to me that about the only advantage, other things being equal, that porcelain has over glass for transmission work is that of mechanical strength. Sometimes it has that advantage and sometimes it has not. It is a fact, however, that in some forms of insulator—in some complex forms—it is possible to get the porcelain insulator cheaper than the glass ones. The losses of insulators from high voltages show practically no difference that could be detected between glass and porcelain in any measurements I have made.

T. A. W. Shock, York, Pa.: I had the pleasure of building a line this last year in the state of Pennsylvania, in which I used an insulator which tested 75,000 volts. The ordinary pressure will be 24,000 volts—that gives a factor of safety of over two. I think I coincide with Mr. Blackwell that in testing insulators for a line of high pressure that the testing pressure should be at least three times the ordinary line pressure. My idea in adopting that style of testing is due to the fact that the insulator was built for a line on the Pacific Coast, for 40,000 volts, and I adopted the insulator to give me an extra factor of safety on the line.

F. N. Waterman, New York: Mr. Blackwell's reference to testing a double insulator—an insulator primarily of two parts—that each should be separately tested, seems to me practically to bar out double insulators and does not seem to be logically founded.

Mr. Thomas: Mr. Gerry and Mr. Lincoln have referred to one point in the testing of insulators that deserves a good deal more consideration, and that is the point of initial strains, the annealing of the glass. Mr. Mershon also spoke of the difficulty of getting glass well annealed. The breakage of glass insulators on the line during rain may more often be due to too much sun on one side of a poorly annealed insulator than to electrical operation.

C. C. Chesney, Pittsfield, Mass.: I think, in general, that the glass insulator will give as good satisfaction as porcelain insulators, except the annealing strains which, when the sun strikes them unequally, simply break out on all sides. I had some experience in some of the California work, in which very large insulators are used, and after very cool nights, when the sun strikes them on the side only, they will drop off.

Mr. Mershon: I cannot entirely agree with the author in regard to the use of one transformer for testing purposes. A series of transformers need not have a bad regulation or seriously distort the wave form, and such a testing set has a very great advantage that a transformer breakdown is much less serious than in the case of a single testing transformer. For very accurate results in any case a step-down voltmeter transformer is desirable.

Neither can I agree that insulators should necessarily be tested on iron pins. As I have stated before, an iron pin is likely to be the means of putting upon the insulator a mechanical stress all out of proportion to any which it would meet in practice if installed upon a wooden pin. An insulator which will stand up well under a salt-water test will often break down quickly when tested on a metal pin. While I do not believe in depending upon the wooden pin for insulation, I see no good reason for condemning it in general where there will be no trouble from burning.

I agree thoroughly that any new type of insulators should be given a rain test; that is, a voltage test while water is being sprayed upon the insulator in imitation of rain. If a wooden pin is used in this test it should be covered with tinfoil from a point inside the petticoat nearest the pin to a point two or three inches below. The voltage should be applied between the foil and the wire around the neck of the insulator, or preferably, between the tinfoil and a piece of wire representing the line wire, and tied to the insulator as it will be in practice. It has been my practice to endeavor to adjust the spray for a precipitation of one inch in five minutes.

W. L. Waters, Milwaukee, Wis.: The charging current in a test on insulators on an overhead line generally conforms more or less to the potential wave form of the alternator, and whether the current is lagging or leading, the distorting effect on the wave form is slight, and with all ordinary excitation and loads on the alternator the effect on the insulator test will be inappreciable.

I think there is only one really satisfactory way of measuring high voltages, and that is, by means of a voltmeter transformer connected straight across the insulator being tested. The above remarks are strictly only applicable to voltages up to 50,000, as I have had no experience with higher voltages.

[To be concluded.]

Silvey Storage Batteries

The Silvey storage battery has been produced by W. L. Silvey and is the result of years of practical research. Two types of cells are made, the portable and car-lighting type and the central-station type. The former cell is said to be the only storage battery to-day in use which has seen continuous service on any railroad for more than 10 years. The Chesapeake and Ohio Railroad Company is lighting its cars almost entirely by electric light and has been

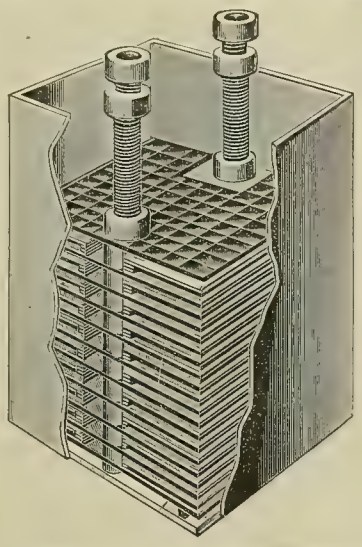


FIG. 1. SILVEY STORAGE BATTERY.—PORTABLE AND CAR-LIGHTING TYPE.

for 11 years, the Silvey battery being used exclusively. A statement of comparative cost of operating the several systems of lighting now on the market, furnished to the Southern and Southwestern Railway Club, shows the cost of the Silvey storage-battery system to have been $0.007 per lamp per hour while the costs for gas, oil and other electric systems varied from $0.02 to $0.083 per lamp per hour.

The Silvey portable and car-lighting type of cell is illustrated in Fig. 1. This cell is made with a hard-rubber jar in all sizes, up to 500-ampere-hour capacity. The cell has been constructed in a substantial manner, being especially designed to meet the wants of those who require a cell that will admit of very rough handling. The plates are perforated; the perforations being filled with material especially designed to admit of excessive discharge rates. The filling for the plates is principally superficially oxidized particles of metallic lead and an oxide of lead in an almost impalpable state hardened in place by chemical means and then formed in a solution of sulphuric acid and water, which is said to make the cell far better than one in which the plates are formed by partially destroying the conductor plate itself in order to form the active material.

The plates after being made are bolted together, a

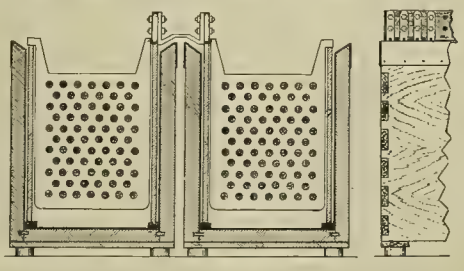


FIG. 2. SILVEY STORAGE BATTERY.—CENTRAL-STATION TYPE.

nut being placed between each plate and to insure perfect contact, the nuts and plates are electrically welded together. The positive and negative plates are placed alternately, with a double-thickness sheet of porous separating material between them. This separating material absorbs and carries about seven-eights of all the solution, so that in case a battery jar gets broken only a small percentage of the solution would be lost and the cell would do its work properly until such time as a new jar can be procured. In this respect the battery is almost a dry cell. It is stated that a set of cells has been used for lighting by entirely removing the jars after they had been charged, and the cells performed their work nearly as well during the discharge as they would had the jars been in place.

There is little free acid to spill should the cells become upset, which commends the battery to automobile people, to physicians and surgeons and to those who require a heavy discharge for blasting and cautery work.

The separator used between the plates is quite durable and serves the double purpose of retaining the solution and keeping the plates properly separated. It is almost impossible to have a short-circuit in the battery, for the filling cannot fall out of the holes in the conductor plate.

Fig. 2 illustrates the construction of the Silvey central-station type of cell with an improved connector. This cell is made with five different sizes of plates, the capacities varying from 500 to 20,000 ampere-hours according to the number and size of plate. The plugs used in the plates consist of a doubly corrugated ribbon, the corrugations in the plates being filled with superficially oxidized particles of oxide of lead and metallic lead, the strip being then rolled into plugs and inserted in the holes in the support plate, where they are fastened by the edges of the strip being upset. This method of construction permits the division of the active material into very small particles, where it is confined, and prevents the active material from falling out. The ribbon conducts the current through the entire active mass, enabling the cell to be discharged at the most excessive rate without injury. The manufacturer, the Dayton Manufacturing Company of Dayton, Ohio, says it has put these cells through the most severe tests imaginable, and has never been able to injure them in the least.

Space-telegraph Newspaper.

While the wireless telegraph has not as yet fully demonstrated its commercial value the present year has witnessed several notable steps in that direction, the most important being the successful transmission of messages across the Atlantic. Equally interesting have been the continued efforts to communicate from the shore with incoming and outgoing vessels and between vessels in mid-ocean. So successful has this service become that on a recent westward voyage of the Cunard steamship Etruria the pursur was able to print a little sheet of general news matter obtained entirely by wireless telegraph. Although naturally a small affair, the result has a general interest since it was the first newspaper ever published in mid-ocean printing news of the current day obtained wholly by wireless telegraph. It is herewith, for this reason, reproduced in its entirety:

R. M. S. "Etruria,"
7th February, 1903.

LATEST NEWS PER REUTER'S AGENCY.

VIA MARCONI WIRELESS TELEGRAPHY.

Venezuela question still unsettled; negotiations discussing various proposals, which appear satisfactory to either party; meanwhile blockade continues. Castro inflicted another severe defeat on revolutionists.

Senate postponed for a week for consideration of nomination of Dr. Crum.

Coal famine in New York seriously delaying departure of liners.

American warship going Amapala, Honduras, owing to indications of a general conflagration in the Central America Republic.

Lehmann of Yale awarded first Rhodes scholarship.

Roosevelt and Hay practically abandoned hope of Senate ratifying the Alaskan treaty, owing to opposition of senators—North and West.

Brazil decided upon the military occupation of Acre.

The sultan of Morocco routed the pretender.

King Edward confined to house since Monday by influenza.

It is somewhat interesting to note that out of nine items America furnished seven, and of these five were regarding matters in the United States. The variety of topics touched upon is suggestive of the capacity of the wireless telegraph for supplying general news services of this character systematically before long. When this is done there will be no refuge for the man of affairs from the news of the day which will follow him even when he puts out to sea.—Dun's Review.

Rapid Photographic Printing by Arc Light.

A machine was recently exhibited at the Franklin Institute, Philadelphia, by Frank A. Brunner, with which it is said photographic prints were made from negatives at the rate of 90 an hour. The machine, it is asserted, has solved the problem of the rapid and inexpensive reproductions from negatives independent of weather conditions. The apparatus is designed to make use of the various slow-printing papers used by professional photographers. The machine is octagonal in form and takes up a floor space of three by three feet. Only one arc lamp is required to print eight negatives, 11 by 14 inches, or a greater number of smaller ones, one lamp being placed in each machine. The arc lamp is of special design, producing a light of a bluish cast, which is rich in actinic value. The actinic rays of light, which are blue, indigo, violet and ultra-violet, are present in the rays of the sun, but the ultra-violet rays are lost to a great extent in passing through the earth's atmosphere. It is stated that the construction of this arc lamp is such as to make it even more efficient than sunlight, inasmuch as the actinic rays can be obtained in abundance. By actual experiment it has been proved that the machine will print any of the printing-out papers in one-half the time required by bright sunlight.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

R. A. Darling has sold his telephone system at Tintah, Minn., to John and Henry Skinnemon of Wendell, Minn.

A bill is before the Minnesota Legislature to regulate the charges of telephone companies. The maximum charge shall be $2 per month for a business connection and $1 for residences within half a mile of the exchange, with an additional 20 cents for every half mile further. Rates in accordance are named for toll-line service.

The Interstate Telegraph and Telephone Company of Austin, Minn., has been incorporated with $60,000 capital stock.

The Norwood-Young America (Minn.) Telephone Company has secured a franchise at Chaska, Minn.

Several operators of the Douglas County Telephone Company in Superior, Wis., went on a strike. Operators were brought from Duluth to replace them, but the matter has been taken up by subscribers and others, and there is considerable agitation over the matter.

The Ontario and Wilton Telephone Company has been organized to establish local exchanges at Wilton and Ontario, Wis.

A local company has been formed at Wakonda, S. D., and an exchange with rural connections is soon to be established.

The Minnesota Valley Farmers' Mutual Telephone Company has been formed in South Bend, near Mankato, Minn., to build lines to New Ulm and Mankato.

Timber suitable for telephone and telegraph poles in the Lake Superior district is becoming scarce. The Pittsburg and Lake Superior Iron Company has closed deals for poles to the value of $150,000 at prices considerably advanced over a year ago. The American Bell Telephone Company took half the amount disposed of.

A proposition was made to the village of Hallock, Minn., to purchase the telephone exchange, but a mass meeting voted to retain the ownership.

A bill has been offered by Senator F. H. Peterson of Moorhead in the Minnesota Legislature, providing for municipal ownership of telephone exchanges. The bill allows a municipality to construct or purchase an exchange provided a majority of the voters elect. The corporation may require all telephone companies whose lines touch the village or city to connect with the exchange, under reasonable regulations. Another bill before the Legislature is to prevent the use of slugs or false tokens in automatic telephones.

The Zenith Telephone Company of Duluth, Minn., has appealed to the City Council for permission to increase its rates, and claims that there is no profit in the business at the present time. The company suggests an adjustment of rates on a sliding scale, the rates to be raised or lowered as the number of subscribers raises or lowers.

A lively telephone discussion is on at Austin, Minn., where an Independent company is being formed. The Northwestern has arranged to connect with the Mower County Telephone Company, a rural line, and is otherwise willing to make reasonable arrangements. A year ago this company refused to make terms with country lines.

The Farmers' Co-operative Company has been formed at Osage, Minn., to build a line to Park Rapids and other points.

Farmers around Judson, Minn., will construct a rural telephone line with 200 to 300 subscribers.

The council of Muscatine, Iowa, is considering an ordinance for underground wires. The Iowa Telephone Company has plans for placing its wires in subways there. Farmers' lines are raising objection to the ordinance, thinking that its result will be to drive the Mississippi Valley Telephone Company out of business and result in an increase of rates.

The Independent Telephone Company of Sioux Falls, S. D., has arranged for the construction of a long-distance line to Worthington, Minn., where it will be met by a line from the Twin City Telephone Company. The former has made a proposition to the Independent interests of Sioux City, Iowa, which now seeks a franchise there, to construct a line to Sioux City from Sioux Falls. R.

Ohio Telephone Notes.

The strike of the telephone linemen at Youngstown has been settled and the men went back to work at the old scale of wages. Both the Youngstown Telephone Company and the Central Union were affected.

It is said that English sparrows have caused much trouble on the telephone lines near Geneva by building nests on the lines. It was found that they worked out the fuses and disturbed the circuit.

The Eastern Ohio Telephone Company of East Rochester has increased its capital stock from $5,000 to $25,000. Lewis Walker is the president of the company.

The Pleasant Hill Telephone Company, Pleasant Hill, has been incorporated with a capital stock of $10,000 by A. J. Verner, D. E. Simes, George H. Probeck, C. M. McLaughlin and D. E. Rathmell.

Barber & Brailey have transferred to the Toledo Home Telephone Company suburban lines extending to Maumee, Whitehouse, Grand Rapids, Sylvania and Blissfield, Mich. The Toledo company thus acquires the toll-line system in Lucas County.

It is supposed the Fitzsimmons Telephone Company of Cincinnati will make an attempt to establish an Independent system in Cincinnati and Hamilton County, which its amended incorporation certificate will allow it to do.

The Mercer Telephone Company of Princeton, W. Va., has been incorporated with a capital stock of $5,000 for the purpose of constructing and operating a system in Mercer and adjoining counties. E. W. Maxwell, Spanishburg; J. C. Hughes, Princeton, and others are interested.

The Ohio Telephone and Telegraph Company has asked the City Council of Toledo for permission to build its lines through certain streets in that city. This company is doing a large part of the long-distance business of the Central Union.

The Connonton Valley Telephone Company, Connonton, has the following officers: President, G. O. Fleming; treasurer, Charles Stewart; secretary and manager, Charles Busby. Lines connecting Jewett, East Springfield, Germano and other points will be built.

The Port Clinton Telephone Company, Port Clinton, is putting up a lot of new cable and making other improvements. An examination of the cable which leads to Put-in-Bay and the other islands shows it to be in the best condition.

At a meeting of the directors of the Local Telephone Company at Bellevue, a few days ago, it was decided to make extensive improvements on the exchanges at Attica, Sulphur Springs, Wakeman and New London, and to build a new toll line from Wakeman to Berlin Heights. G. A. Wright was added to the board of directors.

The Farmers' Telephone Company of Attica chose the following-named officers at a recent meeting of the directors: President, J. W. Walker; secretary, Jacob Zellers; treasurer, Henry Deuchley. The company will have lines in several counties about Attica.

The Cumberland Telegraph and Telephone Company will build several branch exchanges in Louisville, Ky., at once. They are now at work on a building for the eastern portion of the city. Some other improvements will also be made. O. M. C.

Indiana Telephone Items.

The Crystal Telephone Company filed articles of incorporation with the secretary of state April 3d. The declared purpose is to construct and operate telephone lines and exchanges in Dubois, Orange and Crawford Counties. The principal office will be in Jasper. William A. Line, Walker Mickler, J. M. Sinclair, P. P. Smith and S. N. Clapp are directors.

The New Telephone Company of Indianapolis is making extensive improvements in the local plant by adding additional rooms to the main exchange building and changing the switchboard from drop to lamp signals and putting in new cut-off relays. The company is also making similar improvements and changes in its north-side branch-exchange building. It is also putting out private branch exchanges in manufacturing establishments, department stores and large commercial offices. These improvements have been forced on the company by reason of its rapidly increasing business.

J. M. Griest of New Haven, Conn., has purchased the Danville Telephone Company's plant and is now in control of a system that extends like a spider's web all over Hendricks County. The price paid is said to be nearly $35,000. Mr. Griest also owns the Plainfield system, nine miles south.

The Orange Mutual Telephone Company, the last Independent telephone organization in Rush County, began to construct its system last week. The company has headquarters in Orange, Fayette County. The system covers a large farming territory, and will begin operations with a large number of subscribers.

The local telephone men who are out on a strike at Muncie presented a proposition to the Delaware and Madison County Telephone Company, but it was not recognized, and electrical workers then went out at Elwood, Alexandria and Anderson. The Brotherhood of Electrical Workers in the gas belt is asking for an increased wage of 25 cents a day and threatens to call out all of the members thereof in the gas belt and probably of the state. The Central Union Telephone Company is operating its plant with non-union men, but the Delaware and Madison County Telephone Company is negotiating with the strikers for a settlement. F.

By the consent of the Indian Territory Telephone Company to join in the telephone merger which was brought up at Muscogee, I. T., recently, a deal has been closed which merges all of the telephones of Indian Territory, Oklahoma and Northern Texas, and the entire control passes into the hands of the North American Telephone Company, which is an Independent telephone line. The lines consolidated are the lines in Oklahoma along the Santa Fe, Rock Island and Frisco railroads, and the lines on the Frisco and Katy railroads in the Indian Territory. The property affected by this merger is estimated to be worth $5,000,000.

American Bell Company Increases Capital Stock.

At a special meeting of the American Telephone and Telegraph Company in New York city on March 31st the capital stock of the company was increased from $150,000,000 to $250,000,000. President Fish states that there is no immediate likelihood of an issue of the new stock. He says that the principal reason for authorizing it was to give the directors power to issue should it be found necessary. He emphatically denies the report that the stock will be used to purchase a controlling interest in the Western Union Telegraph Company.

At the annual meeting of the company on the same day the old board of directors was re-elected. The proposition of the directors to amend the by-laws by giving the directors power to elect as many vice-presidents as they deem necessary instead of limiting the number to three was adopted. The amendment providing for the closing of the transfer books 30 days before the date of payment of dividends and meetings of the stockholders was also adopted. William J. Ladd, Charles C. Jackson and Louis Curtis were appointed a committee to select an auditor to inspect the company's books as required by the law of Massachusetts. Later the newly elected board met and re-elected the former officers, adding, however, the new vice-presidents. They are J. M. Cummings, Thomas Sherwin and C. J. French.

The Evansville Telephone Situation.

The initiatory steps in the organization of the municipal telephone company in Evansville, Ind., were taken at a meeting of the stockholders last week, when Alexander Gilchrist, Fred Peterscheimer and A. F. Kargus were elected directors, to act with James R. Goodwin, A. P. Lahr, R. K. Dunkerson and James Gray, appointed by Mayor Covert. The directors will decide in a few days what plan is best to pursue in regard to launching the first municipal telephone plant in this country. The ordinance requires that $190,000 must be raised, and of this amount $135,000 in stock has been subscribed. Either of the numerous construction companies endeavoring to secure the contract is willing to take stock to the amount of $55,000, so as to make up the required amount. It is desired, however, to keep the stock with the local people if possible. The cause pending in the federal court to determine the right of the Cumberland company to continue to occupy the streets will not come up until June.

NEW COMPANIES.

A telephone system will be installed at Augusta, Ill., by the newly organized Augusta Mutual Telephone Company.

The Strawn Telephone Company, recently incorporated with $1,500 capital, will install and operate a telephone system at Strawn, Ill. The incorporators are E. C. Gullberg, Jos. Duntz and J. W. Kirkham.

A telephone company has been organized at Greenville, Tex., by R. T. Hicks, L. A. Chamberlain, E. D. Glandon and others. The company will be known as the Home Telephone Company and is capitalized at $100,000.

The Granby Telephone and Telegraph Company of Granby, Mass., has filed its certificate of incorporation with the Massachusetts secretary of state. It has a capital of $1,200. Willard A. Taylor is its president and Richard L. Dickson is its treasurer.

The New York and Northern Telephone Company of Troy, N. Y., has been incorporated to operate from Troy to Bennington, Vt., and other points. The company's capital is $50,000 and its directors are Fletcher S. Hyatt of New York and J. V. Jacobs and C. E. Gardner of Troy, N. Y.

The Southern Telephone and Telegraph Company has been incorporated with offices at Hot Springs, Ark. The company has a capital of $200,000 and has applied for a franchise to construct a long-distance telephone system. Harry H. Hale, Chas. D. Graves, P. C. Burns and others are interested.

The Oklahoma Southern Telephone Company of Oklahoma City has been granted a territorial charter to construct a telephone line in Pottawattomie and Cleveland Counties and in the Creek, Chickasha and Seminole Indian nations. Incorporators are W. A. Jennings, Graham Burnham and R. C. Willard. The capital is $15,000.

It is reported that a new telephone company is to be incorporated, with headquarters at Colorado Springs, Colo., and to be known as the Colorado Automatic Telephone Company. It is said that the company is backed by such men as James F. Burns and Frank G. Peck of the Portland Gold Mining Company and Irving W. Howbert, president of the Cripple Creek Short Line. The promoters expect to invest between $1,500,000 and $2,000,000 in their enterprise, and applications for franchises will be made to the city councils of Denver, Pueblo, Colorado Springs and ultimately to the municipal authorities of all towns where the Bell system is now in operation.

Ohio Telephone Companies Merged.

The Portage County Telephone Company of Ohio has been organized to take over the property and franchises of the following companies: The Kent Home Telephone Company, the Ravenna Home Telephone Company, the Mantua Home Telephone Company, the Garrettsville telephone plant; also about 100 miles of toll lines belonging to the various companies.

The capital stock of the new company will be $100,000, and there will be a first mortgage placed upon the entire property to secure first-mortgage six per cent. 20-year gold bonds to the amount of $100,000.

The franchises of the various companies have from 15 to 20 years to run and are said to be in all respects most favorable to the companies. It is stated that the companies have invested in actual cash an aggregate sum greatly in excess of $100,000, in addition to the franchises.

The bonds of the Portage County Telephone Company are being offered at par, and for every $100 of bonds subscribed the company will give a stock bonus of 50 per cent., or $50 par value of stock. The Akron Trust Company of Akron, Ohio, is registrar of the bonds and trustee for the bondholders. The company will have seven directors, of which at least four will be residents of Portage County.

W. H. Butler, whose successful work in building up the present fine business of the Kent Home Telephone Company of Kent, Ohio, has gained him an enviable reputation as a promoter of telephone properties, has been appointed manager of the Portage County merger.

TELEPHONE MEN.

I. S. Mahin, who has been with the Jasper County Telephone Company, at Newton, Iowa, has gone to Le Mars, Iowa, where he will have charge of the Le Mars Telephone Company.

A Detroit (Mich.) correspondent of the Western Electrician states that James F. Land has returned to that city from Kansas City and has accepted the position offered him by the Union Trust Company as general superintendent of the Michigan (Bell) Telephone Company. The proffer of the place was made after Mr. Land had resigned to become general manager of the Missouri and Kansas Telephone Company, and he went to Kansas City to tender his resignation of this office and see that his household goods were sent back to Detroit. Mr. Land's former position with the Michigan Telephone Company was general superintendent of the central divisions, and his supervision is now extended over the whole state.

EXTENSIONS AND IMPROVEMENTS.

An automatic switchboard will be installed at Meridian, Idaho, by the Boise Independent Telephone Company.

The Utah Telephone Company states that it will parallel the Bell telephone lines in Idaho. It is thought that this will lead to another telephone war.

The new Pacific States Telephone and Telegraph exchange building at Walla Walla, Wash., is about completed. During the last year about 320 new subscribers have been installed in that city, the local system at the present time consisting of about 1,180 telephones.

Seattle, Wash., will soon be connected with the west side of Puget Sound. The Peninsula Telephone Company, with headquarters at Bremmeton, has arranged with the Sunset Telephone Company, to connect the lines. This entails a submarine cable three miles long.

An extension to the lines of the Cumberland Telephone and Telegraph Company will be built from Jackson to Gulfport, Miss. The company will also make extensive improvements at New Orleans. These are to cost $100,000 and to include three branch exchanges, a large warehouse, etc.

During the month of March the Chicago Telephone Company made a net gain of 1,477 subscribers, bringing the total telephones in the city up to 64,507. The month was the best thus far this year. It compares with 1,450 for January, and 1,080 for February. The record up to date was a gain of 2,221 in November last.

Simplification of the Telephone Switchboard.[1]

By Sidney Hand Browne.

In his closing remarks, Mr. Lockwood, in his article entitled "The Evolution of the Telephone Switchboard," refers to the complex organization of the modern relay switchboard, and intimates that the next step in its evolution may be along lines which will simplify it, rather than in a direction involving a radical departure from its present organization.

A partial simplification has been obtained, resulting in a better "talking circuit" and reduction in first cost and in maintenance. Such simplification consists of a reduction in the amount of switchboard cable required in wiring the multiple jacks to two-thirds of what is required under the system described; avoiding the use of a shunt to put out the supervisory lamp; dispensing with the use of the repeating coil in the cord circuit, as shown, and with the third contact in the multiple jacks.

In Mr. Lockwood's diagram (Fig. 4 on page 96 of Western Electrician of January 31, 1903) it will be seen that the relay which controls the operation of the supervisory lamp is placed in series on one side of the talking circuit, although there is no corresponding impedance in the opposite side of this circuit. And although this relay is of low resistance, it will slightly unbalance the line, and its insertion in this manner should be avoided if possible.

It is also seen that the test rings of the multiple jacks are connected by a third wire running the entire length of the switchboard. If this third connection could be avoided, it would simplify matters and be a desirable improvement. By reference to the diagrams herewith presented, it will be seen that this has been accomplished, with a consequent saving in switchboard cable, first cost of construction and a reduction in cost of maintenance. By dispensing with this third wire in the multiple jacks we have also been able to use a two-conductor cord, instead of a cord with three conductors, as shown in Mr. Lockwood's diagram. This reduces the first cost of cords and their maintenance.

It is desirable, if possibile, to avoid the use of the repeating coil in the circuit shown in Mr. Lockwood's diagram, as it is frequently the case that these coils are not properly balanced, and a very slight variation in the size of the core or inaccurate winding by the manufacturer will cause enough unbalancing to interfere with the proper working of the circuit. The use of this repeating coil has also been avoided in the system described.

By shunting the supervisory lamp, as shown in Mr. Lockwood's diagram, when the telephone is taken from its hook, the flow of currents through these lamps and their shunts continues, and causes considerable drain on the batteries.

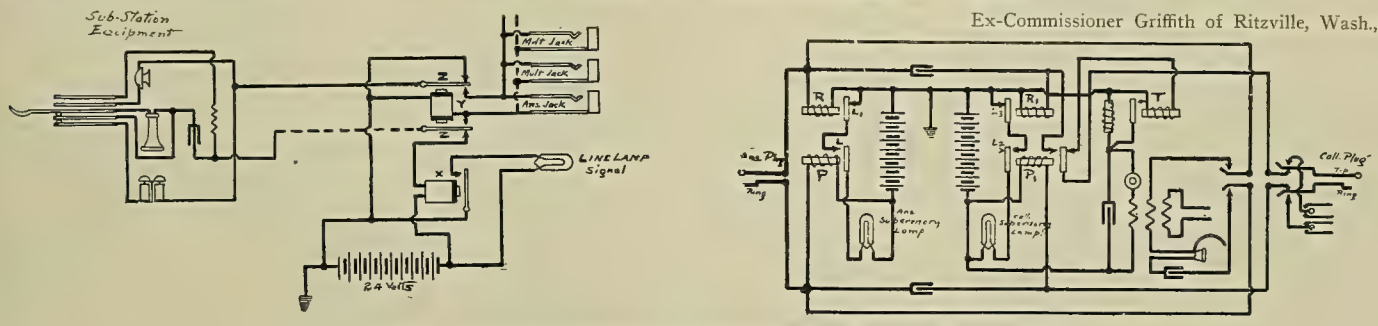
The diagrams given here show two telephones connected through a telephone-exchange system whose operation is as follows:

The operation of removing the receiver from the hook of the sub-station instrument closes the circuit and energizes the line signal relay (X) in the usual manner. The operator, by inserting the plug in the answering jack, allows current to flow over the ring of the plug, through a relay (Y) of high impedance, to the ground; this relay, being energized, attracts its armature (Z), and disconnects the line-signal apparatus, consisting of relay (X) and lamp, and also "puts current" on the sleeve of the jack which will give the busy test through a relay (T) placed in the operator's circuit. The advantage of this relay controlling the busy test is that by its use the operator only gets the signal without conveying it to the subscriber who has made the call. The insertion of the plug also causes current to flow through relay (P), closing the local contact at (L), and allows current to flow through the lamp to the local contact at (L) on relay (R) to ground. These relays are of low resistance and are placed on each side of the cord circuit. When the subscriber answers his call by taking the telephone from its hook, it allows the current to pass back over the tip of the cord to relay (R), to ground, and opens the local contact at (L), thus cutting out the supervisory lamp. It will be noticed that there is a straight through circuit from the tip and sleeve of the answering cord to the tip and sleeve of the calling cord, with the condensers inserted. These condensers permit the flow of voice currents and prevent the steady flow of current from the battery, which simply simplifies current for the substation transmitter.

The system described eliminates the features which we stated above we did not think were desirable, and as shown in diagram in Mr. Lockwood's article. It is true we have introduced the relays (R) and (P) and (R1) and (P1), but these relays are wound to a high impedance and are not connected directly in the talking circuit, but are bridged across it. The circuit is perfectly balanced, which is not true of the circuit as shown in Mr. Lockwood's diagram, and instead of shunting the lamp and allowing current to flow through the lamp circuit, we open the lamp circuit and save the drain on our batteries.

To anyone who is familiar with the amount of wire necessary in a large multiple switchboard and the consequent greatly increased cost of manufacture, it will be apparent that immense saving can be made by the elimination of one-third of the amount of multiple-switchboard cables, as shown in the system described by Mr. Lockwood, by the use of two-contact jacks instead of three-contact, by the use of two-conductor cords instead of three-conductor, and still obtain a much more direct and better talking circuit.

1. A paper read at the Pittsburg meeting of the American Institute of Electrical Engineers, February 5, 1903.



SIMPLIFICATION OF THE TELEPHONE SWITCHBOARD.—DIAGRAMS OF CONNECTIONS.

GENERAL TELEPHONE NEWS.

The merchants and farmers of Coquille, Ore., have formed an organization to construct a telephone line from Coquille to Arago. D. D. Pierce is the chairman.

Ex-Commissioner Griffith of Ritzville, Wash., has secured a franchise to build and operate telephone lines in that city.

Articles of incorporation have been filed by the Luckamute Rural Telephone Company in Polk County, Wash. L. S. Perkins, W. E. Williams and B. F. Smith are the incorporators.

Orders have been placed for all equipment necessary for a new system for the Pomona Valley Telephone Union at Pomona, Cal., and it is expected that the company will be able to begin the service by May 1st.

The Salisbury (N. C.) Telephone Company and the Southern Bell Company have perfected an agreement by which the former's service will be greatly improved and connected with the long-distance service of the Bell company.

The Payette Valley Telephone Company has been incorporated at Boise, Idaho, to build and operate a system near New Plymouth in Canyon County. The capital stock is $40,000. The directors are J. N. Shaw, R. E. Shaw and W. S. Hinchliff.

The Home Telephone Company of Salt Lake City has been reincorporated under the name of the Utah Independent Telephone Company, and work on the new system will begin next month. The company is now in search of a site for a suitable central office. The construction work of the line will be in charge of C. S. Hall, an eastern municipal engineer.

The Chicago, Burlington and Quincy Railroad Company is installing a telephone system along its road. An exchange at Lincoln, Neb., has been completed and is now being operated. A copper metallic line has been erected between Omaha and Lincoln, and the exchange at Omaha is rapidly nearing completion. Galesburg, Ill., is being provided with an exchange which will connect with 65 stations. It is already connected by a copper metallic line with Chicago.

MANUFACTURERS AND DEALERS.

The Central Electric Company of Chicago has published a new telephone price list, dated April, 1903. This price list contains a complete line of telephones and telephone parts; also construction material of every description.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago reports a most extensive business, and states that its factory at the present time is turning out 1,200 telephones a day, and to keep up with orders it may have to increase its factory space to a considerable extent. The company has recently sold telephone equipments to companies in Windsor, Gilmore, Green Valley and London Mills, Ill.; Rossville and Winchester, Ind.; Parkersburg, W. Va., Duluth, Minn., and Woodburn, Ore.

Properties of Radium.

Several interesting properties of radium have recently been announced by Professor Crookes and M. Curie, the French physicist. Assisted by his clever wife in isolating radium, M. Curie discovered that it possesses the extraordinary property of continuously emitting heat without combustion, without chemical change of any kind, and without any change in its molecular structure, which remains spectroscopically identical after many months of continuous emission of heat. He found further that radium maintains its own temperature at a point 1.5 Centigrade (34.7 Fahrenheit) above its surroundings.

This is equivalent to saying that the actual quantity of heat evolved is such that the pure radium salt would melt more than its own weight of ice every hour, or that half a pound of radium salt would evolve in one hour heat equal to that produced by burning one-third of a cubic foot of hydrogen gas, this evolution of heating going on constantly for indefinite periods, leaving the salt at the end of months of activity just as potent as it was at the beginning.

The world is thus made acquainted with a heat sufficient to raise mercury in a thermometer 2.7 degrees Fahrenheit, the output of which is maintained indefinitely without any visible compensation to the heat-giving body.

Professor Crookes says that although the fact of the emission of heat by radium is in itself sufficiently remarkable, this heat is probably only a small portion of the energy radium is constantly sending into space. It is at the same time hurling off material particles which reveal their impact on a screen by luminous scintillations. If these are stopped by a glass or mica screen torrents of Roentgen rays pour out from a few milligrams of radium salt in a quantity to exhibit all the phenomena of the rays, and with energy enough to produce a nasty blister on the flesh if kept near it for an hour. Professor Crookes believes that in some way yet unexplained radium replenishes its energy from the movements of the molecules of air surrounding it. Even in the stillest air the atoms are constantly in movement, and the energy derived by radium from its surroundings may come from electrons within the atom. He adds that radium has a high atomic weight, and electrons within atoms are exceedingly numerous. They appear to be so numerous as to be unstable in their revolutions, thus constantly flying out and disturbing surrounding substances. Thousands of costly experiments probably must be made before the meaning of the discovery of M. Curie that radium throws off heat without combustion and without material change of substance is fully realized.

A. Debierne has found that an induced radio-activity can be obtained not only from radium salts, but also from actinium salts, but that the character of the induced radio-activity allows of a clear distinction between the effects of the two substances. A radium preparation applied to the skin produces no immediate effect, but leads to the development of a very painful gangrene within a period varying from eight to 20 days. J. Danysz has studied the physiological effect of these rays, and finds that different tissues are sensitive to very different degrees. It appears that the skin absorbs most of the radiation, and, therefore, protects the inner tissues.

Annual Report of the Metropolitan Elevated Railway.

The stockholders of the Metropolitan West Side Elevated Railway Company of Chicago met on April 4th to hear the report of the board of directors for the fiscal year ended February 28, 1903. George Higginson, Jr., W. W. Gurley, John P. Wilson and J. B. Forgan were re-elected directors to serve three years.

The number of passengers carried by the Metropolitan road for the fiscal year ended February 28th was 39,548,354, an increase of 5,637,564 over the preceding year. The total earnings for the year were $2,040,005.22 and expenses $952,707.36, which leaves a surplus of earnings of $1,087,297.86, or $71,194 more than last year. An increase in bond interest and $30,767.18 loss by fire and accident, together with a three per cent. dividend, brings the total surplus down to $10,855.87.

The increase in gross passenger earnings was very gratifying, but the increase in net earnings was not so satisfactory, for the reason that the higher cost of material and labor during the year made the operating expenses proportionately higher than they were last year.

During the year two extensions which were under construction at the end of the last fiscal year were opened. The Douglas Park extension, from about Campbell Avenue to Fortieth Avenue, a distance of about 1.85 miles, was fully in operation on June 16, 1902. The Garfield Park extension from Forty-eighth Avenue to Fifty-second Avenue, a distance of one-half mile, was completed and in operation on August 25, 1902. The Garfield Park addition was particularly built to connect with the Aurora, Elgin and Chicago Railway. The mileage of the road was increased 4.7 miles, bringing the total up to 41.98 miles. There are a total of 351 cars in use, 89 motor cars and 262 coaches. A new 3,500-horsepower engine was completed in November of 1902. This makes a total of about 14,000 horsepower now in the power house.

To relieve the congested condition of the downtown terminals a strip of property was purchased between Van Buren and Jackson Streets and another between Fifth Avenue and Market Street, where a terminal station will be built.

Affairs of the Lake Shore Electric Railway Company.

Judge Wing of the United States Circuit Court has terminated the receivership of the Lake Shore Electric Railway Company of Cleveland, Ohio, and Albion E. Lang has been discharged from that position. This is the termination of the troubles among the electric-railway companies, which were controlled by the Everett-Moore syndicate. Mr. Lang has had charge of the property since January, 1902. The bondholders have taken the property in charge and will operate it under the management of experienced men, but, after all, the old syndicate will have a voice in its affairs. It is headed by the American Trust Company and has taken the $1,750,000 bonds issued by the company. The new issue of $1,500,000 preferred stock was taken by the stockholders at 60, and Messrs. Everett, Moore and Mahler each took 3,000 shares of the stock, the other members of the original syndicate taking less. Barney Mahler tendered his resignation as president of the company and it was accepted. The new directorate consists of the following: C. W. Wasson, J. B. Hoge, J. B. Hanna and W. J. Gawne, representing the stockholders, and the following, made up of the bankers who financed the company: H. E. Andrews, Cleveland Electric Railway Company; H. P. McIntosh, Guardian Trust Company; E. G. Tillotson, Cleveland Trust Company; E. V. Hale, American Trust Company; S. F. Haserot, Prudential Trust Company; J. R. Nutt, Citizens' Savings and Trust Company. Henry E. Everett, E. W. Moore, Barney Mahler of Cleveland, and W. H. Price of Norwalk, and J. H. Harding of Philadelphia, were also made members of the directorate. It is not known who will be elected president of the company. Mr. Everett, Mr. Mahler and Mr. Andrews have been spoken of. It is probable that General Manager F. J. Stout will be retained in his position.

The property now consists of about 130 miles of road, built on a private right-of-way. It is the intention to put on through cars between Cleveland and Toledo at once. The plan of financing the road pays all the debts and provides a working capital of $400,000, so that many needed improvements will be made at once. There is little doubt that it will be put in first-class condition without delay.

BOOK TABLE.

THEORETICAL ELEMENTS OF ELECTRICAL ENGINEERING. By Charles Proteus Steinmetz. New York: Electrical World and Engineer. 1902. Pp. (six by 9¼ inches) vii., 330, with 144 illustrations. Price, $2.50.

This is the second edition of Mr. Steinmetz's excellent work. The first edition was published in 1901 and was reviewed in the Western Electrician of December 7, 1901. The author has revised and corrected the text and added three new pages on self-exciting induction machines. The work is divided into two parts, the first dealing with general theory and the second with special apparatus, including synchronous machines, commutating machines, synchronous converters and induction machines.

STEAM POWER PLANTS, Their Design and Construction. By Henry C. Meyer, Jr., M. E. New York: McGraw Publishing Company. 1903. Pp. (six by 9¼ inches), 160, with 65 diagrams and 16 insert plates. Price, $2.

Owners and managers of manufacturing plants or buildings requiring their own power installations, who frequently have occasion to specify or purchase machinery for the efficient and economical operation of their plants, will find much information in this book to help them. The work has been specially prepared for this class of men, but will also prove to be of considerable value to the expert engineer and all others interested in modern steam power-plant construction. Much of the text originally appeared in a series of articles in The Engineering Record, and the whole has been thoroughly brought up to date and is representative of the most modern state of the art.

In the opening chapter the author treats generally of the design of steam power plants, including the location, drawings, type of power house, building and foundations. The proportioning of steam boilers and the design of tubular boilers and boiler specifications are taken up in the next two chapters. Chapter IV. is devoted to the selection of types of engines and deals with pressures, speeds, proportioning of cylinders, variable loads and overload capacities, superheated steam, and steam jackets and reheaters, a brief mention of steam turbines being also given. The following chapter treats of specifications for steam engines. The remaining six chapters handle in a similarly thorough and practical manner steam and water piping, condensers, feed-water heaters and economizers, mechanical draft, chimneys, and coal handling, water supply and purification. The text is illustrated by suitable diagrams and also by several folded insert plates which excellently illustrate typical existing electric power plants.

Shelby Angulating Device for Photometers.

Most disinterested authorities strongly favor a method of determining the real value of an incandescent lamp as a source of light should be, by determining the spherical candlepower of the lamp and considering it in connection with the actual current required to operate it, in preference to measuring the lamp in the arbitrary manner most generally used at present, namely, for its horizontal intensity.

The principal argument against rating lamps by their spherical candlepower is that there has not been an instrument by which the spherical-candlepower measurements can be taken at one reading that is not extremely complicated. To determine the spherical candlepower by taking numerous readings requires considerable time and is, therefore, conceded

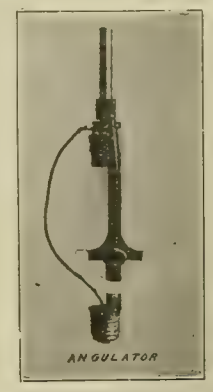


FIG. 1. SHELBY ANGULATING DEVICE FOR PHOTOMETERS.

to be uncommercial. These facts do not, however, alter the true condition, and the real value of the lamp cannot be determined in any other way.

Prof. C. P. Matthews of Purdue University is among the number who have devoted considerable time to the solving of this important question. Mr. Matthews has invented a very satisfactory apparatus for determining the spherical candlepower at a single reading. The expense incurred in the ownership of one of these instruments is such, however, that many feel that they cannot afford to purchase one.

Professor Sharp of Cornell University has also devoted time to the solving of the problem and has prepared a method of calculating the spherical candlepower of lamps, having various forms of carbons, that is sufficiently close for any commercial purpose. Professor Sharp's method consists of determining the mean-horizontal candlepower in the regular manner and then making one measurement through the tipped end of the lamp, multiplying the mean horizontal by 0.7 and the tipped-end measurement by 0.3. The sum of the two results will be

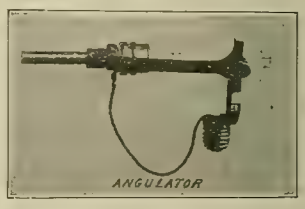


FIG. 2. SHELBY ANGULATING DEVICE FOR PHOTOMETERS.

very close to the real spherical candlepower of the lamp.

Most owners of photometers have not, until recently, recognized the great advantage of a lamp delivering a large volume of light through the end opposite the base. The attention of the users of lamps was first called to the value of this light by the Shelby Electric Company. This company is now placing on the market an angulating device (see Fig. 1) which readily fits into the socket of any standard photometer. By the aid of this device the horizontal candlepower can be determined and the lamp can then be turned so that the light can be measured at any angle (see Fig. 2).

While the makers of photometers have not encouraged the measurement of lamps in other than the horizontal direction, various papers read before scientific bodies within the last two years show conclusively that the light delivered through the end opposite the base is in fact the most valuable light the lamp emits. Illumination is divided into but two classes, namely, general illumination and local illumination, and the value of the lamp for general illumination can only be determined by considering the light emitted in all directions, and by far the greater part of the light that is used for local illumination is delivered through the end of the lamp opposite the base, or within 45 degrees therefrom.

The angulator, illustrated herein, has been designed with a view of placing, at the disposal of each and every owner of a photometer, a method of determining the value of his lamps regardless of whether the lamp is used for general illumination or for local illumination. It is sold by the Shelby Electric Company of Shelby, Ohio.

CORRESPONDENCE

London Letter.

London, England, March 28.—Since electric lighting first came to be utilized to any considerable extent in Great Britain, the question of fire risks to buildings has been an important one from the point of view of the fire-insurance companies, almost every one of which has from time to time formulated a set of rules of its own. With consulting engineers and station engineers altering and modifying the existing rules to meet their own requirements, a state of chaos was gradually being attained to, and consequently, as in the case of machinery, standardization eventually came to be considered. To help towards such a state of standardization in this matter the Institution of Electrical Engineers appointed a committee to draft a set of rules and regulations based upon the best wiring practice, and these have now been published. They have been accepted by the Incorporated Municipal Electrical Association and by some of the leading fire-insurance offices. The idea is for members of the Institution to abide by them, and recommend their use, and so help toward their universal adoption. A standing committee has been appointed for the purpose of considering suggestions for their improvement, and small alterations, if deemed advisable, will be made at once. The rules include the conductivity and size of conductors, insulators, joints and casing, switches, fuses, ceiling roses, switch and distribution boards, lampholders, arc and incandescent lamps, dynamos and motors, resistances, choking coils, transformers and testing, as well as a table showing maximum currents, thicknes of dielectric and insulation, resistance for copper conductors, insulated and laid in casing or tubing.

What is known as the "linolite" system of electrical illumination is now being introduced into this country. These are incandescent lamps, nine inches long, carried in semi-circular reflectors, and will probably have a special application in connection with picture galleries, shops, and such places where the light is required to be thrown directly downward.

Along the banks of the Manchester Ship Canal are no less than 22 electric cranes. Twelve of these are capable of lifting a weight of 3,000 pounds at a radius of 42 feet and are portable, the other 10 being fixed all having a radius of 16 feet, three lifting 3,000 pounds and seven 1,000 pounds. A 28-horsepower motor does the hoisting for the 3,000-pound cranes. It is directly geared to the hoisting barrel, and runs off a 500-volt circuit at 355 revolutions per minute. The steering gear of these motor cranes is operated by a five-horsepower motor, and a three-horsepower motor is sufficient for the 1,000-pound cranes.

Lieutenant-colonel Yorke, the chief inspector of railways to the Board of Trade, has just issued a report upon a tour he recently made in the United States, to inspect American railway working and methods. The subject is treated in a sound manner, and his comparisons, although in many instances unflattering to ourselves, are extremely valuable. Not only are steam railways considered, but electric lines are discussed at great length, albeit his opinions are distinctly against American signaling methods. At the same time, Colonel Yorke has shown by his evidence before the London Traffic Commission that he is very favorably impressed, in a general way, with the manner the subject of locomotion has been tackled in Boston, New York and Paris, holding up in contrast the encouragement given to private enterprise in those cities as compared with the reverse in London.

The parliamentary committees to consider the London "tube" railway bills begin their sittings this week, and although all the important bills have been postponed, pending the report of the London Traffic Commission, one important one, viz., the City and Northeast Suburban, is down on the list for immediate hearing. This runs over a portion of the route dealt with by Mr. Morgan last year, and any decision of the Traffic Commission can hardly affect it. The majority of the other bills down for hearing this week deal with minor extensions of time, etc.

The London County Council's proposal to undertake electric wiring, fittings, etc., has been thrown out by the government. The council's conduit tramway system will be opened by the prince of Wales on May 15th.

All the "tube" railway bills which it was proposed to suspend, pending the report of the royal commission on London traffic, have now been withdrawn for the session. W.

New York Notes.

New York, April 4.—The Manhattan Elevated Railroad passed into the hands of the Belmont syndicate at midnight of last Tuesday, the event being observed by a small dinner party given by Julien T. Davies, for many years counsel of the company. After a number of speeches, Alfred Skitt, vice-president and general manager of the road, on the stroke of 12 presented Mr. Belmont with a silver casket which contained an old rusty railroad spike that had seen service for a number of years on the road at the Battery station.

Although it was rejected by the elevated employes' new association when it was submitted to them a week ago by the then General Manager Skitt of the Manhattan Railway Company and General Manager Bryan of the Interborough Rapid Transit Company, the new wage schedule was put into effect Wednesday by Mr. Bryan, when he assumed the management of the amalgamated companies. This schedule provides for certain increases of from five to 50 cents a day in the wages of employes of various classes, but fails to grant all the increases demanded and more notably fails to grant what was most strenuously demanded, a nine-hour day. It is said the schedule is not acceptable to the men.

An interesting exhibit by means of a moving-picture machine was made before the Rapid Transit Commission on Thursday of the moving-platform railway scheme which is proposed for connecting the Brooklyn and Williamsburg Bridges and extending down into the financial district around Wall Street. Schmidt & Gallatin, who represent a syndicate for the construction and operation of the moving-platform system, propose that the construction of the subway shall be undertaken by and at the expense of the company to be formed, and that fares over the route shall be uniformly two cents at all hours. If other transportation lines would enter an agreement, a system of transfers will be issued between them for a single fare of five cents. As an evidence of good faith the company would deposit a certified check or cash. Leo A. Phillips, who had charge of the platform in Paris, explained the mechanism and compared it with other methods of transportation. The moving platform, he said, would transport 60,000 persons an hour. Bridge Commissioner Lindenthal said the plan was feasible, both for use on the bridge and in a subway.

The Board of Aldermen has adopted a resolution indorsing and urging the immediate passage of the legislative bill to permit the city to construct and operate a municipal lighting plant. The resolution declared that "the high-handed methods, exorbitant charges, and the inferior service of the several lighting companies have become well nigh intolerable."

Civil Justice F. J. Worcester, sitting in the Eleventh District Court, has handed down a long and sweeping decision in favor of Paul Blume in the suit which he brought, as a representative of the Citizens' West Side Transit Reform Committee of One Hundred, against the Interurban Street Railway Company to recover four penalties of $50 each because he had been refused transfers from one line to another at certain points of intersection. The court holds that the law is compulsory, that transfers must be given, and the fact that giving them there might cause undue crowding in the street and at the crossings is no excuse for not giving them unless sanctioned by legislative action. The case will be appealed.

The Corporate Electric Company has been incorporated to manufacture electricity for light, heat and power purposes in Garden City, Long Island, and in the five boroughs of New York city. The capital is $300,000, and the directors are Harold S. Recknagel, Harold C. Vaughan and Walter L. Worrall of New York city, C. C. Freeman and Henry C. Eldert of Brooklyn.

The People's Illuminating Company has also been incorporated to supply electricity in Manhattan and Bronx Boroughs of New York city. The capital is $25,000, and the directors are C. C. Freeman and H. C. Eldert, Brooklyn, and W. L. Worrall of New York city.

President William H. Baldwin, Jr., of the Long Island Railroad Company, at Thursday's hearing of the special commission that is to express to the Appellate Division of the Supreme Court its opinion as to whether or not the proposed Pennsylvania tunnels and Manhattan station should be constructed and operated, declared his belief that when the work is completed, "Philadelphia will be a suburb of New York," and that the trip between the two cities could be made in 90 minutes, enabling people of the Quaker City to dine at home, attend the theater in Manhattan and return to Philadelphia the same night.

It was reported in Jersey City to-day that the proposed consolidation of the North Jersey Street Railway, the Jersey City, Hoboken and Paterson Railway, the Elizabeth and Plainfield Railway, and the Orange and Passaic Valley Railway, would be effected in the interest of the Pennsylvania Railroad, and that the merger of the trolley companies would include a union with the United Gas Improvement Company of Philadelphia, and the Fidelity Trust Company and the Prudential Insurance Company of Newark, of which United States Senator Dryden is president.

The New York Telephone Company has opened up a new branch exchange in a new building, at 110 to 114 East Fifty-eighth Street, to be known as the Plaza exchange. The switchboard cost $175,000 and has an ultimate capacity for 9,600 subscribers and will start with 5,600 lines, they being drawn from the neighboring stations. O.

New England News.

Boston, Mass., April 3.—The Massachusetts Legislature has passed a bill imposing a fine of $10 on anyone "not intending to become a passenger" who "unlawfully" boards a street car while the car is in motion. This, of course, exempts newsboys from the penalty. Reference to the next Legislature was the fate of three petitions that cities and towns be authorized to construct, maintain, purchase, operate or lease conduits for electrical conductors, and a petition for authority to establish railway transportation to the summit of Blue Hill.

Since the Boston and Suburban Electric Companies instituted lines of through cars between Park Street Subway Station and Newton, Waltham and Lowell, Mass., the business has increased 50 per cent., compared with the corresponding period last year. The through cars are the result of an arrangement with the Boston Elevated Railway Company, whose men handle the cars on its tracks between Park Street and where the tracks join those of the suburban companies.

The Bryant Electric Company of Bridgeport, Conn., has completed plans for a brick addition to its plant. The new building will measure 250 by 60 feet and will be four stories high.

The Cambridge (Mass.) Board of Health has passed the following regulation: "Every street-railway passenger car (closed) operated in Cambridge shall, while so operated, be properly ventilated; such cars shall be thoroughly aired at the end of each round trip; every such car shall be thoroughly cleansed at the end of each day's service and shall be disinfected once each week. These regulations shall be posted in a conspicuous place in every such car; and whoever violates any of the foregoing regulations, shall forfeit a sum not to exceed $100."

Cheney Brothers, silk manufacturers, are about to install 17 more electric motors in their South Manchester (Conn.) plant, making 25 motors in the plant, all operated from their recently erected power station on the Hockanum River.

Thomas C. Perkins of Hartford, Conn., is endeavoring to secure a legislative charter for the Eastern Connecticut Electric Power Company, which proposes to develop waterpower on the Quinnebaug River in Plainfield and Canterbury, Conn., and use it for the generation of electricity, to be sold to street-railway, electric-light and manufacturing companies in Windham, Tolland, New London and Middlesex Counties. The company does not intend to engage in the electric-lighting business. It expects to obtain from 1,800 to 2,200 horsepower.

The Scotland Electric Power Company is also asking the Connecticut Legislature for a charter, enabling it to develop a large water privilege on the Shetucket River in Scotland, Conn., and to supply electricity in that town, Franklin, Windham, Sprague and Lisbon.

The Malden (Mass.) Electric Company is to erect a building around its present quarters, thus securing 14,000 feet of floor space. It will also build a wharf at which its coal will be delivered. These improvements will cost $100,000.

The Albert and J. M. Anderson Manufacturing Company has applied for a charter under Maine laws. It was organized at Portland, Maine, with a capital of $200,000, $200 paid in, and it proposes to manufacture electric motors. Albert Anderson of Boston is president, and John M. Anderson of Boston is treasurer.

At a recent legislative committee hearing it was stated that it was proposed to consolidate the Amesbury and Hampton, the Haverhill and Plaistow, the Haverhill and Southern New Hampshire, the Lawrence and Methuen, and the Lowell and Pelham street-railway companies into the Northern Massachusetts Corporation, and that eventually the Exeter, Hampton and Amesbury Company would be added.

The Beverly (Mass.) aldermen have refused to grant a franchise to the Gloucester, Magnolia and Beverly Street Railway Company on the locations desired by the company.

The Hartford and Worcester Street Railway Company has been organized by the election of the following officers: President, Fred C. Hinds of Boston; vice-president, Thomas C. Perkins of Hartford, Conn.; treasurer, Charles H. Wilson of Boston; clerk, Charles L. Wilson. This is a Massachusetts corporation with a capital of $300,000. It will build an electric railway through Leicester, Charlton, Wales, Sturbridge, Brimfield and Holland, and will form a connection with a similar company incorporated in Connecticut.

The directors of the Bristol and Plainville Tramway Company have voted to build an electric railway between Bristol and Terryville, Conn., and expect to have cars running over it by July. B.

Canadian Intelligence.

Ottawa, Ont., April 3.—The British cable steamer Iris, built specially for work on the Pacific cable as a tender and repair ship, is on her way to Esquimalt, B. C., being expected there in June next, via Honolulu and Suva. At the latter point she will load 40 miles of cable, and this will be laid from Bamfield Creek up the Alberni Canal, so as to overcome the bad section of the land line, which had to be repaired frequently during the winter. This steamer will be kept permanently on repair work. Cable headquarters will still remain at Bamfield Creek, the extension up the canal being for the Canadian Pacific Railway Telegraph Company.

The Municipal Council of Fort William, Ont., has closed a contract with the Anglo-American Power Company of Chicago, to develop the waterpower on the river Kaministiquia. The agreement is that at least 5,000 horsepower is to be developed in 2½ years. The company is to supply the town with 1,000 horsepower to commence with, at $15 per horsepower. The town has the right to take addi-

tional power up to 10,000 horsepower, as it may require, and to sell the power in quantities of five horsepower or less. The sum of $100,000 is to be deposited in the Bank of Montreal by the company.

A petition from the City Council of Winnipeg, Man., has been presented to the Canadian Parliament, which declares that it is against the public interest to grant power concessions of Niagara Falls unless on terms which will make the grantees practically a corporation for public and not private purposes.

Within the next few months a plant will be established either in the city of Montreal or at Shawinigan Falls, Que., for the conversion of crude black copper into refined copper. This will be followed by the establishment of extensive works for the manufacture of the free copper into sheets and tubes. C. K. Milbourne, an English capitalist, has been locating a site for the plant, which he proposes erecting in Canada, for the refining of copper by electricity. This process is known as the copper-Coles electric process for the deposition of copper. The plant for the proposed works is now being constructed in Glasgow, Scotland, and will be ready in June next. Great results are expected to be reaped from this method of copper treatment, which is quite new. W.

Detroit, Mich.

Detroit, Mich., April 4.—The Indiana Railway Company (electric) has decided to build its line to Benton Harbor from South Bend, via Michigan City, instead of Niles, Buchanan and Berrien Springs. Work on the Niles extension will be deferred until the Michigan City-Benton Harbor route is built. The road from South Bend to Niles is all done but the laying of the rails. It is understood that this will be done after the other branch is completed.

Charles F. Medbury, district manager of the Westinghouse Electric and Manufacturing Company, has just sold $110,000 worth of power-house and railway equipment to the Detroit, Monroe and Toledo Short Line, including motors for a dozen cars, each equipped for 300 horsepower and capable of making 50 miles an hour. It is expected to begin regular service between Toledo and Detroit by July 1st.

Owing to the fact that the Dowagiac Creek, from which power is derived to operate the Niles electric-light and power plant, cannot be depended upon the year round, the Board of Public Works is negotiating with C. A. Chapin with a view to purchase power from his dam at Buchanan, which is now supplying power at South Bend.

Ecorse citizens are now clamoring for a village lighting plant like the one erected at Trenton. Highland Park, River Rouge and Ford, all suburbs of Detroit, have started a movement for electric lighting, and Ecorse people refuse to be left behind, so the agitation for street lights commands universal attention. Prominent citizens will procure estimates on cost of erecting a plant and will bring the matter before the Board of Trustees.

The Detroit and Toledo Construction Company expects to begin work on the Detroit, Monroe and Toledo electric line by April 15th. It is the intention of the new company to have cars running between Detroit and Toledo by next fall. Steel has been ordered and the only difficulty to be encountered in construction is the erection of bridges.

The Saginaw Southern electric road, which was projected about two years ago, to be built between Saginaw and Durand, will be built to Owosso instead of Durand. Saginaw capitalists, including Messrs. Linton and Emerick, have been in conference with Owosso people, and they say a Cleveland trust company stands ready to put a million dollars into a 40-mile road. The line will parallel the Michigan Central railroad.

The projected electric road which the Union Traction Company started last year, between Saginaw and Flint and failed to complete for want of funds, will probably be pushed through by Saginaw interests. C. G. W.

From the Buckeye State.

Cleveland, Ohio, April 4.—A company known as the People's Rapid Transit Company has been formed at Toledo with a capital of $500,000 to build a line from that city to Cincinnati. The promoters claim that the right-of-way has been obtained over two-thirds of the route between the two cities, and that everything, including the money, is in readiness to begin work. The road will extend on a straight line from Toledo to Defiance, and from there in the same way to Cincinnati, passing through Lucas, Fulton, Henry, Williams, Defiance, Van Wert, Mercer, Drake, Preble, Butler and Hamilton Counties. It is estimated that it will require about $4,000,000 to build the line, and it is claimed that eastern capital is backing the enterprise. The names which have been given out in connection with it are Adam Burger and George Bloodheart, Toledo; Thomas B. Franey, Perrysburg, and Albert Merkley, Tontogany.

It is said that a boat operated with a gas engine has been successfully tested on the Miami and Erie Canal, and that a line of them will be put in operation in competition with the electrically propelled boats of the Miami and Erie Canal Transportation Company.

The Youngstown and Sharon Railway and Light Company will build a line from Sharon to West Middlesex.

The Cincinnati, Milford and Eastern Traction Company has been granted a franchise over the Cincinnati and Wooster turnpike, which has been in contention for some time. Senator Roudebush and others are interested in this company.

The Dayton Heating and Power Company, Dayton, has been incorporated with a capital stock of $5,000 by Henry Zwick and others. The Union Traction Company, also of Dayton, has been incorporated with a capital stock of $5,000. W. F. Chamberlain, Ira Crawford and others are interested. The two seem to bear some relation to each other.

The Mt. Gilead Water, Light, Heat and Power Company, Mt. Gilead, has increased its capital stock from $60,000 to $70,000.

Judge McNeill of Cincinnati, in a case brought before him, has rendered a decision that a railroad operating between cities and villages and doing an interurban business, operating with power other than that furnished by animals, may condemn rights-of-way along public highways and through private property. It has been contended that unless a company is incorporated as an interurban railway company, it cannot condemn rights-of-way. As many of the interurban companies in this state have been incorporated as street or electric-railway companies, this view of the matter would prevent them from exercising such authority, but the decision of the court sets them aright.

The Citizens' Railway, Light and Power Company of Mansfield has transferred its property to the Mansfield Railway, Light and Power Company, and the new company has filed a mortgage in favor of Kleybolte & Co. of Cincinnati, to cover an issue of $1,000,000 in bonds. The Mansfield lines will be improved and the Shelby line will be extended to Plymouth.

The Columbus and Washington Railway Company of Columbus has been incorporated with a capital stock of $10,000 by Richard Emory and others. This is an Appleyard company and was formed to build a line from Columbus to Washington Court House, using the Grove City line as a portion of the road.

The Miami Light, Heat and Power Company of Piqua has been incorporated with a capital stock of $300,000 by S. B. Hartman, Hamer Bartey, John W. Brown and others.

The Toledo Urban and Interurban Railway Company, Toledo, has been granted a 25-year franchise by the village council of Maumee. The company must commence construction work within 15 days or forfeit a deposit of $5,000. Several other roads have been working for this franchise for some time, as it is considered the only opening for the outside lines into the city of Toledo. O. M. C.

Information from Indiana.

Indianapolis, April 6.—Intimations of a big interurban consolidation scheme continue to come from various parts of the state, and information from the eastern financial centers gives strength to these rumors. It is pretty generally understood that there is persistent activity toward consolidation of the eastern and northern Indiana lines, and that it is the Widener-Elkins syndicate back of the scheme. It is said the plan is to get control of every interurban system in Ohio, and that many Indiana interests will be taken in at the same time.

It is announced that the Indianapolis-Northern Traction Company's line to Logansport will be extended north by way of Royal Center, Winamac, North Judson, La Crosse, Valparaiso, Hobart and Hammond to Chicago, and south from Logansport by way of Kokomo, Tipton, Anderson, Newcastle, Richmond, Hamilton and Cincinnati. The several links of the southern route are either under operation or being constructed.

George F. McCulloch and James Murdock and others, who have bought the Fort Wayne street-railway system, made an inspection of the property last week and ordered a number of improvements. These men have secured an option on the Fort Wayne and Southwestern Traction Company's line from Fort Wayne to Wabash, by way of Huntington, and Lyman Law, general manager of the Wabash River Traction Company, operating 34 miles between Wabash and Logansport, announces that negotiations are on for the sale of the road to the McCulloch-Murdock people. The price asked is $850,000. There is little doubt that both of these lines will be acquired and a line built between Logansport and Lafayette, thus giving the syndicate a complete line between Fort Wayne and Lafayette, where the local systems are owned by the McCulloch-Murdock people.

New officers were elected last week by the directors of the Muncie, Hartford City and Fort Wayne Railway Company. S. M. Haxton, Cleveland, was made president, A. L. Johnson, Muncie, vice-president, and F. M. Osborne, Cleveland, secretary. This line will be completed to Montpelier in a few days.

President Henry of the Indianapolis, Rushville and Cincinnati company says it is now decided to construct the power house at Rushville, and that it is the present intention to equip the power house with a steam turbine. Mr. Henry says there are several things that recommend the new-style engine, viz., cost of machinery will be 25 per cent. less; cost of operation from 10 to 12 per cent. less. "Sargent & Lundy, my engineers, of Chicago, have assured me that the turbine engine is the engine of the future for this kind of work," said he. Mr. Henry's line has been surveyed and work will begin May 1st.

The following new interurban companies filed articles of incorporation with the secretary of state during the week: The Madison, Greensburg and Indianapolis Electric Railway Company (capital stock, $50,000), to build from Madison to Greensburg by way of Versailles and Osgood. The directors are Richard Johnson, Nicholas Horuff, M. D. Wilson, N. V. Cravens and David Johnson of Madison. The survey of this line is now being made.

The Western Electric Railway Company, to build a line from Logansport to Hammond, through Cass, White, Jasper, Newton and Lake Counties, with branches into Benton, Pulaski, Fulton, Starke, Marshall, Laporte and Porter Counties. The estimated length of the system is 150 miles. The capital stock is $150,000, and the incorporators are Newland I. Depau, New Albany; H. B. Smith, Hartford City; W. M. Elliott, Logansport; E. B. Sellers, Monticello; J. R. Johnson, Hartford City; H. D. Reasoner, Marion; A. T. Hert, Louisville, Ky., and W. A. Godman, Cincinnati.

The Frankfort and Logansport Traction Company (capital stock, $100,000), to build from Frankfort to Logansport, by way of Darwin, Middleford, Michigantown and Burlington. The principal offices will be in Frankfort. David A. Coulter, W. P. Sidwell, T. N. Lucas, J. E. Hillis of Frankfort, Denis Uhl of Logansport and O. V Darley, Kokomo, are directors.

The local electric-light plant of Muncie, belonging to C. M. Kimbrough and others, has been sold to Muncie capitalists, who will spend a large sum on improvements, extensions and new machinery.

Columbia City is boasting of satisfactory results from municipal electric lighting. The plant was purchased of a private company by the city at a time it was paying $80 per street lamp. The report for the municipal plant estimates the cost last year for the same lamp on an all-night schedule at $28. The plant is operated in connection with a municipal waterworks plant, and the same officials and employes look after both. The capacity of the lighting plant will be increased to accommodate the growing demand for light and power.

The Indiana Master Electrical Contractors' Association of Indiana was organized last week, with headquarters in Indianapolis. G. W. Sanburn is president, and W. A. Royse, secretary. F.

West Virginia and Kentucky.

Lexington, Ky., April 4.—The Louisville Lighting Company, Louisville, with a capital stock of $3,000,000, has been incorporated and will take over the properties of the Louisville Electric Light Company and the Citizens' Lighting Company. W. H. Edinger, Harry Bishop, George Gaulbert, J. B. Speed and Udolpho Snead are the Louisville directors, A. N. Brady and T. E. Murray of New York are also on the directorate.

The Ohio Valley Traction Company is having some trouble in securing a franchise to enter Louisville by the way of Maiden Lane. This is the company which proposes to build a line from Newport and Covington to Louisville.

Electric-railway companies seeking to operate in Newport are having a rather strenuous time. The City Council has finally decided to advertise the various streets upon which lines may be built, and the companies will be compelled to bid for their franchises. The trouble is with the interurban companies, which are seeking to enter the town.

The Hunter Water, Light, Heat and Power Company of Hinton, W. Va., has been incorporated with a capital stock of $120,000 by O. M. Lance and S. H. Hicks of Kingston, Pa; T. F. Lyman, H. G. Marcey and L. S. Marcey of Wilkesbarre, Pa. The plan is to supply water, light and heat to the towns of Hinton and Avis. C.

Northwestern Notations.

Minneapolis, Minn., April 4.—The Faribault (Minn.) Gas and Electric Company has filed articles of incorporation with a capital stock of $250,000.

The employes of the Railway and Light Company of Winona, Minn., have been granted an increase of wages, so that the older men in service receive 18 to 20 cents an hour, according to the length of connection with the company.

Lead, S. D., is to have a trolley service. The Burlington Railway will extend its electric line running from Deadwood to Lead into the city, and has awarded a contract for the construction. Ultimately the line will be continued to Terry, S. D., connecting the three principal mining towns of the Northern Black Hills. A storage battery is to be installed in Lead, to conserve the power when the cars are standing or are going down hill. The plant is located at Deadwood, and as the grade is heavy, the power is not equalized.

The Minnesota Legislature has passed a bill authorizing the development of electric power from the rapids of the St. Croix River, between St. Croix Falls, Wis., and Taylors Falls, Minn. The Wisconsin Legislature has already authorized the construction of a dam and the national congress has authorized it. A company was formed some months

ago to develop the power and transmit it to Minneapolis and St. Paul.

The village of Fairfax, Minn., is about to install an electric-light plant.

J. Y. Fiddler of Eagle Grove, Iowa, has bought the electric-light plant at Manson, Iowa.

Citizens of Sauk City, Wis., want an electric-light plant.

The electric-light and heating plant at Ackley, Iowa, has been sold to the Daly Land Company of St. Paul.

The council committee and the electrical commission of Duluth, Minn., have settled that the electric wires on Superior and Michigan Streets shall be removed within a year.

The Knox Construction Company has refused a franchise for a street-railway line through Kaukauna, Wis., as granted by the City Council, because of certain stipulations, and will buy a right-of-way into the city instead.

Guthrie Center, Iowa, will vote on a franchise for electric lighting.

A petition has been circulated at Grand Forks, N. D., asking the council to arrange for commercial lighting from a city plant. The city now does its own street lighting, and it is believed that by a slight addition to its plant, the commercial business could be covered.

Arrangements have been completed by the Watertown and Lake Kampeska Railway and Transportation Company to construct a street-railway line from Watertown, S. D., to Lake Kampeska.

The Central Electric Company of La Crosse, Wis., will increase its capital stock from $50,000 to $100,000 and will enlarge and extend the plant.

An electric interurban railway is projected from Iowa City, Iowa, to Washington, Iowa. Other lines are projected, radiating from Washington to Cedar Rapids.

W. P. Walsh has been granted a franchise for an electric-light plant at Reinbeck, Iowa. It is to be installed by July 1st.

Owing to the injunction proceedings, the City Council of Mankato, Minn., has returned all bids for the municipal light plant unopened.

An electric railway will be built from Devils Lake, N. D., to the Chautauqua grounds.

A company has been formed at Cannon Falls, Minn., for the development of waterpower above and below. There is a head of 77 feet within the corporate limits of the city. The minimum flowage approximates 300 cubic feet per second. The minimum power exceeds 2,000 horsepower, while the summer power will exceed 4,000 horsepower. Plans are being developed for an electric freight and passenger railway to utilize the power. Edward P. Burch of Minneapolis is the consulting engineer.

No electric railways have been constructed within the state of Minnesota for the last 3½ years. The outlook for 1903 is for the construction of 40 to 50 miles in the southern part of the state.

The village of Grand Rapids, Minn., has just put in service a modern electric-light plant. There are two Morrison internal-furnace, 160-pound boilers and two 125-horsepower, compound-condensing Ideal engines, direct-connected to 75-kilowatt, 2,200-volt alternators. The plant was accepted after a guaranteed test, which called for a steam consumption of engines with auxiliaries of 19 pounds of steam per indicated horsepower-hour. The consumption was less than that named in the guarantee.

The Helena Light and Power Company of Helena, Mont., will not rebuild its steam plant in Helena, but will construct a sub-station nearer the heart of the city, to receive power from the Missouri River Power Company.

The New Richmond (Wis.) Roller Mills Company has contracted for a waterpower plant, including a complete electric power-transmission plant. It consists of one horizontal Leffel wheel, direct-connected to a 450-kilowatt Westinghouse generator. The voltage is 6,600. Power will be transmitted to New Richmond, about five miles, to drive induction motors for rollers. The plant will be in full service August 1st. J. W. Rickey is the hydraulic engineer and Edward P. Burch of Minneapolis is the electrical engineer.

C. J. Grove of Plainview, Minn., seeks a franchise at Winona, Minn., to furnish electric light and power from a plant to be installed on the Zumbro River near Plainview. R.

On the Pacific Slope.

San Francisco, April 1.—The Mutual Electric Light Company of this city will erect a power house on the corner of Folsom and Spear Streets. The structure will be fireproof and two stories high, of brick. In it will be installed engines and dynamos, with an aggregate horsepower of 40,000. Boilers will be installed which will burn either oil or coal. The contract for the ironwork has been let to the Pennsylvania Iron Works, and the generators will be constructed by the Bullock Electric Manufacturing Company of Cincinnati. P. O. Cornwall and D. O. Mills are interested in the enterprise.

W. C. Anderson, a civil engineer, is now at Visalia, Cal., surveying the route for the proposed electric railroad, as contemplated by John H. Hammond and Harold Wheeler. The line will run from Visalia to Lemon Cove.

F. L. Sanders, a Seattle (Wash.) capitalist, has applied for a franchise for an interurban line from Ballard to Everett, Wash.

Three surveys, said to be made for the North Shore Railway Company, have been completed from a point between Manzanita and Millwood Stations to Bolinas, with the admitted intention of constructing an electric line connecting Bolinas with the main line of the North Shore Railway.

The City Council of Vernal, Utah, has granted a franchise to William Ochs and Mr. Benedict to install and operate a light plant and trolley system at that place.

The council at Seattle, Wash., has adopted an ordinance directing the Board of Public Works of that city to proceed with the work of constructing and installing a municipal electric-light plant.

Councilman Aubury says in regard to the new electric-lighting plant for Stockton, Cal., that a 20,000-light plant will be sufficient for the city at present; also that the seven electric-light corporations there will continue in existence and that there will be two lighting systems in the city. Professor C. L. Cory of the University of California has been engaged to draw up engineering plans for a plant for the city.

The Kendrick Milling Company of Kendrick, Idaho, is figuring on a proposition to put in an electric-light plant during the present year, to furnish light and motive power for the towns of Juliaetta, Leland and Kendrick.

Governor Pardee has signed the bill passed by the Legislature, which closed its session at Sacramento last week, appropriating $10,000 for installing new engines, boilers and dynamos at the Veterans' Home at Yountville, Cal.

The American District Telegraph Company has been incorporated at Fresno, Cal., with a capital stock of $300,000, and the following-named directors: H. G. Bennett, C. R. Johnson and others. The purpose of the company is to establish local district-telegraph and messenger systems.

In connection with the improvement of the Canadian Pacific Railroad mountain hotels in British Columbia, during the coming spring and summer, the company has recently decided upon and is now carrying into effect an elaborate plan for the substitution of electricity for acetylene-gas lighting at the important stations, including Vancouver, Glacier, Lake Louise, Emerald Lake, Banff and Field. The outlay of the company in installing this extensive electric-light system will be about $75,000.

A stockholders' meeting of the Power Transit and Light Company has been called for May 22d, in the Mills Building, San Francisco, for the purpose of considering the creation of a bonded indebtedness of $2,500,000. It has been intimated from other sources that the interests of this company and the Bay Cities Water Company are the same. It is believed that the bond issue will be used to buy up electric and other companies in the central coast districts.

An electric power and lighting plant is soon to be erected at Summerland, Cal., for the purpose of supplying the entire coast section from Carpinteria to Santa Barbara. In connection with the enterprise there will also be constructed an electric line between these places, and there is a possibility that a system of street railways for Santa Barbara will be included in the scheme. H. B. Slater represents the promoters, who, it is thought, are identified with the Huntington interests at Los Angeles, Cal. A.

Seattle, Wash., April 1.—A company is being formed at Spokane, Wash., for the purpose of building an electric railway from that city to Medical Lake, a distance of 18 miles.

A company composed of C. E. Fredericks, G. W. Petticord and associates, has asked the City Council of Palouse, Wash., for a 25-year franchise to build and operate an electric road in that city.

It is announced that the Great Northern Railway line from Fairhaven to Samish, Wash., which has been abandoned since the completion of the Chuckanut cut-off, will be rebuilt into an electric line. This branch includes a line into La Connor, Ferndale and to the Brick Bay country and Blaine.

John D. Ryan, representing the Marcus Daly estate, which purchased the electric-light and street-railway plants in Great Falls, Mont., has asked the City Council to grant the company a 25-year franchise. Mr. Ryan states that, if granted, the company will pay one per cent. of its gross earnings to the city treasurer during the life of the contract.

Articles of incorporation have been filed by the Smilkaneen Falls Power and Development Company. The object of this company is to sell waterpower. The capital stock is $1,200,000.

The City Council of Seattle, Wash., has granted Fred E. Sander a franchise to construct and maintain an electric railway through the northern part of the city.

The Spokane Light and Power Company of Spokane, Wash., will make application to the City Council for a 50-year franchise to erect, maintain and use wires for the conveying of electric power to Spokane, Wash.

It is reported that the citizens of Greenwood, B. C., will accept the Great Northern Electric Company's proposal and allow it an exclusive light and power franchise for 25 years.

The citizens of Marysville, Wash., have offered a bonus of $5,000 to any trolley company that will build a line between that city and Everett. P.

PERSONAL.

P. M. Lincoln of Pittsburg read a paper at a meeting of the Electric Club in Cleveland, Ohio, last week on "Difficulties of High-tension Transmission."

Arthur M. Waitt has resigned his position as superintendent of motive power of the New York Central and Hudson River Railroad. Mr. Waitt's resignation was for personal reasons.

E. P. Roberts, electrical engineer and contractor of Cleveland, Ohio, has decided to open an office in New York city, with W. C. Andrews, formerly associate editor of the Street Railway Journal, in charge.

Professor Elihu Thomson, the well-known electrical inventor, celebrated his fiftieth birthday at his home in Swampscott, Mass., during last week. During the last 30 years he has made over 600 inventions, mostly electrical.

Lyman T. Lawton, well known as an electrical inventor, died on April 2d, at Meriden, Conn., aged 55 years. He was formerly president of the Automatic Lighting Company and the Connecticut Telephone and Electric Company.

W. W. Card, vice-president of the Westinghouse Air Brake Company and president of the Pittsburg Screw Company, was run over and killed on April 4th by a trolley car. The accident occurred directly in front of Mr. Card's home in Wilkinsburg, Pa.

Dr. R. Mullineux Wamsley, principal of the Northampton Institute, London, England, is visiting the United States for the broad purpose of inspecting the electrical field, including the telegraph, telephone, etc., and measurably the country's industrial and educational interests.

Samuel Insull, president of the Chicago Edison Company, arrived in Chicago on Saturday last, after an absence of about 3½ months spent in rest and travel in England and on the Continent. Mr. Insull returned to his desk in excellent health and spirits, reinvigorated by his holiday for the multifarious duties which demand his attention.

J. B. d'Homergue, manager of the Keystone hair-insulator department of the H. W. Johns-Manville Company, sailed on March 30th for England, to make an exhaustive and comprehensive investigation of the trade for asbestos and sound-deadening materials in that country. Upon his return, in May, he will be permanently located in New York.

William J. McNamara, for 25 years auditor of the Western Union Telegraph Company, died on April 2d at his home, 446 West Twenty-fourth Street, New York city, after an operation for appendicitis. He was a member of the New York Telegraphers' Aid Society and was secretary of the Horatio Seymour Tammany Club of the Ninth Assembly District.

Before the Bay State Engineering Society, last week, A. B. Upham of Boston read a paper on "Good Roads and the Trackless Trolley," exhibiting a miniture trackless trolley line and a trolley road roller in illustration. The lecturer asserted that in the construction of macadamized roads a trackless trolley machine, operated by one man, would do the work of 30 or 40 men working in the usual manner, lessening the cost one-half.

Hugh L. Cooper, an expert engineer of Montreal, has gone to Mexico where he will take up his work as resident engineer of the Mexican Light and Power Company. Mr. Cooper had charge of the hydraulic works at Sao Paulo, and it is expected that the work on the installations of the Mexican company will be very much of the same nature as those at Sao Paulo. F. S. Pearson of New York, vice-president of the company, accompanied Mr. Cooper.

George R. Mockridge, superintendent of the Western Union cable station at Penzance, England, died on March 25th of influenza. Mr. Mockridge entered the telegraph business in 1869 and was for a number of years in the employ of the Direct United States Cable Company at Nova Scotia, Rye Beach, N. H., and Boston, Mass. In 1881 he accepted the superintendency of the station at Penzance of the American Telegraph and Cable Company, now the Western Union Telegraph Company, where he had since remained.

Nathan T. Brenner, manager of the American Insulated Wire and Cable Company of Chicago and a member of the Chicago City Council, representing the Ninth Ward, was held up and robbed of $300 one day last week. Mr. Brenner drove away from his home with the intention of doing a little active campaigning. He was accompanied by a gentleman prominent in telephone circles, and when they had gone a short distance Mr. Brenner alighted at a place where he thought a number of votes might be secured. The other gentleman was left to hold the horse, but he was soon relieved of his duty by three men who escaped with the horse and buggy after having first relieved the alderman of $300. The horse and buggy were recovered, but the campaign fund is $300 short.

ELECTRIC LIGHTING.

Lafollette, Tenn., is about to grant a franchise for the erection of an electric-light plant.

The Cheyenne (Wyo.) Electric Light Company will extend its wires to Fort Russell.

An electric-light and waterworks plant will be installed at Galveston, Ind., this spring.

Plans are being prepared for a new electric-light plant to be erected at Harrodsburg, Ky.

The citizens of Spring Grove, Minn., have voted to issue $5,500 bonds for the erection of an electric-light plant.

An ordinance for the erection of a municipal electric-light plant has been passed by the City Council of Newport, Ohio.

A new electric-light plant will be erected at Marion, Ind., by the Citizens' Electric Light Company, recently incorporated with a capital of $100,000. R. J. Spencer, John Kelley, Harry M. Miller and others are interested.

The Burlington Electric Light and Power Company was incorporated recently with capital stock of $50,000. The company will construct a plant at Burlington, Wis. The incorporators are Leonard J. Smith, Clarence E. Partee and Mary D. Smith.

The Rockford (Ill.) Edison Company will make a number of improvements this spring, the cost of which will amount to $75,000 or $80,000. An addition will be built on the power house and four new boilers and a large generator will be installed. The company expects to furnish power for the Rockford and Freeport electric line when completed.

The Economist Lighting Company was granted a charter at Norfolk, Va., on March 30th, to carry on a business in the United States of manufacturing and supplying light, heat and power by means of electricity. The capital is to be from $1,000,000 to $20,000,000. The directors are Samuel B. Lawrence, Alfred T. Davisson, Henry C. Everdell and John B. Summerfield of New York, and James W. Wilcox of Norfolk.

The Quincy Gas and Elecric Company of Quincy, Ill., which has for four years been owned by a syndicate of capitalists of Augusta, Maine, has been sold to a New York syndicate, represented by the J. T. Lynn Company. This syndicate controls plants in Port Huron and Alpena, Mich.; Sheboygan, Wis.; Joplin, Mo.; Goshen, Ind.; Fremont, Marion, Belleview, Bowling Green, and Portsmouth, Ohio; Rome, N. Y., and Williamsport, Pa. The gas and electric plants are capitalized at $6,000,000, with a bond issue of an equal sum.

A strike threatened by the Stationary Firemen's Union at the Chicago Edison Company's plants, which was to have gone into effect on April 2d, was declared off after a conference between the officials of the company and the union. The men were receiving 25 to 28 cents an hour and demanded 34 cents. An agreement was reached whereby the firemen are to receive 32½ cents an hour, water tenders the same, and the oilers will be raised from 20 and 22 cents an hour to 25 and 28 cents. Under the terms of the agreement reached there will be three eight-hour shifts and the company will not discriminate against the union men. There are 170 firemen employed in the five generating stations of the company.

ELECTRIC RAILWAYS.

The state Legislature of North Dakota recently appropriated $20,000 for the construction of a trolley line by the state from Bismarck, the capital, to the Northern Pacific station.

Two cars soon to be placed on the lines of the Consolidated Railway and Power Company, at Salt Lake City, are the largest in the West. They measure 38 feet long, and have a capacity of 100 passengers.

There is talk of building an interurban trolley line from Mullins to Dillon, S. C., and thence to Bennettsville, on to Cheran, to tap the Seaboard Air Line Railway. It is said the road will likely be built by local capital.

The Mendota Gazette says that Dixon, Ill., is in a peculiar position. The citizens are said to be anxious to have an electric railway, but the city officials have discovered that under the charter the city has no power to grant a franchise.

The citizens of Waukegan, Ill., on April 4th, celebrated the opening of the new West Side electric railway, the Waukegan, Fox Lake and Western. The City Council, county officials and railway officials made the initial trip over the road.

The decision of the Superior Court of Boston, Mass., that the owners of abutting property on the line of the elevated-railway system of that city are entitled to recover damages for noise from the operation of the trains, has been sustained by the full bench of the Massachusetts Supreme Court.

The Illinois Railway and Light Company, with an authorized capital of $3,000,000, was recently incorporated at Trenton, N. J. The company is to construct and operate street railways and to furnish light. The incorporators are Louis B. Dailey, Joseph M. Mitchell, H. O. Coughlin, Warren N. Akers and B. B. Lewis, all of Jersey City.

The Schenectady Railway Company, Schenectady, N. Y., is about to extend its lines to Amsterdam and other places in the vicinity. For this purpose the company has authorized an issue of $7,000,000 worth of additional bonds. President Parsons denies the story of the absorption by the company of the lines of the Union Traction Company of Troy and Albany.

At the adjourned annual meeting of the stockholders of the Lake Street Elevated Railroad, held in Chicago on April 2d, but little business was transacted, owing to the fact that an insufficient amount of securities had been deposited to warrant the presentation of a reorganization plan. The traffic of the road showed an increase for March, as compared with March of a year ago, the daily average for this year being 43,762, an increase of 2,812 over last year.

Traffic continues to increase on the elevated railways of Chicago. March of 1902 was considered a record breaker for traffic, but the figures for March of the present year show a decided increase on the Metropolitan, South Side and Northwestern lines. The daily average of passengers carried during March, 1903, on the Metropolitan was 116,716, as against 105,512 for 1902. This shows an increase of 11,204, or 10.62 per cent. The South Side line carried 87,989 passengers, an increase of 7,676, or 9½ per cent., and the Northwestern increased from 65,362 to 70,070, 7.20 per cent. The total number carried over the latter line during March was 2,172,179.

POWER TRANSMISSION.

A fire, caused by a short-circuit, is said to have recently damaged the big electric plant of the Bay Counties Power Company of Colgate, on the Yuba River, a short distance from Nevada City, Nev.

The Buffalo Hump Power Company of Grangerville, Idaho, which has just incorporated, will take power into that great region. The benefits to be derived from electricity by the mines of that district are large.

The Electric and Power Manufacturing Company has been formally organized at Spartanburg, S. C., with W. E. Burnett president and treasurer. The capital stock is $100,000, with privilege of increasing to $3,000,000.

SOCIETIES AND SCHOOLS.

On April 15th W. W. Curtis will give a paper before the Western Society of Engineers in Chicago entitled "Some Notes on Timber Treatment and of a Recent Plant."

If he is successful in breaking his father's will, Isaac H. Stratton, son of the late millionaire, W. S. Stratton, says he will build a polytechnic school at Colorado Springs, Colo., to cost from $500,000 to $1,000,000.

A recent bulletin of the Lowell Textile School, Lowell, Mass., contains information of interest to prospective students of the school. Besides the textile courses, mechanical and electrical engineering are taught.

The Municipal Engineers of the City of New York is a new society comprising civil, mechanical and electrical engineers, architects and chemists employed by the New York city government, which was formed last week in the clubhouse of the American Society of Mechanical Engineers in West Thirty-first Street. About 300 men responded to the call of O. F. Nichols, the chairman of the meeting. Twice this number are expected to be enrolled.

TELEGRAPH.

In the future the telegraph lines of the St. Louis and Gulf railway will be operated by the Western Union Telegraph Company.

The Western Union Telegraph Company is to have a new office at Denison, Texas. Everything will be strictly up-to-date, and one of the finest switchboards ever installed in the Southwest will be put in.

The Postal Telegraph Company has decided to place its wires underground in the business portion of Kansas City, Mo. The conduits of the Kansas City Electric Wire Subway Company will contain the cables, which will be about six miles long and contain over 100 miles of wire.

In the Appellate Court at Indianapolis, Ind., on March 31st, the Postal Telegraph-cable Company won a victory over the Chicago, Indianapolis and Louisville Railway Company, whereby the Postal company has the right to set its poles on the railway company's right-of-way from Hammond to Monticello. The decision reverses Judge Gillett, who is now a member of the Supreme Court.

It is claimed that the Delany high-speed telegraph system, recently perfected, is capable of transmitting 100 to 8,000 words a minute over a single wire—the speed depending on the distance and the electrical properties of the line; that is, on the electrostatic capacity, resistance and inductance of the circuit. Eight thousand words a minute can be recorded over a line of 50 miles, while 100 words would be about the limit over a No. 8 copper wire between New York and San Francisco.

The heavy snowstorm the latter part of last week was responsible for considerable annoyance and delay to the telegraph companies and long-distance telephone lines. All the lines experienced the usual trouble subsequent to so heavy a fall of snow. At Hammond, Ind., and Blue Island, Ill., the violence of the storm was greater than in other localities, owing to a heavy windstorm which passed through that section. Here both the Western Union and Postal Telegraph Companies were crippled to considerable extent. The added weight of heavy clinging snow made it impossible for the poles to withstand the strong wind and many of them were blown down. The officials of the companies, however, consider that they were very fortunate in the small amount of damage done, as in the spring of the year when the ground is soft the poles are easily blown down, the ground, even though the poles are set five feet deep, frequently being too soft to support them.

PUBLICATIONS.

The flexibility of Flexduct, manufactured by the Osborn Flexible Conduit Company, New York city, is well illustrated in a recent mailing folder.

The Emerson Electric Manufacturing Company of St. Louis calls attention on a mailing card to a new type of four-blade ceiling-fan motor which it is putting on the market.

"To Make a Short Story Long" and incidentally to tell about its business in manufacturing incandescent lamps, the Columbia Incandescent Lamp Company of St. Louis, Mo., is distributing a small odd-shaped folder.

The Sprague Electric Company of New York city has issued a booklet descriptive of its Lundell 1903 fans of different types and also another booklet which contains a list of some of the installations of motors and generators made by the company in Chicago during the last four years.

The Elmore-Fowler-Jacobs Company, Fisher Building, Chicago, is distributing a blotter to its friends, which has pictures of one of its camps in Northern Wisconsin and a sample car of poles. The blotter also calls attention to the company's Wisconsin, Michigan and Idaho stock of cedar poles for telephone, telegraph, electric-light and trolley construction.

A very handy and useful wire table is sent out to its friends and customers by the Fiber Conduit Company of Orangeburg, N. Y., manufacturer of electrical conduit. The table is printed clearly on one side of a sheet of celluloid, 2⅜ by 3⅞ inches in size, and gives diameters, safe carrying capacities, weights and resistances of different wire. On the other side is a table of sizes, weights, etc., of the company's conduits.

Among recent publications issued by the Fort Wayne Electric Works, are bulletins descriptive and illustrative of their motor-starting rheostats with double release and combined switch and circuit-breaker, small direct-current generators and direct-current belted motors; flyers treating of fan motors and the B. & B. commutator-truing device, and an interesting treatise on "Perfection in Transformer Insulation—How It Is Attained."

A catalogue descriptive of the Silvey storage battery has been issued by its manufacturer, the Dayton Manufacturing Company of Dayton, Ohio. Illustrations are given of the portable and car-lighting type of cell and of the central-station type, together with views of the plates and other parts of the batteries. Several battery boosters are also illustrated and the descriptive matter of the battery and its construction and application is full.

SPACE TELEGRAPHY.

It is stated that as a result of the recent experiments in Chicago, the De Forest Wireless Telegraph Company has closed an agreement to connect the plants of Armour & Co. in Chicago, Kansas City, St. Louis and Fort Worth, Texas, by space telegraphy.

A young Swedish electrical engineer is the inventor of an interesting apparatus for the transmission and reception of signals and speech through the ground without the use of wires. Demonstrations of the apparatus have recently been given in London at which the practicability of dispensing with wires and masts and using currents of electricity for commercial, military and naval purposes was illustrated.

The German army is said to be experimenting with a new system of space telegraphy which directs the waves exclusively to one point. The result is obtained through a series of parabolic mirrors, which give all the electric waves a parallel course. The system is available for distances of 12 to 15 miles and is intended principally for communication between vessels in harbor or along the coasts. The transmitting velocity is 25 words per

minute and the inventor is Ernst Ruhmer, well-known for his experiments with a wireless-telephone system.

MISCELLANEOUS.

The contract for the interlocking-switch plant for the St. Louis Union Station has been awarded to the Union Switch and Signal Company of Swissvale, Pa. The plant will be located near the Eighteenth Street bridge, and it will be an electro-pneumatic operating interlocking plant, with three towers for the operators. There will be from 350 to 400 levers, and it will be, it is said, the largest in the world.

Fifteen hundred yards of wire and 49 batteries were recovered by the police of New Albany, Ind., one day recently. The outfit was the property of wire tappers, who worked the pool rooms at French Lick and West Baden Springs, Ind., securing $8,000. The wire was tapped at a point two miles north of New Albany, and a fine copper wire run down the pole and along the ground through the woods to a vacant house a quarter of a mile away, thence under the house and through the floors to the second story, where the instruments were located.

TRADE NEWS.

The city of Water Valley, Miss., wants two new dynamos for lighting the city.

The Benjamin Electric Manufacturing Company of Chicago has increased its capital from $2,400 to $25,000.

The Gainesville Gas Company of Gainesville, Fla., wants complete equipment for an electric-light plant, including engines, boilers, poles, wire, etc.

Estimates on generators for 30 arc lights and 500 incandescent lights are wanted by the Richards Machine Company, 64 South Forsyth Street, Atlanta, Ga.

The Pennsylvania Equipment Company was awarded the contract for installing electric-lighting plants at the Upper and Lower Roxborough filter plants, Philadelphia.

Pierre F. Cook has been appointed receiver for the George A. Williams Company, general electrical contractor of Jersey City, N. J. The concern's assets amount to $27,000, while the liabilities are placed at $54,000.

The electrical and mechanical-engineering business of the late A. M. Patitz has been acquired by the Newton Engineering Company, Hathaway Building, Milwaukee, Wis., which has extended its business of structural and civil engineering to include hydraulic and electric power plants and waterworks.

Sealed proposals will be received by the clerk of the Board of Public Works of the city of Columbus, Ohio, until April 24, 1903, for furnishing poles, wires and pole-line sundries for the municipal electric-light plant, according to plans and specifications on file in the office of the superintendent of light. Proposals should be addressed to John A. Connor, clerk of the Board of Public Works, Columbus, Ohio.

On account of its constantly increasing business the Crandall Packing Company has found it necessary to lease more commodious apartments at 123 Liberty Street, New York city, where its offices and salesroom will be located. S. M. Hildreth, local manager, will be very glad to welcome the company's numerous customers at the new location and explain the various packings, which should be interesting to all users of steam goods.

The new officers of the Stanley Electric Manufacturing Company of Pittsfield, Mass., elected at the recent meeting of the board of directors are as follows: President, W. Murray Crane, Pittsfield, Mass.; first vice-president, Dr. F. A. C Perrine, Pittsfield, Mass.; second vice-president, M. D. Barr, New York, N. Y.; third vice-president, S. N. Hammill, New York, N. Y.; treasurer, W. W. Gamwell, Pittsfield, Mass.; assistant treasurer, R. S. Murray, Pittsfield, Mass.; secretary, W. S. Westover, New York, N. Y.; assistant secretary, A. G. Davis, New York, N. Y.

The Buffalo Forge Company of Buffalo, N. Y., the well-known manufacturer of heating and ventilating machinery and engines, announces the establishment of a new branch office in Detroit, at 1409 Majestic Building. For some time the trade of the company in the Michigan district has been growing so rapidly that the need of an office centrally located has been strongly in evidence. Ample space has been provided for future growth and the offices are being equipped with every modern facility. As heretofore, the Michigan district business will be in charge of H. M. Brightman.

President Ralph L. Shainwald of the Standard Paint Company of New York was last week a guest in Chicago of Manager J. C. Shainwald of the company's western branch office. Mr. Shainwald was given a theater party on Saturday evening by Western Manager Shainwald and returned the first of the week to New York. The Standard Paint Company's western business has been steadily on the increase for the last year, and there is no doubt but that a liberal share of the country's present general prosperity has been acquired by the Standard Paint Company. Western Manager J. C. Shainwald has never been more active than during the last year, and the increase in results is highly flattering to his handling of the company's large western business.

George E. Fisher of Detroit, Mich., formerly president of the Chase Construction Company of that city, has completed arrangements with an eastern syndicate to finance electric-railway, lighting and gas properties, which he will undertake to organize, construct and operate. Mr. Fisher has secured the contract for the entire municipal lighting plant for the city of Grand Rapids. He is also president of the Pontiac (Mich.) Standard Lighting Company. It is understood that Mr. Fisher's relations with the syndicate being formed by James T. Lynn of New York are very close, and it is probably through their office that the gas properties will be handled. This syndicate now controls gas and lighting plants in 26 cities.

The John F. Kelly Engineering Company has recently been incorporated to do a consulting and contracting engineering business, with headquarters in the Singer Building, 149 Broadway, New York city. The three gentlemen who compose the company have been prominently identified for years with the Stanley Electric Manufacturing Company. John F. Kelly, who is president and consulting engineer of the new company, is well known in every branch of the electrical field. He will remain as consulting engineer of the Stanley Instrument Company. W. L. Fairchild, vice-president and secretary, and T. W. Kloman, treasurer and manager of the new company, were, respectively, sales engineer and New York manager of the Stanley company. The new concern begins business with considerable transmission work in the West and in Mexico.

BUSINESS.

The Western Electrical Supply Company of St. Louis announces that it is anxious to distribute as many copies of its large new general supply catalogue, No. 50, among electrical people as possible. The catalogue may be obtained upon application to the company.

At a recent meeting of the Board of Education of Chicago a contract was awarded to Frank C. Stover for 200 fire-alarm boxes, to be placed in the city schools. The contract price was $9,000 and the work will include the furnishing of the boxes with the necessary wiring and making connections with the city fire-alarm office. Mr. Stover represents the Gamewell Fire Alarm Telegraph Company of New York.

The Standard Tie Company of Detroit, Mich., reports an exceptionally fine trade in its pole and tie business, having closed contracts for over $800,000 worth of its product since January 1, 1903. This company asserts that an inspector for the American Telephone and Telegraph Company, upon looking over the company's pole stock at Au Train, Mich., said that it consisted of the finest poles he ever inspected and that they were in the best shape for inspecting.

A large contract for the underground-conduit work in and around the L Street central station of the Edison Electric Illuminating Company of Boston, Mass., has been awarded to G. M. Gest, the conduit contractor of Cincinnati and 277 Broadway, New York city. This construction will be very heavy, having 186 ducts in one trench. Mr. Gest has also just been awarded additional contracts by the Brooklyn Heights Railroad Company for underground-conduit work along Flatbush Avenue, Brooklyn. This will be a large piece of work and will amount to many thousands of dollars.

The Engineering Agency, Monadnock Block, Chicago, says it received applications in one day last week for 67 high-grade technical men, one company asking for 25 blast-furnace draftsmen at $125 to $150 a month, and another company for 30 structural draftsmen at $125 a month. The agency has vacancies on its books for over 200 competent men, including instructors in shop work for technical colleges, teacher for manual-training school, assistant editor for technical journal, chemists, engineers of all kinds, shop superintendents, draftsmen, etc. It has special facilities for placing good technical men in positions for which they are best fitted, and in that section of the country where they prefer to work. Over 5,000 men have been so placed by it during the last 10 years. The officers of the agency are: President, F. A. Peckham, for 12 years with the Engineering News; treasurer, A. B. Gilbert, for 11 years with the Engineering News; secretary, A. G. Frost.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) March 31, 1903.

723,804. Storage Battery. James M. Allen, St. Louis, Mo., assignor to the Solar Furnace and Power Company, Los Angeles, Cal. Application filed July 21, 1902.

The battery has a series of rectangular imperforate or uncut plates, each provided with one open end and with an integral connecting lug, connecting bars for mechanically securing and electrically connecting the plates together, connecting posts formed integral with the bars, and a series of U-shaped hard-rubber insulators adapted to fit over the edges of the plates.

723,817. Electric-current Controller. Lynde Bradley, Milwaukee, Wis., assignor of one-half to Stanton Allen, Milwaukee, Wis. Application filed November 11, 1901. Renewed September 8, 1902.

In the controller are combined an electrical circuit, a resistance medium, means for bringing the resistance medium into and out of the circuit, and means for exerting a pressure on the resistance medium.

723,836. Induction Apparatus. Percy F. Cowing, New York, N. Y. Application filed October 24, 1902.

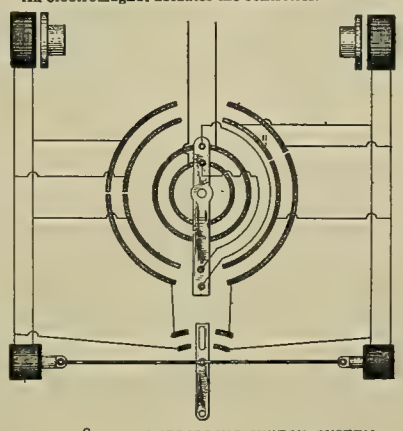
Combined with a support are a primary coil mounted on one side thereof, a standard provided with a secondary coil and a translating device in circuit with the secondary coil and supported on the other side of the support, the construction being such that the primary and secondary coils may be placed in angular inductive relation to each other.

723,840. Controlling-switch System. Adolph L. De Leeuw, Hamilton, Ohio, assignor to the Niles Tool Works Company, Hamilton, Ohio. Application filed October 13, 1902.

In the system are an electromagnet, an energizing circuit therefor, a switch controlling the circuit through the electromagnet and serving in its movement from position of closure to reverse the direction of circuit momentarily and then open the circuit, and means for automatically actuating the switch. (See cut.)

723,842. Electric Controller for Pumps. Charles F. Dew, Minneapolis, Minn. Application filed May 6, 1902.

An electromagnet actuates the controller.



NO. 723,840.—CONTROLLING-SWITCH SYSTEM.

723,845. Alarm and Annunciator. Roscoe J. Dodd, Cottage Place, Va. Application filed April 16, 1902.

The apparatus comprises a boxing, a bell mounted therein having its inner concaved surface formed as a reflector, an incandescent lamp supported by the bell, and a stencil plate closing the opening in the concave portion of the bell, and electrical means for sounding the bell and lighting the lamp to disclose a visible signal upon the stencil plate.

723,866. Electric Switch. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed July 19, 1902.

In a plug cut-out are a face plate having an opening therein, a plug adapted to pass through the opening, a shutter for the opening, the surface of the shutter being normally substantially flush with the surface of the plate, and means to operate the shutter in advance of the plug.

723,892. Tile or Conduit for Electric Conductors. Robert W. Lyle, Perth Amboy, N. J. Application filed July 1, 1902.

The conduit comprises a hollow tile having intersecting webs which divide the tile into separate cells, the intersecting portions of the webs at an end of the tile being removed to provide a mortise with side openings, which latter communicate with the cells.

723,928. Electro-endosmotic Process of Extracting Sugar. Botho Schwerin, Berlin, Germany. Application filed November 15, 1901.

The process consists in placing the saccharine material to be treated in a disintegrated and wet state between a layer of finely divided carbon supported by a negative electrode pervious to liquid and a body of water surrounding the positive electrode, driving the electrolytically nondissociable liquid bodies present toward the negative electrode by passing a current through the layer of water, material and layer of carbon by means of the electrodes, supplying the water driven into the material from the water surrounding the positive electrode, collecting the liquor percolating through the layer of carbon and its supporting negative electrode, and separating therefrom sugar.

723,943. Reflector for Showcases. Maurice Taussig, Chicago, Ill., and Philip A. Conne, New York, N. Y. Application filed July 1, 1902.

A reflector for incandescent lamps is described.

723,989. Pole Shoe for Dynamo-electric Machines. Alexander Churchward, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 23, 1901.

Combined with a slotted pole-piece is a pole-shoe made in two U-shaped parts each of which partially encircles the pole-piece and terminates at the slot.

724,[illegible]. Process of Making Electric Accumulator Plates. Joseph J. H. Hunte, Charlton, England, assignor to the Accumulator Industries, Limited, Woking, England. Application filed April 15, 1902.

The process for manufacturing positive pole plates for electric accumulators is described.

724,021. Automobile Vehicle. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 25, 1900.

There are provided independent driving wheels for the two sides of the vehicle, independent motors for operating the wheels, each motor having a series field winding which is connected to the other through a bridging connection, and a series-multiple controller operatively connected to the windings of the motors.

724,060. Transforming System. Noah Thomas, Jr., London, Ohio. Application filed November 25, 1901.

The system comprises two operatively disposed induction coils, a source of electricity to which the primaries of the coils are connected mutually in multiple and individually in series, the secondaries being connected through independent transmitting circuits to a common working circuit, and a vibrator connected in the primary circuit and adapted alternately to make and break the circuits through the primaries of the coils.

724,069. Electric Furnace. Robert Winter, Berlin, Germany. Application filed August 7, 1901.

One claim reads: In an electric furnace the combination with the outer walls of rods of fireproof and insulating material, covering the inner faces of the walls, the rods being so arranged as to leave small spaces or grooves between them, grooves in opposite walls of the casing of the furnace to receive freely the ends of the rods, passages in the rods heating wires resting freely in the passages and means for securing the outer ends of the wires to the furnace.

724,071. Electric Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Application filed January 18, 1902.

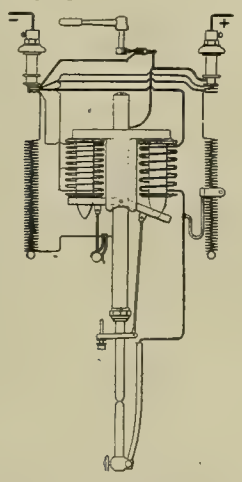
In the lamp are combined a horizontally disposed frame pivotally supported between its ends, a coarse-wire electromagnet fixed to one end of the frame, a fine-wire electromagnet secured to the other end of the frame, stationary armatures co-operating with the poles of the magnets and clutch operating devices connected with the frame.

724,072. Alternating-current Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Application filed March 12, 1902.

The lamp has a pivoted lever, a clutch, an electromagnet having a fixed core mounted on one end of the lever and included in a shunt-circuit, a fixed armature for the magnet, a weight on the other end of the lever, and a mechanical connection between the shunt magnet and the clutch.

724,073. Alternating-current Regulator. Thomas E. Adams, Cleveland, Ohio. Application filed March 26, 1902.

The regulator comprises a depending fixed core, a coil adapted to move upwardly on the core and mechanical means co-operating with the electromagnetic pull of the regulator to raise the coil, the mechanical means being adapted to vary in power inversely to the magnetic pull.



NO. 724,229.—ARC LAMP.

724,079. Method of Producing Electric Insulating Bodies. Hans Biehn, Budapest, Austria-Hungary, assignor to the Pyrisolith Isolating Material Manufacturing Company, Limited, Budapest, Austria-Hungary. Application filed April 29, 1902.

A method for producing electric insulating bodies of pulverized brittle insulating material and a fusible bituminous substance is described.

724,089. Means for Operating Motors in Dust-laden Atmospheres. Thomas A. Edison, Llewellyn Park, N. J. Application filed January 9, 1903.

See page 286.

724,093. Combined Telephone Signal, Burglar and Fire Alarm. Benjamin O. Fox, Milwaukee, Wis. Application filed February 14, 1902.

See page 286.

724,099. Trolley Wheel. Jacob Hengen, North Amherst, Ohio, assignor of one-half to Adolph Baker, North Amherst, Ohio. Application filed June 30, 1902.

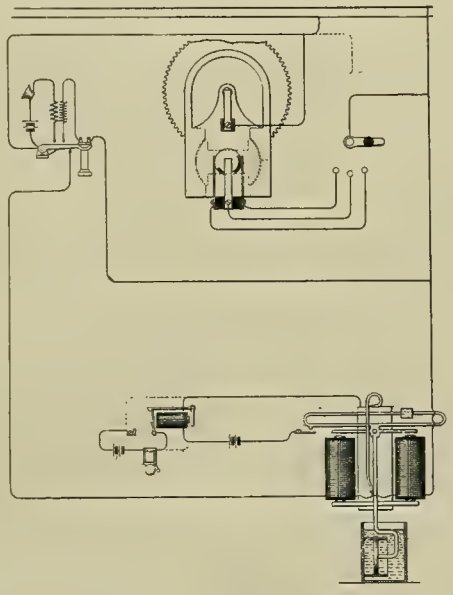
An improved trolley wheel is described.

724,102. Electric Flasher and Circuit Therefor. Henry C. Horstmann, Chicago, Ill. Application filed March 28, 1902.

A mechanical flasher has a number of electrical circuits automatically and independently operated, and so connected with the flasher and with each other as to permit a current to pass through all the circuits when contact is broken in the flasher.

724,144. Attachment for Electric Generators. Elmer A. Terpening, Geneseo, Ill. Application filed January 10, 1903.

A supporting frame separable from and adapted for connection to an electric generator is combined with a movable commutator mounted in the frame, and a driving instrumentality associated with the commutator and adapted for operative connection with a moving part of the generator to move the commutator synchronously with the inductor or armature of the generator.



NO. 724,219.—TELEPHONE-CALL SYSTEM.

724,169. Signal Lamp for Railway Cars. Frederick W. Dressel, New York, N. Y., assignor to the Dressel Railway Lamp Works. Application filed September 9, 1902.

A railway signal lamp adapted for use on the roofs of cars contains a stationary support for an incandescent or other lamp or light secured to the roof of the car.

724,186. Electrical Apparatus for Therapeutical Work. Howard Jackson, Newton, Mass. Application filed January 22, 1903.

The apparatus comprises in series a source of alternating current, a step-up transformer and a condenser for producing a high-tension, high-frequency current, and an arc lamp operated thereby for producing ultraviolet rays.

724,191. Cell for Electrolytic Bleaching Plant. Leonard E. Lander, Warren, N. H. Application filed September 22, 1902.

In the cell are a tank constituting a cathode, a skeleton framework of iron supported on the bottom of the tank, an asbestos lining for the interior of the framework, the lining forming a porous receptacle to receive the liquid solution to be decomposed, and also acting as a means to protect the framework from the effects of the liberated gas, a cover fitting the lining with a gas-tight joint, and an anode suspended from the cover.

724,215. Photochemical and Electrotherapeutical Apparatus. Albert E. Sterne, Indianapolis, Ind. Application filed October 23, 1901.

The apparatus has a compartment adapted to contain the head of the patient, an electrical circuit terminating within the compartment in fine brushes arranged to form an electric arc, and whereby the electrical current is diffused at the point of discharge, and a suitable vessel interposed between the brushes and adapted to contain a remedial agent, whereby the properties of such remedial agent are commingled with the ozone produced by the electrical discharge, and medicated gas thus formed adapted to be administered by inhalation.

724,219. Telephone-call System. Elmer A. Terpening, Geneseo, Ill., assignor of one-third to Newhall Atwood, Geneseo, Ill. Application filed March 12, 1902.

The system comprising a line, mechanism for producing currents of different character upon the line, open-circuit alarms, local sources of electricty for energizing the same, polarized magnetic members, armatures for the same, yokes mounted upon the armatures, contacts connected with the yokes and the alarms, weights mounted upon the yokes and movable at will for engaging and disengaging the contacts, and automatic mechanism for rendering the armatures sluggish in action. (See cut.)

724,228. Electric Circuit-breaker. James J. Wood, Fort Wayne, Ind. Application filed May 8, 1901.

The circuit-breaker comprises a main and a shunt circuit, means accelerated by gravity and connected with a terminal of the shunt circuit for first moving a terminal of the main circuit to break the main circuit, and then suddenly moving a terminal of the shunt circuit to break the shunt circuit, and a spring arranged to assist the initial movement of the means.

724,229. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind. Application filed April 23, 1902.

The lamp has its feed-controlling magnetic element proportioned to feed at the normal voltage when heated to the minimum temperature of normal use, and to compensate for the effect of higher temperatures by a balance between the diminishing excitation as the coils heat and the increasing magnetic attraction as the movable member of the magnet is attracted to the feeding position. (See cut.)

724,274. Signaling Apparatus. Howard A. Fessenden, Detroit, Mich., assignor to the Detroit Electric Signal Company, Detroit, Mich. Application filed November 19, 1900.

In the apparatus are a signal circuit including a signal adapted to operate progressively, a resetting circuit for the signal, magnetic operating means in the resetting circuit, adapted by a single impulse to reset the signal, a switch for each circuit, an operating device for the switches and connections between the operating device, and switches compelling when the operating device is released after operation thereof the actuation of the resetting circuit switch prior to the operating of the switch for the signal circuit.

724,287. Manufacture of Electrodes. Jean J. Heilmann, Paris, France, assignor to Marc Louis de la Bonniniére, Comte de Beaumont, and Jonathan Holder. Application filed September 6, 1900.

The machine has a cylinder through which a core is adapted to pass, means for advancing the core through the cylinder, means for coating active material upon the core, and means for shearing off electrodes thus formed into predetermined lengths.

724,307. Controlling Mechanism. Arthur P. S. Macquisten, Glasgow, Scotland. Application filed July 28, 1902.

An electromagnet enters into the operation of the mechanism.

724,329. Insulator. Robert H. Polk, Birmingham, Ala. Application filed June 17, 1902.

The knob comprises a suitable body portion, and a segmental cleat extending therefrom, having its outer edge extending approximately for one-quarter of a circle and arranged in a plane at right angles to that of the body portion, the cleat tapering to the body portion and extending beyond the same.

724,336. Telephone Attachment for Telegraph Lines. Edgar Russel, United States Army. Application filed October 26, 1901.

The telephonic apparatus comprises a condenser, an inductance coil, a transmitter, a receiver, and two local circuits, one inclosing the inductance coil and the transmitter, and the other inclosing the same inductance coil and also a calling device.

724,339. Lightning Arrester. Harry M. Shaw, Newark, N. J. Application filed September 20, 1901.

Metallic ribbons having oppositely disposed serrated ends are combined with a composite body, made up of a series of plates of non-arcing material insulated from one another and separated by a non-conductor. The composite body is insulated from its support and positioned between the serrated ends of the metallic ribbons. (See cut.)

724,351. Insulated Strain. Louis Steinberger, Brooklyn, N. Y. Application filed August 25, 1902.

The device comprises a pair of links provided with threaded sockets and insulated from each other, a mass of insulating material enveloping portions of the links and forming a handle, and threaded eyebolts engaging the sockets.

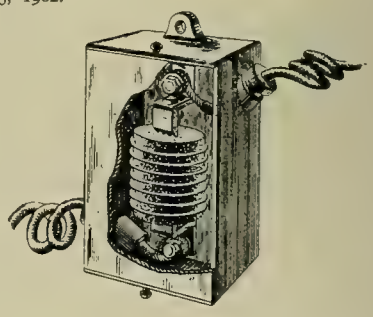
724,366. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind. Application filed March 19, 1902.

One claim reads: A differential magnet and armature, the latter pivoted to rock as the relative strength of the magnet poles varies, the magnet poles and armature relatively shaped to distribute the magnetic flux symmetrically so that the armature is attracted in line with the poles and without imparting end thrust thereto, and the armature acted on by a force opposing and substantially equal to the normal attraction of the magnet, so that under normal excitation the armature floats in substantial equilibrium, whereby pressure against its pivotal surfaces is mainly avoided and a high degree of sensitiveness is attained.

724,367. Electrical Traction Towage. Stephen W. Wood, New York, N. Y. Application filed June 25, 1902.

For this and three succeeding patents see page 285.

724,368. Electrical Towage on Canals. Stephen W. Wood, New York, N. Y. Application filed June 25, 1902.



NO. 724,339.—LIGHTNING ARRESTER.

724,369. Electrical Towage Traction Way. Stephen W. Wood, New York, N. Y. Application filed July 12, 1902.

724,370. Electrical Traction Way for Canal Towage. Stephen W. Wood, New York, N. Y. Application filed July 12, 1902.

724,387. Method of Producing Storage-battery Plates. William Gardiner, Chicago, Ill., assignor to Henry T. Clarke, Jr., trustee. Application filed December 13, 1900.

The process of producing storage-battery plates consists in passing an electric current from the plates, as positive electrodes, through an electrolyte containing in solution an acid which is a good solvent of lead, an acid which is a poor solvent of lead, and an organic acid; then reducing the resulting oxidized lead plates by passing an electric current to the plates through a solution containing a sulphate and a tartrate; and finally passing an electric current from the plates through a solution containing a soluble sulphur compound having a lower degree of oxidation than sulphuric acid.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, APRIL 18, 1903 No. 16

Construction Work at St. Louis Exposition.

The construction work on the World's Fair buildings, St. Louis, has been progressing with great rapidity during the last week. Several thousand men are employed, and it is now certain that three of the largest exhibit buildings, the Education Building, Electricity Building and Varied Industries Building, will be completed this month in time for the dedication ceremonies, which will be held on April 30th. In addition to these, Machinery Hall and the Liberal Arts Building will be so far completed that but a few weeks' work will be required to make them ready for the installation of exhibits.

Of the accompanying photographs, Fig. 1 shows very clearly the scheme of wiring which prevails on the Education Building, and which will be followed in all the buildings bordering on the Grand Basin. The picture (Fig. 1) was taken on the roof of this building, and it shows the manner in which the lamps will be disposed about the architectural ornaments; also the method of wiring the sockets.

Just outside the railing here shown and extending around the entire cornice line of the building will be another row of lamps, spaced 15 inches apart, while lines of lamps, as is shown in the picture, are now being installed on the numerous flagpoles. The box-like pedestal in the background is to be crowned with an historic group of statuary.

Still further in the background appear the towers and domes of the Varied Industries Building, while to the extreme right is the framework of the Manufactures Building, now well under way. There will be, in all, over 20,000 incandescent lamps in the Education Building.

FIG. 1. CONSTRUCTION WORK AT ST. LOUIS EXPOSITION. WIRING ON ROOF OF EDUCATION BUILDING.

The Liberal Arts Building, in which over 20,000 people will be seated for the dedication ceremonies, is now completely under roof, and the painting and laying of floor is going on with great rapidity.

In the Electricity Building the roof trusses are painted by hand, the painters standing on light steel framework, constructed after the manner of windmill towers, the tops of which are equipped with platforms. In the Liberal Arts Building, however, the contractor has used a painting machine, which is shown in Fig. 2 (page 302). This consists of a paint mixer, a barrel reservoir for the paint and a force pump driven by a five-horsepower induction motor. The paint is applied in a fine spray, and large areas can be rapidly covered in this manner. It is probable that the use of this machine will be extended as the construction work advances, as every week witnesses the introduction of one or more labor-saving devices, many of which have proved of great value to the contractors.

The temporary power plant is almost completed, and the exposition will be able to develop its own power on the grounds 12 months before the opening day. The Durr marine boiler, the first foreign exhibit to arrive at the grounds, is now being installed in the temporary boiler house and will be used to furnish steam during dedication week.

Nearly every electric line running to the exposition grounds has been provided with increased terminal facilities, and the officials of the companies are firm in their belief that they can handle any crowd on dedication day. Interest in the exposition has increased considerably within the last month, and it is expected that the dedication will bring to St. Louis a great throng. F.

The Future of the Gas Engine.

Discussing "The Economy of Small Gas Engines" before the recent meeting of the Canadian Society of Civil Engineers, Homer M. Jaquays of Montreal said: "In small units, at any rate, the internal-combustion engine can, as far as cost is concerned, successfully compete with the steam engine; while the employment of gas and oil engines for driving electric-lighting and pumping machinery, for automobiles and marine work has long passed the experimental stage. Perhaps under no conditions does the gas engine promise more than in connection with, and when run by the gas from, blast furnaces. So great has been its success already in this relation that one enthusiast has ventured to prophesy that 'the day is not far distant when iron will be a by-product of the blast furnace, and furnaces will be primarily gas producers, while steam engines will have to be sought for in museums.' It is probable that even the most ardent supporters of the internal-combustion engine do not look for this state of affairs in the immediate future. But when we realize that smelting one ton of iron supplies gas equal to 9,000,000 British thermal units, and that the gas is more than 3½ times as efficient when used in the gas engine as when used in steam-boiler furnaces, and when, moreover, we bear in mind the successes of the past decade, we cannot but expect from these engines much more in the near future than has been or is at present being accomplished."

Improvements on the Chicago and Milwaukee Electric Railway.

Considerable interest has always attached to the Chicago and Milwaukee electric railway, as it was one of the pioneers in the use of high-tension transmission from a central power house to sub-stations and direct-current distribution to the feeder lines. The road operates between Evanston and Waukegan, a distance of 26½ miles along the shore of Lake Michigan, north of Chicago. It was put into operation in the fall of 1899, and the traffic has increased to such an extent that elaborate plans are now being put into effect to increase the service and also the efficiency of operation. These changes include additions to the equipment of the power house at Highwood and the sub-stations at Winnetka and North Chicago, by which the car schedule will be raised from a 20-minute to a 10-minute service. A branch line from Lake Bluff west, a distance of six miles to Libertyville, has also been built.

The changes in the power house have already been made, two large generators being substituted for two smaller ones, so the equipment now comprises a 250 and a 550-kilowatt alternating-current generator and a 225 and a 300-kilowatt direct-current generator. All four generators are connected by means of the Arnold system to a 1,000 and a 600-horsepower tandem-compound engine. Usually the 300-kilowatt direct and the 550-kilowatt alternating-current generators are run from the 1,000-horsepower engine, the other machines being cut in when necessary. The alternators generate at 5,500 volts, at which pressure the current is transmitted to the two sub-stations. The old three-phase transmission line consists of No. 4 wires and a new line of No. 0 wire will now be carried to each sub-station, the two lines to be operated separately or in multiple. The direct-current feeders to the line will consist of No. 0000 and 300,000-circular-mil cables, with a 500,000-circular-mil cable between Winnetka and Evanston. Eventually the transmission current will be raised to 11,000 volts. The Libertyville branch, which will be opened this summer, will operate on an hourly schedule, and will be fed from the Highwood power house.

At Winnetka there are now two 125-kilowatt three-phase rotary converters. A new 500-kilowatt, six-phase rotary will be installed this summer and the arrangement of switchboard and connections completely changed. The high-tension current will come in through oil switches, and after being stepped down in the transformers will pass directly to the alternating-current sides of the rotaries without passing through the switchboard. In this way no

high voltages will be carried on the switchboard. The storage battery will be changed from glass to lead-covered tanks, and the 288 cells will have a capacity of 320 amperes on a one-hour discharge. The old plates will be taken out and will be used to complete the batteries at Highwood and North Chicago, increasing the capacity of each of them to 280 ampere-hours. At Winnetka a 30-kilowatt differential booster will be installed to operate in connection with the battery.

Similar changes will be made at the North Chicago sub-station, a new 300-kilowatt three-phase rotary being added to the 125-kilowatt machine now installed. A 25-kilowatt differential booster will also be placed there and one of the same capacity at Highwood. Wattmeters will be placed in the substations and at Highwood to check the current, so that the costs of operation may be definitely determined. New motor cars will be added and each of the present cars will be equipped with four 50-horsepower motors instead of two, as formerly. Other improvements are also contemplated. The changes in the electrical equipment are being planned by W. A. Blanck of the Arnold Electric Power Station Company, under the direction of A. C. Frost, vice-president of the Chicago and Milwaukee Electric Railroad Company.

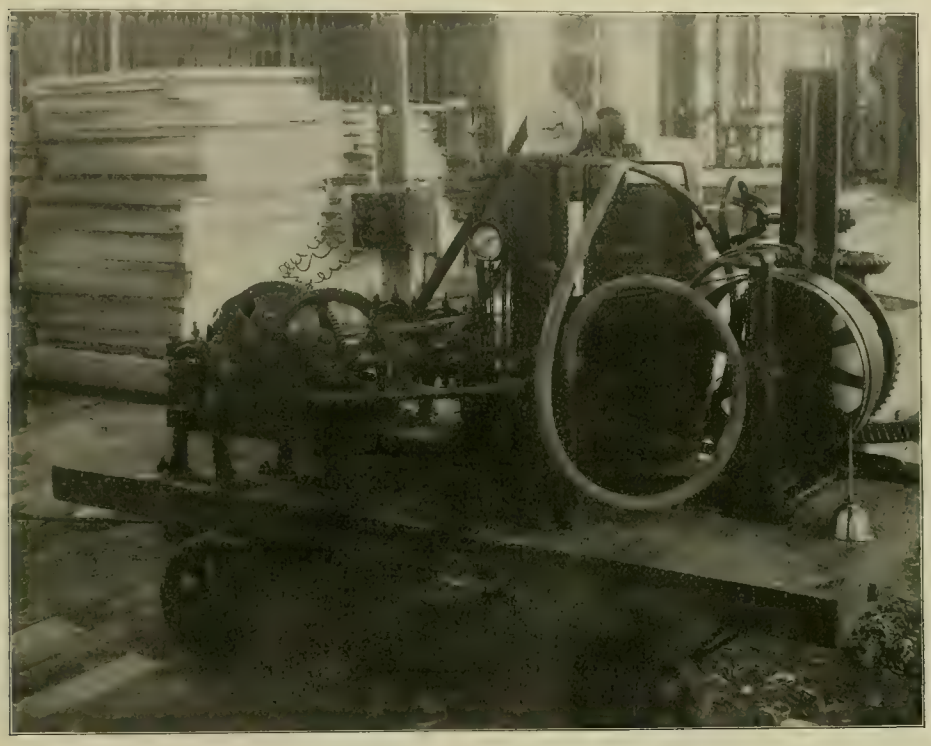


FIG. 2. ELECTRICALLY DRIVEN PAINTING MACHINE AT ST. LOUIS EXPOSITION. (PAGE 301.)

Mr. Insull Places Bonds in London.

One object of the recent visit of Mr. Samuel Insull to London was the sale of $1,500,000 worth of first-mortgage five per cent. bonds of the Commonwealth Electric Company. As is well known, the Commonwealth company is building a large central-station plant, on Fisk Street, in Chicago, fronting on the South Branch of the Chicago River. This plant will have an ultimate capacity of 100,000 horsepower, with an initial installation of 20,000 horsepower. It will represent the very latest equipment in steam-raising apparatus, prime movers and alternating-current generators, and when completed will be a great credit not only to the company but to the electrical industry of the country. Of the amount of bonds covered by the contract of sale executed by Mr. Insull in London $500,000 are for immediate delivery, while the remaining $1,000,000 will be delivered to the purchasers in the future as the company requires the money for its new work. It is evident that in securing this money in London the company has anticipated its capital requirements, for funds for present needs were in hand before Mr. Insull sailed for England. The ease with which Mr. Insull placed this loan shows not only the confidence which English investors exhibit in American electrical securities of the highest class, but also gives another assurance of President Insull's skill as a financier.

North Adams, Mich., is to have electric lights. The proposition to bond the village for that purpose was voted on and carried at the last election.

New Western Members of the Institute.

At the last regular monthly meeting of the directors of the American Institute of Electrical Engineers no less than 200 new names were added to the list of associate members. Space does not permit the giving of the names of all these new members, but the following named were admitted from that part of the United States west of Pennsylvania, West Virginia and Virginia and south of the last-named state and from foreign countries:

Akron, O.—Alfred P. Lohmann, B. F. Goodrich Company; J. H. Vance, B. F. Goodrich Company.

Anchorage, Ky.—Percival Moore, Louisville and Eastern Railroad.

Charleston, S. C.—Wallace W. Fuller, Consolidated Railway, Gas and Electric Company.

Chicago.—John Porter, Porter & Berg; James G. Pomeroy, Adams-Bagnall Electric Company; John E. Snow, Armour Institute of Technology; Clarence E. Freeman, Armour Institute of Technology; Irving Parker, Pierce, Richardson & Neiler; Francis P. Johnson, Western Electric Company; Arthur E. Barker, Kellogg Switchboard and Supply Company; Albert D. Gilmore, Chicago Edison Company; Paul G. Chance, D. H. Burnham & Co.

Cincinnati, Ohio.—Arthur J. Brown, Bullock Electric Manufacturing Company; Harry C. Brown, Bullock Electric Manufacturing Company; Frederick C. Colwell, General Incandescent Arc Light Company; Will F. Bouche, Bullock Electric Manufacturing Company; William Leist, Jantz and Leist Electric Company; Thomas J. Mullen, Bullock Electric Manufacturing Company; Albert E. Payne, Creaghead Engineering Company; Henry J. Pfiester, Cincinnati Gas and Electric Company.

Clarksville, Tenn.—William M. Case, Queen City Electric Light and Power Company.

Cleveland, Ohio.—Arthur C. Eastwood, Wellman-Seaver-Morgan Engineering Company; Peter Yensen, Cleveland Telephone Company; J. Roberts Wilson, Crocker-Wheeler Company.

Columbus, Ohio.—Marmaduke C. Hull, Columbus Edison Company; Mark Simonton, Electric Supply and Construction Company.

Covington, Ky.—Charles P. Wood, The Triumph Electric Co.

Denver, Colo.—John F. Dostal, Denver Gas and Electric Company; Walter F. Brown, Colorado Telephone Company; Irvin Butterworth, Denver Gas and Electric Company; Oliver P. Fritchle, Boston and Colorado Smelting Company; James J. Flint, Flint-Lomax Electric and Manufacturing Company; Robert B. Bonney, Colorado Telephone Company; Frederick C. Barr, Colorado Telephone Company; Samuel R. Beatty, Western Union Telegraph Company; Newton L. Hall, Colorado Telephone Company; Clifford W. Humphrey, Denver Gas and Electric Company; John E. Jenkins, Western Union Telegraph Company; Arthur O. Gates, Mine and Smelter Supply Company; George E. McCarn, Colorado Telephone Company; John W. Minor, Jr., Insurance Inspection Bureau; Daniel H. Rich, Denver Gas and Electric Company; Harry A. Rhodes, Colorado Telephone Company, Thomas S. Richardson, Denver Gas and Electric Company; Will H. Simpson, Western Union Telegraph Company; Bayard K. Sweeney, New York Insulated Wire Company; Charles B. Wickham, Denver Tramway Company; Herman R. Weber, Denver Gas and Electric Company; Franklin P. Wood, Sands & Wood; Theron H. Tracey, Mining and Smelter Supply Company; Henry L. Wolfenden, Gilbert Wilkes & Co.; Albert H. Seep, Mining and Smelter Company.

Golden, Colo.—William J. Hazard, Colorado School of Mines.

Grand Rapids, Mich.—George S. Johnson, Grand Rapids Railway Company.

Madras, India.—T. S. Sarangapani, Karantat-tamkutz, Tanjore.

Marion, Ind.—Harry F. Reynolds, Marion Light and Heating Company.

Milan, Italy.—George Finzi, Brioschi, Finzi & Company.

Milwaukee, Wis.—David Hall, Milwaukee Electric Company.

New Orleans, La.—David M. Munro, Underwriters' Agency.

Peoria, Ill.—Frederick L. Bishop, Bradley Institute.

Portland, Ore.—Orin B. Coldwell, Portland General Electric Company.

Seattle, Wash.—Walter G. Clark, Kilbourne & Clark Company; Arthur L. Havens, Kilbourne & Clark Company.

Simla, British India.—George F. Osborne, Army Headquarters.

Spokane, Wash.—Milan R. Bump, Washington Water Power Company.

St. Louis, Mo.—Arthur H. Timmerman, Wagner Electric Manufacturing Company; Louis B. Pendleton, Universal Exposition.

Victoria, B. C.—Egerton W. Hall, British Columbia Electric Railway Company.

Yokohama, Japan.—John R. Geary, General Electric Company.

The Lodge-Muirhead Wireless-Telegraph System.[1]

By H. C. Marillier.

After a considerable interval of silence, during which the inventors have been engaged in perfecting details, the system of wireless telegraphy on which Sir. Oliver Lodge and Dr. Alexander Muirhead have been engaged in collaboration for some years past, has seen light. It has been exhibited publicly in its now complete form to a number of telegraph experts and to representatives of the press, both at a small experimental range of 8½ miles, which, however, owing to the insulating nature of Kentish chalk formation is equivalent to five times that distance over sea, and also on the two new cable ships of the Eastern Extension Telegraph Company while they were lying off Gravesend prior to their departure for the East. Before this, it is stated, the system had undergone extensive tests under sea-going conditions, between a temporary station near Holyhead and one of the Johnston line of steamers starting from Liverpool for America, as well as over the official range of 62 miles between Portsmouth and Portland, in both cases with satisfactory results; so that the inventors now feel justified in offering it for commercial purposes as a practical working system, and a real advance upon any of the systems hitherto put forward, not as regards distance, which has not been specially aimed at, but as regards clearness and accuracy of signaling. This claim is well borne out by the script taken under ordinary working conditions from a siphon recorder coupled directly to a new pattern of coherer without any relay and without any tapping-back apparatus—a simplification which in itself constitutes a marked and definite improvement.

The fundamental patents on which the Lodge-Muirhead system depends were taken out for the most part in 1897, and provide for the following essentials:

(1.) The combination, in the transmitting and receiving circuits, of two capacity areas and an inductance coil, as a vital element in a syntonic system of wireless telegraphy. The capacity areas may be regarded as the two coats of a Leyden jar spread out in space, one of them being suspended in the air and the other near the earth—in fact, the earth itself if desired. Between them is situated the spark-gap, and between the spark-gap and the lower capacity area is the inductance coil as well as a condenser, both being adjustable (Fig. 1). The purpose of these is to prolong the electrical oscillations, and by means of their adjustment to tune the radiator to any desired frequency or pitch, and thus render syntony in the receiver possible. Sir Oliver Lodge's main idea in regard to transmission has always been to obtain a succession of the waves of definite frequency, the cumulative influence of which will produce a perceptible effect on a suitably tuned receiver, no matter how feeble the waves may be, after the well-known principle of sympathetic resonance. This action is illustrated electrically in Sir Oliver Lodge's old experiment of the syntonic Leyden jars, in which the closed circuit of one jar responds to the other, so that the jar overflows or gives other signs of having become charged whenever discharge occurs in the second through its own distinct, similarly tuned circuit.

The adjustability of the inductance and condenser renders it further possible to tune the two circuits in such a way that they shall be protected against certain kinds of specified outside interference; but for very close tuning of this kind more elaborate devices are necessary, which will not be entered into in the present article.

(2) The second point claimed by the inventors is the use of a transformer, or ironless induction coil (see tp, ts, Fig. 2). This device is probably essential in all long-distance wireless telegraphy, and should disputes arise at any future time as to the claims of individual inventors, it is a feature which might conceivably be fought over. Its purpose may be described briefly as tending to magnify the electromotive force, and putting the coherer into a second circuit, instead of in direct series with the vertical collecting wire and the lower capacity, or earth plate. The passage in which this transformer claim occurs is as follows, and may be found in Sir Oliver Lodge's patent, No. 11,575 of 1897.

> In some cases I may . . . . surround the syntonizing coil of the resonator with another or secondary coil (constituting a sort of transformer) and make this latter coil part of the coherer circuit, so that it shall be secondarily affected by the alternating currents excited in the conductor of the resonator, and thus the coherer be stimulated by the currents in this secondary coil, rather than primarily by the currents in the syntonizing coil itself; the idea being thus to leave the resonator freer to vibrate electrically without disturbance from attached wires.

The illustration which accompanies this description in the specification definitely indicates the

1. From the London Electrician.

transforming-up and magnification of the electromotive force.

(3) The use of a condenser shunt (x_2 in Fig. 2) in the coherer circuit such as will enable that circuit to have a definite time period, as described in the Lodge-Muirhead patent, No. 18,644 of 1897. The addition of the condenser as a shunt eliminates the battery and receiving instrument so far as oscillations are concerned, and is regarded by the inventors as a feature of great importance. This, as well as the transformer, has been adopted in principle by other workers, and a common modification of it is to divide the secondary of the transformer in two parts and place the condenser between them. In the Lodge-Muirhead patent, No. 29,069 of 1897, the condenser is shown placed between the lower or earth capacity and the syntonizing inductance coil described in (1). In practice, when a transformer is used, it has been found best to have two condensers, the one described, and another in the secondary transformer circuit. (See Fig. 2.)

The last-mentioned patent also provides for en-

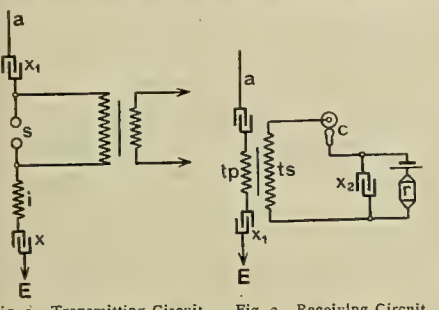


Fig. 1. Transmitting Circuit. Fig. 2. Receiving Circuit.
LODGE-MUIRHEAD WIRELESS SYSTEM.

closing the coherer in a completely closed metal case, a precaution which in the practical development of the system is supplemented by a device which automatically short-circuits the coherer whenever the connections are switched from the receiving on to the sending apparatus.

Beside these more or less essential features of the system, Sir Oliver Lodge and Dr. Muirhead have introduced a number of detailed changes into the apparatus which tend to simplify or to improve the working. The most important of these is the new coherer. Up to a short time ago the inventors thought that they had reached the desired point of perfection in a filings-tube coherer fitted with two needle points in place of the usual plugs or knobs, the tube being tapped by a constantly working clockwork tapper as shown by Sir Oliver Lodge in 1894. There are certain disadvantages, however, attendant upon all coherers in which metal filings are employed. They require a special and carefully adjusted apparatus for tapping back, and many of them are capricious in working and liable to fatigue. The new coherer introduced by Lodge and Muirhead requires no tapper, but is kept perpetually sensitive by the rotation of a small steel disk just separated from a column of mercury by a film of mineral oil. The impulse of electric oscillations breaks down the oil film and establishes momentary cohesion between the steel disk and the mercury. The construction of the coherer is shown in Fig. 3, in which (a) is the rotating steel wheel and (b) the mercury in its trough (d), with an amalgamated spiral of platinum wire (c), connecting it to the terminal or binding screw (h). (e) is a copper brush making connection with the steel disk (a), through its axle (j). (f) is a spring carrying a small cushion of felt (k), which rests lightly on the steel disk for the purpose of keeping its edge clean and free from dust before and after contact with the mercury. (g) are ebonite wheels which gear the steel disk to the clockwork movement actuating the siphon recorder, to the side of which the metal case containing the coherer is fixed.

The coherer, as already mentioned, is placed directly in circuit with a siphon recorder, without the

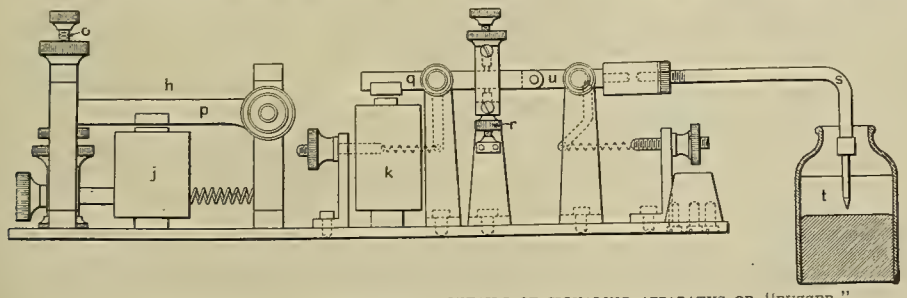


FIG. 4. LODGE-MUIRHEAD WIRELESS SYSTEM.—DETAILS OF SIGNALING APPARATUS OR "BUZZER."

interposition of any relay, and is connected also with a potentiometer for the purpose of regulating the potential difference at its terminals from 0.03 to 0.5 volt, according to circumstances. The coherer is so sensitive, when the wheel is rotating with moderate speed, that the application of a whole volt is sufficient to break down the film of oil and establish coherence. Hence only a fraction of a battery must be used, with the rest of the circuit of appropriate low resistance; and it can readily be understood how the slightest electrical surging, producing any electrostatic effect whatever, is sufficient instantly to break down the film, start the connection, and give the required signal. It is difficult to suppose that any recording instrument operating electrostatically can be more sensitive and more trustworthy than this simple device.

The transmitting circuit in an ordinary open system consists essentially of an elevated capacity, preferably a large globe or a roof, although in general practice a wire cage arrangement, offering as little resistance as possible to the wind, may be used. From this capacity hangs the vertical wire, which is brought into the operating room and connected to one knob of the spark-gap. The inductance coil and condenser are connected in series with the other knob, and a lead is then taken outside again to the earth plate or to a second capacity lying on the ground. The system also includes a Ruhmkorff coil for giving the sparks, and a battery of five cells, more or less, which is replaced for long-distance work by an alternator. Various open and closed methods of making the connections are possible.

The signaling apparatus consists either of a specialized Morse key, worked by hand, or, what is a distinctive feature of Dr. Muirhead's improvements, an automatic signaling machine used in conjunction with a perforator of special pattern. In either case the local signaling circuit, as arranged by Dr. Muirhead, contains a transmitter designed to open and close at a definite rate the primary of the induction coil. This instrument, which is shown graphically in Fig. 4, is made up of two telegraphic sounders cross-connected in such a way as to act reciprocally. An aluminium arm fitted with a copper rod dipping into mercury is attached to the armature of the second sounder, and the rapid make and break between the copper rod and the mercury (about 600 times per minute) serves to fix the frequency of the sparks. The apparatus is known as a "buzzer," and its function is, during the holding down of the Morse key, to cut up the long-continued contact into a rapid succession of sparks, without any attention on the part of the operator (save in so far as he may first adjust the armatures of the sounders, or the length of dip in the mercury, to suit conditions), so that all he has to do is to signal shorts and longs in the usual telegraphic manner. These are translated by the "buzzer" into the requisite mode of disturbance for spark-signaling, and are translated back by the recorder into signals of long and short duration on the tape. If the rapidity of the sparks is insufficiently great, the signal becomes a broken or wavy line, and not a steady deflection; but if the rapidity be increased, the waviness disappears, and the recorder needle is simply held over, giving a steady long deflection to represent a dash, and a momentary one to represent a dot.

This steadiness of deflection, though pleasing to the eye, is not actually essential to the reader, who, with a little practice, can decipher the signals equally well when the sparks are so slow that three separate impulses or deflections represent a dash and one a dot. It may be observed, however, that the new coherer, in combination with a recorder, follows every fluctuation and peculiarity of the received waves, and indicates any inequality and uncertainty which may occur in the sparking transmitter. This method of reception is far preferable to one which acts only through the intervention of a contact-making relay, and is convenient for studying the changes which are brought along by every variation in the mode of signaling. If the signals are coming with irregular amplitudes, the legibility can

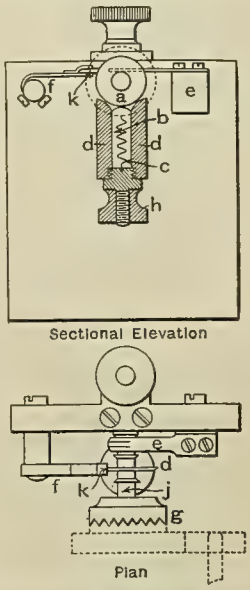


FIG. 3. LODGE-MUIRHEAD WIRELESS SYSTEM.—DETAILS OF COHERER.

be improved by limiting the excursion of the siphon recorder by the insertion of a stop, against which it shall strike, and be held over by a definite amount at each signal. The general arrangement of instruments in a Lodge-Muirhead station is shown in Fig. 5, in which (A) represents a 12-volt box of secondary cells, (B) a complete receiving set, (C)

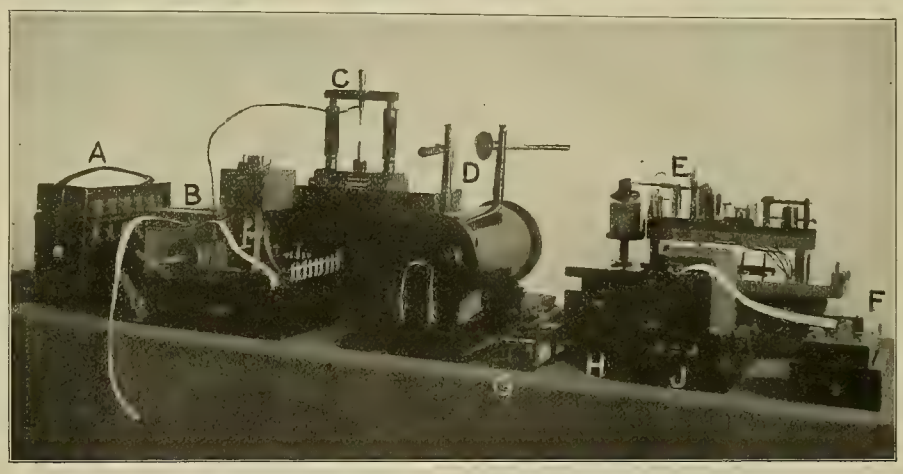


FIG. 5. LODGE-MUIRHEAD WIRELESS SYSTEM.—GENERAL ARRANGEMENT OF APPARATUS.

spark-rod frame, (D) 10-inch spark coil, (E) buzzer, (F) perforator, (G) hand sending key, (H) primary switch and (J) auto-transmitter.

The direct application of ordinary telegraphic signaling apparatus, both at the sending and receiving ends, is one of the most valuable features of the Lodge-Muirhead system, and is chiefly due to Dr. Muirhead, who, indeed, foresaw its possibility as early as 1894, when Sir Oliver Lodge first demonstrated his early experiments before the Royal Institution.

Marconi and His Transatlantic Messages.

London dispatches make out that Marconi is displeased because the British postoffice department still refuses him facilities for sending messages to his space-telegraph station at Poldhu for transmission across the Atlantic. It is stated that the London Times daily "marconigraph" service, which was inaugurated a few days ago, has been intermittent, and this is pointed to as justification of the postoffice department in refusing facilities to the public to offer dispatches which probably could not be transmitted. Being asked concerning the future developments of his system Marconi is quoted as saying: "I only forecast what I know to be certainties. I cannot commit myself to predictions which, if not fulfilled, would excite malicious criticism. My system has a future before it that will shame those who are now skeptical."

Power Transmission on High-tension Lines.

Part III.

Burning of Wooden Pins on High-tension Transmission Lines.

By C. C. Chesney.

Almost the uniform practice in this country in high-tension pole-line construction has been the use of wooden pins. The reason for their use has been the belief that because they were made of wood they strengthened the entire insulation of the pole-line system, and were in consequence additional safeguards. These pins have generally been made of locust, oak or eucalyptus, and in order that the insulation might not deteriorate from the action of the weather, they have usually been treated carefully with hot asphaltum, paraffine or linseed oil. The temperature and character of the treating liquid have depended more or less upon the whim of the constructing or designing engineer. Although there has been no uniform method followed and although the materials used in the treatment have differed greatly, the results have been universally the same. Wood pins when used with glass or well-vitrified porcelain insulators, have given very good service on potentials as high as 25,000 or 30,000 volts. There have been no unusual pin troubles at these voltages which could not readily be explained by porous or cracked insulators or by some peculiar climatic conditions. In my opinion, the success secured in the operation of the great majority of these lines is due to good insulation of the insulator, and the insulation of the pin has in reality contributed very little to that success. For 40,000 volts and for higher potentials, the insulators offered by all manufacturers do not have the same factors of safety as the insulators for lower voltages offered by the same manufacturers. The difference is not so much in the thickness or in the quality of the glass or porcelain used; it is more particularly in the general shape of the insulator and in the dimensions of the in-

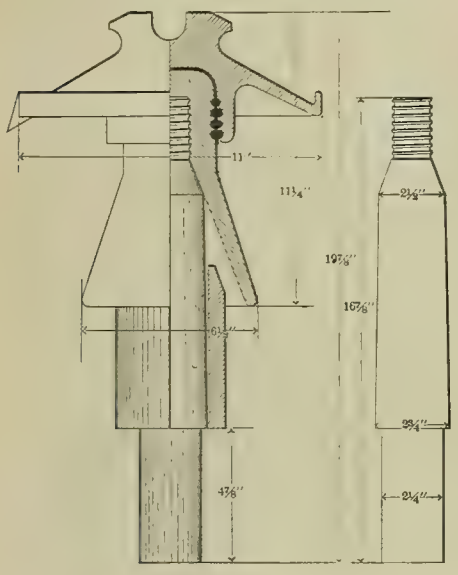


FIG. 7. HIGH-TENSION LINES.—EUCALYPTUS PIN.

sulating surfaces and petticoats. For this reason, even under severe local surroundings, the 10,000, 15,000, 20,000 or 30,000-volt insulators have shown very little surface leakage, and in consequence there has been comparatively little pin burning at these voltages. It is true that in localities of salt storms, of heavy sea fogs or chemical factories, there has been more or less pin burning without regard to the type of insulator used, or to the potential of the system. The writer has been informed that a certain plant using only 440 volts has at times great trouble from the burning of pins, although 10,000-volt insulators are used. This trouble is due entirely to the deposit on the insulators from a neighboring chemical factory, and as might be expected their period of no-burning is during the rainy season. These instances, however, are rare, and when the cause is apparent, the remedy is usually at hand. The pin burning on 40,000 and 50,000-volt lines is somewhat different. Eliminating all causes due to broken or defective insulators, the actual flow of current over the surfaces and through the body of the pin is probably very small.

On the lines from which the writer has secured burned pins two used 11-inch Locke insulators, as shown in Figs. 7 and 8; the third used the Redlands type, Fig. 9. The first two lines were operated at a potential between 45,000 and 50,000 volts, and the third at about 33,000 volts. The pins shown were taken from perfect insulators, and in some cases the insulators were immediately put back on the line. Pins (Figs. 7 and 8) were made of eucalyptus and boiled in linseed oil. The line using pin (Fig. 8) also used a porcelain sleeve covering the base of the pin. Fig. 9 shows the well-known Locke iron pin with porcelain base and oak thread. Fig. 10 shows a burned pin of the type shown in Fig. 8. The striking feature of Fig. 9 is the burning of the wooden thread to the iron pin. The writer has been informed by the general superintendent of this plant that every pin that has been examined on this line is burned in exactly the same way, yet there has been comparatively few punctured insulators and no cross-arms burned from the current leaking over the surface of the insulators. The noticeable feature of a pin taken from a 50,000-volt line is that the burned section is entirely in the upper part of the pin, about 1¾ inches below the thread. The outside surface and the center of the pin below this point show no charring. It would appear that at least, in this instance, the burned sec-

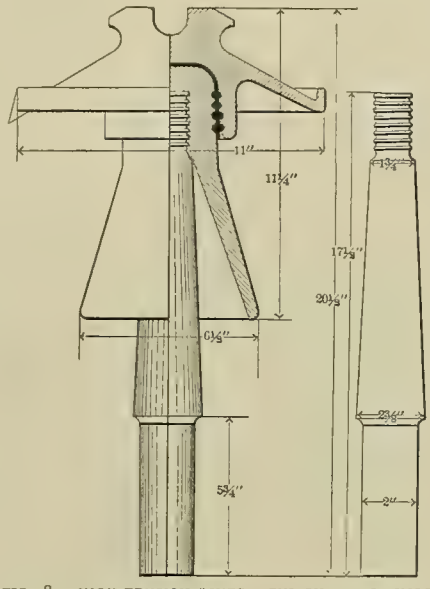


FIG. 8. HIGH-TENSION LINES.—PIN ON 50,000-VOLT LINE.

tion was the point of highest resistance of the pin, and that the lower part of the pin was a good enough conductor to permit the small current which leaked over the surface of the insulator to flow without any special generation of heat in that section of the pin. The reduced insulation of the pin and insulator was no doubt due to the dust and fog. The upper portion of the pin being better protected by the insulator from fog and dust, had in consequence higher surface resistance. A peculiar action which is occasionally found on high-tension transmission lines has been called "digesting the thread of the pin." The thread of the pin softens while in service and may be rubbed off with the fingers. This soft wood has a sour taste and resembles digested wood pulp. This action is not necessarily accompanied by the burning of any portions of the pin.

The evidence here presented, while not conclusive, still points to the advisability of using iron pins with modern insulators properly chosen for the line potential.

Discussion.

M. H. Gerry, Jr.: On a certain number of high-tension transmission lines there has been a burning

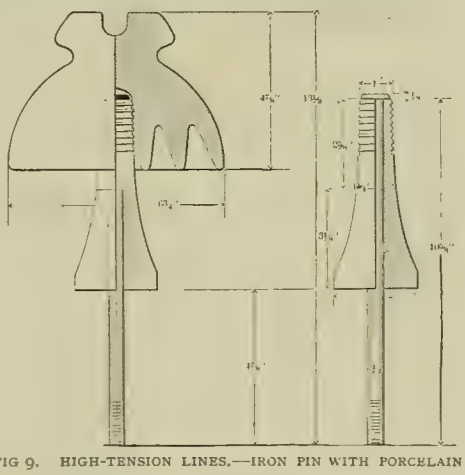


FIG 9. HIGH-TENSION LINES.—IRON PIN WITH PORCELAIN BASE.

of the wooden pins. On other transmission lines of high voltage there has been no such burning. Where burning has occurred it has been due to leakage of current from the surface of the insulators, coupled with resistance conditions in the pin such that sufficient heat was developed to char the wood.

Wood is one of the best of insulating materials when thoroughly dry and one of the poorest when containing sap or moisture. The greatest objection to it is its unreliability, due to the difficulty of removing the last traces of sap or moisture. A thoroughly dry wooden pin, 15 inches in length, will stand indefinitely 100,000 volts of pressure, while a green pin of the same length, containing sap, will break down very quickly under 1,000 volts of pressure. Paraffining the pins on the outside, or coating with asphaltum or linseed oil, is of no value. If the pins are thoroughly dry, the material in which they are dipped can be made to impregnate the entire body of the wood, thus producing a pin of high insulation. In order to prevent burning of pins, they should have either very high or very low resistance. With insulators having a large amount of surface leakage, such as those illustrated by Mr. Chesney, an iron pin is perhaps the only solution of the difficulty.

H. W. Buck, Niagara Falls: In regard to the point which Mr. Chesney spoke of regarding the "digesting of the thread of the pin," I found many pins on the Niagara transmission where disintegration had occurred at the top of the pin and it would crumble into white powder. We recently had some of the powder analyzed by chemists, and they found it to be a nitrate salt, which would look as if nitric acid was found in the static discharge of the pin and had attacked the wood, forming a combination of nitrogen salt. In this connection I want to say that about six months ago we built an experimental single-phase line about two miles in length, which we operated for five months at 75,000 volts. The conducting wires of the line were iron, tied with copper tie wires. At the end of the five months' test, the galvanized iron had turned black, although the iron guy wires remained in their original bright condition, so that the blacking of the wires was not due to atmospheric conditions. We took down the wire and noticed it was disintegrated on the surface to the depth of several thousandth of an inch. The copper tie wire was digested to a certain depth, though not as much as the iron, which also looks as if a nitrogen compound was forming in a thin film around the conductor at this high voltage, due to brush discharge, and attacking the metal. This indicates some trouble may be experienced when high voltages are used, on account of the formation of the salt due to the well-known action of nitrogen and oxygen in static discharge, thus forming nitric acid with the moisture of the atmosphere and the compound attacking the metal conductor.

Mr. Mershon: This is what happens when the pins burn. The insulator, the lower part of the pin, and the cross-arm have their surface resistance lowered by moisture or otherwise, but the upper part of the pin being protected by the insulator does not have its surface resistance so much decreased; the consequence is burning of the protected surface. In

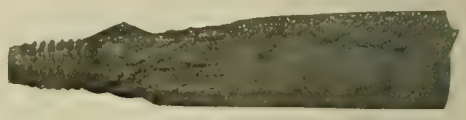


FIG. 10. HIGH-TENSION LINES.—BURNED PIN.

some cases the inner surface of the insulator next the pin and the pin itself are so well protected by the insulator that the current, instead of leaking over the surface of the insulator until it reaches a point where the insulator and pin are in contact, jumps in a brush discharge from the edge of the petticoat to the pin rather than follow the higher resistance of the protected surface. As a result the pin is burnt at the point where the brush discharge strikes it instead of at or near the thread. There are apparent three possible remedies for the trouble due to charring pins:

1. Make the design and size of the insulator such that for all conditions its surface resistance will be so high as to control the leakage and keep it below a point which can harm the pin; 2. Make the pins fireproof, but non-conducting; 3. Make the pins conducting.

The remedy recommended in the introduction to this discussion is (3). It is recommended that an iron pin be used. This certainly would do away with the trouble of charring pins, but whether or not it will introduce other and more serious trouble remains to be seen. It seems to me there is a very likely chance of trouble from the use of iron pins due to the unyielding character of both iron and porcelain or glass and their widely different coefficients of expansion. It would seem better to adopt the first remedy and make the design of the insulator such as to protect the pins.

Mr. de Muralt: It may possibly be interesting to you to know that while the general practice in America is to use wooden pins, in Europe it is just the opposite, and practically all of the high-potential installations use iron pins, and more than that, while here very often the whole pole is treated with as little iron as possible, in Europe there are quite frequently poles constructed entirely of iron with iron pins; and the only insulation relied upon is the insulation proper. I believe this does away with the burning of pins, cross-arms and poles. I do not think there is very much difficulty in the way of avoiding mechanical strains which have been alluded to several times to-night—with regard to the insulator pin, a way to get around that is to fix the pin into the insulator by means of a cement which will take up any such strain, and in a great many installations that I know of cement made of a mixture of litharge and glycerine has been used with, as far as I know, very good results. It seems

to me that it is a very good scheme to lay the entire insulation into the insulator, and then let the rest of the pole take care of itself.

Philip Torchio, New York: Now, it seems to me this Locke insulator, with double petticoat, making the condensers in series and then this oak-thread, porcelain-base iron pin, as shown in Fig. 9, may give rise to that increased potential across the pin to the porcelain, which might explain the charring of the wood.

C. E. Skinner: I understand that the pins used on that line were selected with the utmost care, and were carefully treated, and that they have had practically no trouble whatever in more than a year's run with a potential of over 50,000 volts. These pins are protected by glass from the weather. We should also keep in mind other things, especially that this is in a different climate from any other installation, and that what is a cure for these troubles in one climate cannot be the cure for other climates.

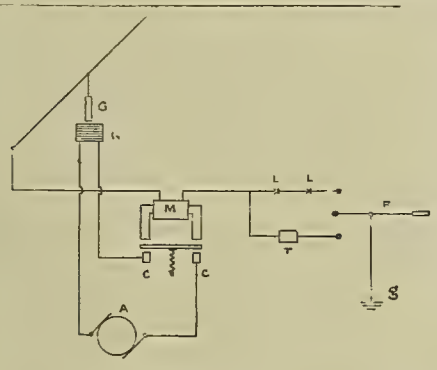
W. N. Smith: In the matter of wood and iron pins, it seems to me along with various other elements, the question of cost will govern. Iron poles in this country at this time are anywhere from $30 up, and a wooden pole of suitable size runs from perhaps $7 to $20, according to size and where it can be got. The matter of cross-arms may be governed to some extent by the size selected for the butt of the pin.

Mr. Chesney: I was particularly interested in Mr. Buck's information concerning the digesting of the pin. This has bothered me considerably in a number of cases and on a number of transmission lines. I attributed it to the formation of ozone. I think ozone is usually to blame for all such troubles. If it is nitric acid, I am glad to know it. With regard to the remarks of Mr. Mershon in reference to the use of the wooden thread, as far as I know on the particular line in which the Locke pin with the wooden thread was used, the burning was not serious, and it simply consisted in practically puncturing the wooden thread at one point and stopping, and did not deteriorate any further. In order to relieve the mechanical strain, I think it is quite possible to use a lead thread. Litharge and glycerine have been used to some extent for iron pins in this country, but lately Portland cement has been used in place of litharge and glycerine. I believe on one of the largest new transmission lines now being erected in Mexico, they are using Portland cement and iron pins, and instead of using iron poles they will use iron towers, having a distance between the insulators of some 400 or 500 feet.

[Prof. W. S. Franklin then read his paper and exhibited a model in regard to the distribution of electromotive force and current along a single-phase alternating-current transmission line, after which the meeting adjourned.]

Trolley-lowering Device.

A new appliance, recently patented in France, for use on electric railways, is designed to lower the trolley arm automatically from the wire by an electromagnetic device. This arrangement is especially applicable to the lines which run from the city to the suburbs, where the trolley is to be lowered in passing into the city, as on many of the combination systems, especially in Paris, where the trolley has not been permitted within the city limits, and the car is obliged to carry accumulators or use the surface-contact or conduit systems. Where the trolley comes to the end of the wire it is proposed to lower it



TROLLEY-LOWERING DEVICE.

automatically by a solenoid device instead of by hand, which makes it necessary to stop the car.

The accompanying diagram shows the arrangement of circuits to effect this, the trolley pole being connected by a wire cable to a core (G), which is movable in a large solenoid (H). An electromagnet (M) is used as a relay to make contact for the solenoid, and takes its current from the trolley, being in series with the lighting circuit (L) of the car or with an extra resistance (r), according to the position of the lever (R). When the trolley is running on the line the lever (R) is kept on one of the contacts. This causes the current to flow in the electromagnet, and its armature is attracted, breaking contact between the points (C) (C), which are in circuit with the solenoid, and no current flows in the latter.

When the trolley comes to the end of the line it leaves the wire, breaking the current in the electromagnet (M). The armature is pulled down by the spring and completes a circuit through the solenoid (H). The motor (A) acts as a dynamo and sends current through the solenoid (or the current from the accumulators may be used where it is available); the solenoid then attracts its core (G) and lowers the trolley pole. At the base plate is placed a spring catch, which serves to hold the pole in place after it is once lowered. The device is thus entirely automatic, and no attention need be paid to the trolley in passing the end of the line.

English Double-deck Car with Collapsible Roof.

On account of unwieldiness, great headroom required, delay in loading and unloading passengers and difficulty in collecting fares, double-decked trolley cars are not very popular among street-railway managers in this country, although they are in use in a number of places. In the more leisurely service in England and some other foreign countries this type of car enjoys a considerable vogue, however. The upper platform is usually open and affords the passenger an enjoyable seat in pleasant weather. But when it rains or storms the outside passenger must seek the lower part of the car, unless a temporary roof covering is provided. The accompanying illustration shows one of the electric cars owned by the town of Halifax in England, which has been fitted with a patent collapsible roof covering that possesses several points of merit.

The covering is of an entirely different design from anything yet placed on the market, says the London Tramway and Railway World, and although collapsible when desired, it is of a thoroughly strong

ENGLISH DOUBLE-DECK CAR WITH COLLAPSIBLE ROOF.

and substantial construction. The cover consists of five channel-iron bridges in which the shutters are run in a manner similar to the lid of a roller-top desk. In the center, running the whole length of the car is a trolley plank, and a single-deck type of trolley base is supplied. On each side of this trolley plank and between each of the bridges are fitted two flexible shutters of baywood slats and a window shaped to harmonize with those on the car body.

When not required the shutters and windows are dropped level with the panel boarding, which takes the place of the handrail, leaving a neat framework which is a protection against falling wires. To cover the roof again, one flexible shutter is drawn up and fixed, then number two, then the window, and the cover is complete. This cover is entirely waterproof. The removal of the trolley standard generally used on the upper deck of such cars greatly improves the appearance of the passenger room, besides giving extra seating capacity. The windows provided also add to the pleasure and convenience of the passengers. The whole structure is handsomely painted and varnished, the ends fitted with sliding doors and end windows, above which are fixed beveled mirrors, the whole finish making the platform interior of a light, handsome appearance.

Cheap Lamps from Germany.

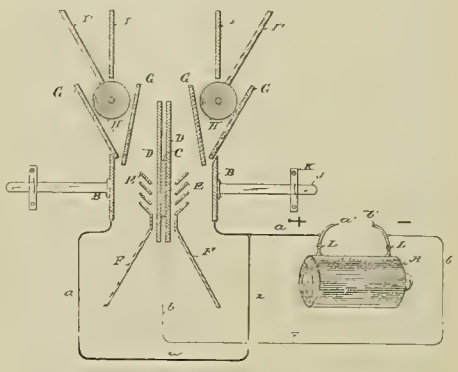
In a recent consular report Consul-general Julius G. Lay, stationed at Barcelona, writes as follows concerning imports into Spain from the United States: "An improvement will be noticed in the imports of electric incandescent and arc lamps, but I regret to say that these have been supplied by European countries, principally Germany. I have asked dealers why they cannot obtain their supplies from the United States, and they reply that the German makers sell cheaper, take smaller orders, and grant easier terms of payment than American firms. Incandescent lamps are sold at 30 to 31 centimes (six cents) each, freight and insurance paid to Spanish port. Large quantities are also sent by parcels post, 25 at a time, packed in cardboard boxes."

During the first 10 months of 1902 there was imported into Spain $142,590 worth of incandescent lamps, $285,910 worth of arc lamps, and $11,408 worth of telephone supplies.

Electrostatic Metal Separator.

Clinton Emerson Dolbear of Boston, Mass., has discovered that if a mixture of conducting and non-conducting particles, such as would exist in pulverized or crushed ore, be subjected to the action of a plate or plates highly charged with electricity the conducting particles will be attracted to the charged plate and immediately repelled therefrom, while the non-conducting particles are comparatively unaffected by the electric charge. He has devised an apparatus by which these facts can be taken advantage of.

In the accompanying drawing, which is a sec-



ELECTROSTATIC METAL SEPARATOR.

tional view of the machine, (A) represents a Ruhmkorff coil or suitable generator of static electricity of high potential. (B) represents two insulated metallic or conductive plates; (a) and (b) are electric conductors connecting the terminals of the electric source (a') (b') with the plate (B) (B) and with a third insulated conducting plate (C). (D) represents two non-conducting plates, situated opposite to and in the vicinity of the charged plates (B) (B).

The operation of the device is as follows: The electrostatic generator being set in operation, the commingling mass of conductive and non-conducting materials reduced to the proper state of subdivision is put into the hoppers (I) (I'). It there spreads out upon the rollers (H) into a comparatively thin sheet and drops down through the chutes (G), directly in front of the plates charged to an opposite potential to that of the plate (C). The conductive particles are charged with the same potential as the plate with which they come in contact and at once repelled therefrom, while the non-conducting particles are hardly affected. These repelled conductive particles are caught by the shelves (E) and directed downwardly along the plates (D), where they are collected. The non-conductive material falls under its own weight, meets the chutes (F), and is turned aside into separate collectors.

Different kinds of materials need different adjustments of the various portions of the apparatus, and this is accomplished in one manner by providing means whereby the plates (B) may be brought into different relations to each other or to the plate (C). With an arrangement such as shown at (J) (K) the plates (B) may be approached or separated or tilted at various angles to suit the nature of the material operated upon. Means (shown at L) are also arranged for varying the relative position of the two generator terminals.

Government Electric Railways for Sweden.

A plan is said to have been adopted in Sweden to operate all the government railroads, consisting of about 2,300 miles, by electricity. The matter is of interest to Americans because the crown's technical advisers propose to employ, tentatively at least, the single-phase current system of power transmission invented by H. Ward Leonard of New York city. This system has not been adopted in this country, but is in use in Switzerland, where it is being developed with a view to its application on all Swiss state railroads, to the exclusion of steam locomotives entirely.

The comparative lack of coal in Sweden and the abundance of waterpower obtainable have led the government to look favorably on any plan which seems to promise a more restricted use of the coal deposits and an economical management of the state railroads. The project adopted calls for the erection of 22 power stations in as many districts; of these, 18 would employ waterpower and four would use peat for producing steam. The greatest distance of any power house from the railroad is 25 miles.

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National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Detroit, Mich. July 15th to 17th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

IN the experiments and actual working out which shall result in the survival of the fittest in illuminants it is instructive to consider the reported remarkable efficiency of the mercury arc. In a recent contribution to a scientific contemporary Mr. W. C. Geer says that he has found that the efficiency of the mercury arc is much superior to that of any other artificial illuminant. Taking the efficiency of an argand gas burner as 0.016 and that of an incandescent electric lamp as 0.06, the efficiency of the ordinary arc light is 0.1, that of acetylene gas the same, and that of the Geissler tube 0.32. The author finds that the efficiency of the mercury arc varies from 0.41 to 0.48, or, in other words, that the proportion of energy supplied which is converted into visible light is nearly 50 per cent. This is the highest known radiant efficiency. In measuring the efficiency, Mr. Geer used a thermopile, and separated the heat rays from the light rays by interposing a water cell and an iodine cell. He also took care to allow for the heat radiated from the walls of the tube. The author worked with very short exposures, and recorded the cooling curve with the aid of a chronograph. The distance between the mercury terminals was about two centimeters, the arc was five centimeters long, and the energy was supplied by a 110-volt direct-current circuit. These are, of course, the results of laboratory tests; but no one can say to what extent the experimental work of to-day may be the standard practice of to-morrow. Artificial illumination goes back to the torch-bearers of prehistoric times and counts its history in thousands of years. But even in such fundamental contrivances as those which enable men to work or play after sunset, what a vast field for improvement remains. "As light as day" is a fond figure of speech—how far are we from it actually and how much we should welcome the efforts of investigators and inventors who are striving to improve the slowly evolved light-giving appliances of the present day!

A REVIVAL of interest in the coal battery may result from the reported intention of John D. Rockefeller to supply the capital necessary for a continuation of the experiments of Professor Jacques of Boston, whose efforts to produce "electricity direct from coal" by means of a carbon cell are well known to the electrical fraternity. The endeavor to find a practical method of utilizing electrically the potential energy of coal without the interposition of boiler, engine and dynamo is a fascinating one, and has engaged the attention of physicists and inventors for a number of years. Among the investigators who have attacked the problem are Borchers, Reed and Jone, but it is the work of Jacques that has especially attracted the attention of Mr. Rockefeller, through the good offices of a mutual friend, according to newspaper report. The capitalist did not make his offer of assistance in a spirit of commercialism, it is asserted, but as a substantial evidence of his interest in scientific research.

While the possibility of producing "electricity direct from coal" is a most alluring one, opening up prospects of the use of electric power and heat in every household, the lions in the path of the inventor pressing forward to this particular goal seem to be almost unconquerable. James Swinburne, president of the British Institution of Electrical Engineers, in considering the subject recently, said: "To sum up the matter shortly, in the light of modern theory, carbon never forms ions, and has therefore no solution pressure, and can therefore give no electromotive force. At ordinary or moderate temperatures carbon is practically inert. Oxidizing agents will attack some forms slightly, and sulphuric acid will attack it. In this latter case the formation of water and its combination with the acid is the determining factor. At high temperatures oxygen, sulphur, silicon, and, to some extent, nitrogen and many of the metals, combine with carbon, but there is no dissociable salt of carbon formed. The carbon cell thus seems impossible."

But in the vocabulary of the true inventor "impossible" is a word that is ignored. No harm, and possibly much good, can come from Mr. Rockefeller's patronage of Dr. Jacques' experiments. Possibly the coal battery may not be produced, but in the investigation discoveries may be made that may lead to important results quite apart from the object of the original research. All honest scientific investigation should be encouraged, and perhaps the only regret is that Mr. Rockefeller does not offer to help all genuine workers in the field, and not the Boston inventor alone.

PORTO RICO, as American territory, is undergoing what appears to be a veritable transformation by the introduction and expansion of all the needful agencies of civilized life. Not only are great improvements under way in the judiciary and in educational methods, but a decided advancement is making in all the material comforts and conveniences that are necessary to the well-being of an up-to-date community. Capital is flowing into the new insular possession in considerable amount, investors being satisfied with the conditions that prevail as guaranteeing the security of their outlay. In such an era of development it would be expected that electrical utilities would be among the first to be introduced or expanded, and such is indeed the case. For instance, some Philadelphia capitalists are just commencing the construction of an electric railroad across the island, utilizing waterpower for that purpose. This road will give to the interior agricultural regions quick and cheap access to the ports and will bring San Juan and Ponce, the two most important commercial centers in the island, into closer proximity. Other investors, from Boston, are just about to commence the construction of a general telephone system throughout Porto Rico, embracing local and long-distance exchanges. A new street railroad is in operation in Ponce, and San Juan, Ponce and Mayaguez, as well as some smaller municipalities, are now lighted by electricity. These are indications that Porto Rico is really rising in the scale of civilization; for are we not entitled to say that the use of applied electricity in any nation or community is a pretty safe indication of its relative degree of enlightenment and progress?

DISCLOSURE of the Curtis steam turbine, manufactured by one of the great electrical manufacturing companies, is made, in a general way, by a paper prepared by Mr. W. L. R. Emmet and presented before the Philosophical Society of Philadelphia a couple of weeks ago. This paper is given in this issue of the Western Electrician and will be read with much attention. It will be found that the description does not go into details; the author does not exhaust the subject, by any means, and much that might be said is left unsaid. Indeed, Mr. Emmet professes only to give a general idea concerning existing designs of this particular turbine for application to electric generators. "Its development," he says, "even for this purpose, is very recent, and will doubtless be subject to important future improvements." It is probably for the reason that the machine is still in the hands of the designing engineers that the author of the paper describes it only in outline and not in detail. The drawings show that the Curtis turbine is of the vertical type, which is in itself an interesting fact. The relation of the moving and stationary blades is shown by a diagram, and some striking drawings show the relative size of turbines and horizontal and vertical piston engines of the same capacity. Curves are given showing water consumption under different conditions of test. In all cases the turbine is considered as part of an electric generating unit, and the output is stated in kilowatts. This is significant of the determination of the electrical companies to produce turbo-alternators complete and not separate turbines to be connected to generators by the user.

The steam turbine looms large on the horizon of the producer of electric current. It has, apparently, "arrived." No designer of a large alternating-current station can now afford to leave it out of his calculations. It has obvious advantages of speed, compactness, simplicity and absence of reciprocating motion. There are disadvantages, too; but, so far as one can judge at the present time, with the limited results and data at hand, the advantages appear to outweight the disadvantages. The steam turbine bids fair to supplant the reciprocating engine for the driving of large alternators, with, of course, a very important modification in the generators so driven.

Iowa Electrical Association.

The most successful meeting ever held by the Iowa Electrical Association was brought to a close at Davenport, Iowa, on April 9th, after a two-day session. Electrical men from all over the state of Iowa were present and there were more than 100 delegates at the meetings. The meetings were held in the Masonic Temple on West Third Street, and several exhibits of electrical apparatus added to the interest of the convention. The association has grown considerably during the last year, having a company membership at present of 64. This is no small organization, when it is considered that the membership is calculated by plants and not by individuals, some plants being represented by six or seven individuals.

The first session was called to order on Wednesday morning at 10 o'clock by President W. J. Green of Cedar Rapids, who made an excellent address, after which reports were heard from the secretary, treasurer, executive committee, programme committee and finance committee. A nominating committee composed of G. S. Carson, Rufus E. Lee, D. F. McGee, M. J. Hilger and W. S. Kelly was elected and then adjournment was taken for lunch.

At the afternoon meeting Secretary W. S. Porter read a paper on electric street lighting, which was discussed at length. J. S. Bellamy of Knoxville presented the report of committee on proposed legislation relating to the development of plans for the inspection of wiring. The committee appointed to establish uniform methods of arriving at the cost of furnishing electric current and to collect forms in use by different companies, reported through the chairman, Isaac B. Smith of Cedar Rapids. Both reports contain valuable data and information. The afternoon session closed with an interesting paper on the "Maintenance and Operation of Central Stations by Waterpower," by George S. Carson of Iowa City.

Wednesday evening was to have been given up to W. D'A. Ryan of Chicago, who was to have lectured on "Modern Illumination," but, owing to his inability to be present, a smoker was given instead. A number of papers were read at Thursday morning's session which conveyed valuable information to all who heard them. They were as follows: "City Pumping by Central Stations," D. F. McGee, Red Oak; "Lamp Testing," George S. Carson, Iowa City; "High-voltage Transmission," Austin Burt, Cedar Falls; "The Necessity of Grounding Secondary Circuits," W. J. Green, Cedar Rapids.

The executive session was held on Thursday afternoon and resulted in the election of the following-named officers: President, D. F. McGee, Red Oak; vice-president, W. L. Bowers, Davenport; secretary, W. S. Porter, Eldora; treasurer, Rufus E. Lee, Clarinda; executive committee, Austin Burt, Cedar Falls; M. J. Higley, Burlington; George S. Carson, Iowa City. The afternoon session was purely a business meeting. Des Moines will entertain the association in 1904. Ames, Burlington, Mason City and Waterloo extended invitations, but the consensus of opinion seemed to favor a more centrally located place, and Des Moines was selected.

Before leaving the city the association was treated to an electric trip by special cars to Rock Island Arsenal, inspecting dam and waterpower plant; then to Rock Island and Moline, visiting the Moline Power Company's plant at the latter place.

The Everett-Moore Syndicate.

It is said with a considerable degree of truth that the Everett-Moore syndicate of Cleveland will cease to exist as soon as the telephone situation is cleared up. The electric-railway companies have all been either sold or refinanced, and their private debts have been paid by conversion into mortgage notes or bonds. The troubles of the telephone companies will likely be settled in the same way, so that all the obligations of the syndicate will be thus wiped out and the companies will be responsible individually for their own debts and their own transactions. However, nearly all the persons who made up this syndicate will be interested in the various properties in the way of holding stocks and bonds. Their relations with the companies will be the same as those of any other stockholders. There were at various times from 100 to 150 persons interested in the syndicate, although not all of them were interested in the same properties at the same time. It was rather a union of interests under a tacit agreement than anything else, and there has never been any particular organization. The heads, however, have been Henry A. Everett, E. W. Moore and Barney Mahler. Mr. Everett is one of the greatest railroad operators and promoters the West has every produced, while Mr. Moore is essentially a financier. Mr. Mahler is a capitalist, but has a wide acquaintance with both branches of the business, and the three made a strong combination. The syndicate made Cleveland a great electric-railway center.

Teachers of Science and Mathematics in Session.

The second general meeting of the Central Association of Physics Teachers was held in Chicago, on April 9th to 11th. The meeting on the 9th was that of the executive committee, which met at the Great Northern Hotel at 7:30 p. m. to receive applications for membership and to discuss various subjects to be brought up at the general meeting on the following day.

On Friday morning at ten o'clock the first general meeting was held in the auditorium of the Armour Institute of Technology with about 250 persons present. The opening remarks by President Charles H. Smith were on the progress of the past and the bright outlook for the future of the association. Dr. F. W. Gunsaulus, president of Armour Institute, was then introduced. He welcomed the association to the hospitality of the Institute and spoke at some length on the effect which the organization is destined to have on the future of science and business. He commended the methods of information and instruction employed by the physics teachers. Dr. A. P. Carman, professor of physics of the University of Illinois, read an interesting paper on the "Past and Present Theories of Electricity," and Dean S. A. Forbes, professor of zoölogy of the same university, delivered an address on "The Scientific Method in Colleges and High Schools." His remarks were instructive and of practical value to science teachers. After luncheon the laboratories and shops of the Institute were inspected.

The first business meeting was held on Friday at 2 p. m., and it was at this meeting that the Central Association of Physics Teachers, although less than a year old, passed out of existence. The association has grown so rapidly that the advisability of reorganizing on a broader scale has been apparent for some time. On the suggestion of the executive committee the old organization was dissolved and the Central Association of Science and Mathematics Teachers was organized in its stead. The association will have five sections, viz., physics, mathematics, chemistry, biology and earth science. The first officers are: President, Charles H. Smith, Hyde Park High School, Chicago; secretary, C. E. Linebarger, Lake View High School, Chicago, and treasurer, E. C. Woodruff, Lyons Township High School, Lagrange, Ill. The executive committee and officers of the various sections have not yet been announced.

Each of the sections held meetings on Friday and Saturday, and, after reorganizing, carried out the programmes which had been arranged. The physics section was addressed by A. H. Sage of Oshkosh, Wis., and Gilbert H. Random of Calumet, Mich. Their subjects were, respectively, "Some Observations on the Teaching of Physics" and "Adjustment of High School Courses in Physics to Meet the Increased Scope of Elementary Physics." Discussions followed on the following topics:

1. Can the notebook be arranged so that the pupil will not dislike writing it, the teacher will not dislike examining it and the notes will be intelligible to the layman?
2. How can the science library be made of the greatest benefit and value to the pupil?

The mathematics section met on Friday at two o'clock and was addressed by Victor C. Alderson, dean of Armour Institute, Chicago; Professor H. E. Cobb, Lewis Institute, Chicago; C. W. Leigh, Armour Institute, Chicago; Professor C. E. Comstock, Bradley Polytechnic Institute of Peoria, and Professor J. W. A. Young, University of Chicago.

Dr. Alexander Smith, associate professor of chemistry of the Chicago University, addressed the chemistry section on the subject, "The Shares of the Teacher, the Book and the Laboratory in Chemical Instruction." Dr. Edward Gudeman and William Hoskins of Chicago gave an interesting discussion on "What Shall the Preparatory School Give in the Way of Chemical Training?" A general "experience meeting" and a "question box" followed the discussion.

The biology section was addressed by Dr. Charles R. Barnes, professor of plant physiology of the University of Chicago, after which the members attended the meeting of the earth-science section and listened to an address by Dr. H. C. Cowles of the Chicago University on "The Influence of Plant Life on Physiographic Forms." The earth-science section was also addressed by Frank W. Darling, Chicago Normal School, and W. W. Atwood, University of Chicago.

Over 400 people attended the meetings on Saturday, and after the organization of the various sections was completed it was found that the association had about 200 members. The meetings of the association were interspersed with luncheons, social gatherings and excursions. On Friday evening there was a dinner and reception at the Young Men's Christian Association's Building, which was well attended. The excursions included trips to the Kimball Piano and Organ factory, McCormick Harvesting works, plant of the Consumers' Ice Company, gas works, Field Columbian Museum and Dune Park.

The attendance at the meeting was much larger than anticipated, and the amount of interest displayed was gratifying. The next meeting will be arranged by the executive committee.

A number of exhibits and demonstrations were made during the meeting. Among them was the "progressive electro-dynamic equipment," a device for giving electrical demonstrations at schools and colleges, exhibited by H. J. Evans, representing the Submerged Electric Motor Company of Menomonie, Wis.

Waterpowers in Georgia.

A comprehensive system of mapping the areas adjacent to the undeveloped waterpowers of Georgia, which will prove to be of great value to manufacturing interests, has just been inaugurated.

Careful surveys will be made of all the important streams in the state throughout their whole length, to show the amount of their fall and the position of their banks and islands; and contour maps of possible dam sites, and, finally, topographic maps of their drainage basins will be prepared.

This system of surveys has been undertaken by of the United States Geological Survey, and W. O. Tufts and J. R. Eakin have started work, respectively, on the Ocmulgee River from Atlanta to Macon, and on the Savannah River from Augusta to its head, including the Broad, Tallulah, Tugaloo and Chattooga tributaries.

Bronze tablets set in cement, marked to show their exact height above sea level, are placed at suitable points, so that future construction surveys may have definite elevations on which to base their work.

High and low-water marks are located. Photographs and elaborate notes are kept of all rapids and falls, and the nature of the river banks and bottoms is observed and recorded, and from this material reports can be prepared showing the relative value of the various possible dam sites.

Railroads, public and private roads, houses and topographic features of the river valleys will be indicated in detail on the maps. Eventually these surveys will be incorporated in the regular series of topographic maps which the United States Geological Survey is making of the whole country.

Maps of about 25,000 square miles of Georgia have already been published and have proved to be of great importance in the development of the state; with the addition of the new information obtained by the contemplated surveys, their value will be much increased. These published maps can now be obtained from the director of the United States Geological Survey, Washington, D. C., for the nominal price of five cents each.

Chicago Street-railway Situation.

The re-election of Carter H. Harrison as mayor of Chicago last week is ascribed by him as more of a triumph for municipal ownership than a personal victory for himself. The mayor says he will carry out his election pledge to settle the traction question as speedily as possible and to that end is assisting the City Council committees and also delegations of citizens in having the state Legislature pass enabling measures for municipal ownership. The Mueller bill, which provides for municipal ownership of street railways, was passed unanimously by the state Senate last week, and the measure is now before the House. Should this bill become a law, it will give the city the power to take over traction property under certain conditions. As the acquisition of the local street railways by the city will probably not be seriously attempted for some time, and certainly not until the city is financially able to buy the properties, the passing of this bill is regarded more as a measure to force an issue with the companies so that the franchise question may be speedily settled and with better advantage to the city. Another phase of the situation is indicated by the City Council recommending to the Legislature a referendum bill requiring all street-railway legislation on franchises exceeding five years to be submitted to the people when petitioned for by 10 per cent. of the registered voters.

Aurora, Elgin and Chicago Road.

The Elgin (Ill.) branch of the Aurora, Elgin and Chicago Railway, it is said, will be in full operation by May 1st. L. J. Wolf of the Mandelbaum syndicate is quoted as saying that the earnings of that portion of the line now in operation between Chicago and Aurora, are very satisfactory. Within 60 or 90 days the power plant will also be in such shape that the company will be able to furnish power for lighting purposes for Batavia, Wheaton, Glen Ellyn, Lombard and other towns, besides furnishing light and power to a large number of manufacturing establishments located in the towns mentioned. The company will also furnish power for the Elgin, Aurora and Southern Traction line, for a line building from Aurora to DeKalb, and also for a line building from Joliet to Aurora.

A report is current that the Chicago, Burlington and Quincy Railway Company is about to build an electric line from Galesburg to Kewanee, Ill., to forestall the possibility of an electric line to Chicago. A prominent Illinois citizen is quoted as having said that the Burlington has become so alarmed at the electric-road-building situation that it has determined quietly to break into the chain of roads, and thus delay the inevitable a few years longer. The Burlington company already owns and operates an electric railway from Lead to Deadwood, S. D.

The Curtis Steam Turbine.[1]

By W. L. R. Emmet.

The development which this paper describes is based upon the original theories and inventions of Mr. C. G. Curtis of New York, whose ideas were first made the subject of patent application about 1895. Since that time these inventions have been the subject of experimental investigation at Schenectady, under the direction of Mr. Curtis and of the General Electric Company's engineers; the object of these experiments being to establish data and laws which would form a basis for the correct design of commercial apparatus. The difficulties of such an investigation are very great. All new facts must be established by the test of different machines or parts which are difficult and expensive to produce. About two years ago the results of these experiments gave us data which showed great commercial possibilities, and since that time work has gone on on a large scale in the production of commercial machines. The contracts for these machines now aggregate 230,000 horsepower in turbine-driven electric-generating units, the largest size so far built being 7,500 horsepower. Thus a great industry has been brought into existence in a very short time, and, since the work has all been done in one place and by a few persons, very little information concerning it has reached the public. This paper is the first printed matter which has appeared on the subject.

The reason for this immense demand and production without publicity, and in so short a time, is that the improvements effected are radical in economy, simplicity and efficiency of action.

All improvements in prime movers are of great importance to the engineering world. The steam turbine is destined to effect the first really great improvement since the days of Watt, and the forms of Curtis turbine here described make the first great stride in advance of other steam engines.

Every efficient steam engine must provide means by which a fair proportion of the expansive force of steam can be converted into useful work. In the engines of James Watt and his successors this result is accomplished in various degrees by the application of pressure from the steam to moving pistons. In steam turbines the expansive force imparts motion to the steam itself, and this motion is given up to a revolving part by impacts of the moving steam upon it.

The idea of the steam turbine is quite simple, and is similar to that of the water turbine or impulse wheel. The practical difficulty which has heretofore prevented the development of good steam turbines lies in the very high velocity which steam can impart to itself in expansion, and the difficulty in efficiently transferring this motion to wheels at speeds practicable for construction or practical use. Steam expanding from 150 pounds gauge pressure per square inch into the atmosphere is capable of imparting to itself a speed of 2,950 feet per second, and if it is expanded from 150 pounds gauge pressure into a 28-inch vacuum it can attain a velocity of 4,010 feet per second. The spouting velocity of water discharged from a nozzle with 100 feet head is 80 feet per second. These figures illustrate the very radical difference of condition between water turbines and steam turbines. In both water and steam turbines the theoretical condition of maximum economy exists when the jet of fluid moves with a velocity equal to about twice that of the vane against which it acts. In waterwheels this relation is easily established under all conditions, while with steam the total power produces a velocity so high that the materials available for simple wheels and vanes are not capable of sustaining a proper speed relation to it under practical conditions.

Before the appearance of the Curtis turbine two practical methods of accomplishing fair economy had been devised, namely, the turbines of Carl De Laval of Sweden and of Hon. Charles Algernon Parsons of England, both of which were brought out more than 15 years ago.

In the De Laval turbine the total power of the steam is devoted to the production of velocity in an expanding nozzle which produces velocity very efficiently. The jet so produced is delivered against a set of vanes on a single wheel, which, by an ingenious construction and method of suspension, is adapted to operation at a very high peripheral velocity. The very high rotative speed which this construction entails is made available for dynamo driving by very perfectly made spiral-cut gears, which effect a 10-to-one speed reduction. The peripheral velocity of the wheel in the largest De Laval turbines is about 1,200 feet per second, while the velocity which energy can impart to steam is over 4,000 feet per second. Thus the wheel falls far short of the theoretically economical speed.

In the Parsons turbine the steam is carried in an axial direction through the space provided between a succession of internal revolving cylinders and external stationary cylinders which inclose them. Both the internal and the external cylindrical surfaces are covered by many successive circles of vanes, so arranged that the steam has to pass alternately through rows of moving and stationary vanes. In passing through this turbine the steam never acquires a speed which approaches the velocity which it attains in the De Laval nozzle, but, instead, moves along alternately, acquiring velocity by expansion, and partially giving it up by impact with the moving vanes.

Both of these turbines have attained some success, but neither, as thus far developed, affords sufficient advantage over the steam engine to cause any very rapid or radical change in engineering conditions.

The important disadvantages of the De Laval type are that it is limited by the imperfections of high-speed gearing, that its efficiency is not particularly high, and that the design is not conveniently applicable to large sizes. The Parsons type is principally limited by the multiplicity and weight of its parts and the high cost of construction.

The Curtis turbine retains some of the features of its predecessors, but introduces new ideas which make possible a much lower speed, less weight, fewer and simpler parts, higher economy, less cost, and other important advantages.

The general arrangement of a turbine generating unit of this type is shown by the drawings which accompany this paper. Its functions may be briefly described as follows, and are illustrated by the accompanying cut (Fig. 1):

Velocity is imparted to the steam in an expanding

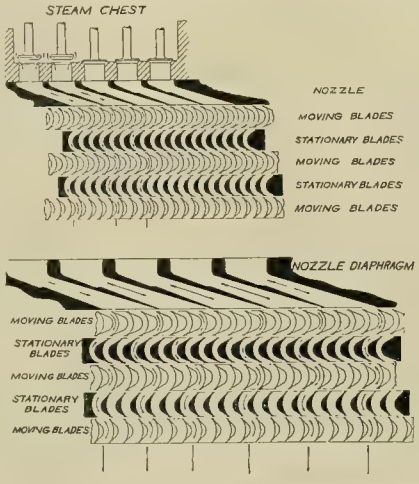


FIG. 1. CURTIS STEAM TURBINE.—DIAGRAM OF NOZZLES AND BUCKETS.

nozzle so designed as to convert efficiently nearly all the expansive force, between the pressure limits used, into velocity in the steam itself. After leaving the nozzle the steam passes successively through two or more lines of vanes on the moving element, which are placed alternately with reversed vanes on the stationary element. In passing successively through these moving and stationary elements, the velocity acquired in the nozzle is fractionally abstracted, and largely given up to the moving element. Thus the steam is first thrown against the first set of vanes of the moving element, and then rebounds alternately from moving to stationary vanes until it is brought nearly to rest. By this means a high steam velocity is made to impart motion efficiently to a comparatively slowly moving element. The nozzle is gen-

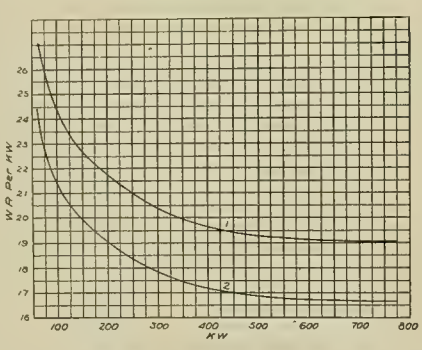


FIG. 2. CURTIS STEAM TURBINE.—COMPARATIVE CURVES OF WATER CONSUMPTION.

erally made up of many sections adjacent to each other, so that the steam passes to the wheels in a broad belt when all nozzle sections are in flow.

This process of expansion in nozzle and subsequent abstraction of velocity by successive impacts with wheel vanes is generally repeated two or more times, the devices for each repetition being generally designated as a stage. There may be various numbers of stages and various numbers of lines of moving vanes in each stage. The number of stages and the number of lines of vanes in a stage are governed by the degree of expansion, the peripheral velocity which is desirable or practicable, and by various conditions of mechanical expediency.

Generally speaking, lower peripheral speeds entail more stages, more lines of vanes per stage, or both. Our general practice is so to divide up the steam expansion that all stages handle about equal parts of the total power of the steam.

The losses and leakages of the earlier stages take the form of more heat or more steam for the later stages, and are thus in part regained. Much water of expansion, which might occasion loss by re-evaporation, is drained out of each stage into that which succeeds it.

The governing is effected by successive closing of nozzles and consequent narrowing of the active steam belt. Fig. 1 shows part of the nozzle open and part closed, the arrows showing space filled by live steam. In the process of governing, the nozzles of the later stages may or may not be opened and closed so as to maintain an adjustment proportional to that of the first stage, which is always the primary source of governing. Some improvement of light-load economy may be effected by maintaining a relative adjustment of all nozzles; but in many cases the practical difference in economy is not great,

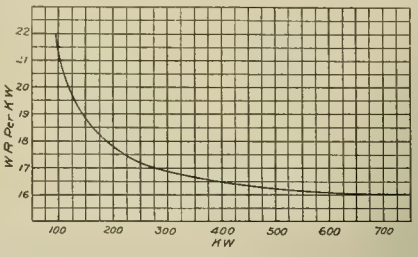


FIG. 3. CURTIS STEAM TURBINE.—CURVE SHOWING WATER CONSUMPTION.

and automatic adjustment of nozzle opening in later stages is dispensed with in the interest of simplicity. In some machines an approximate adjustment is maintained by valves in later stages, which open additional nozzles in response to increases of pressure behind them. These are used as much for limiting the pressures in stage chambers as for maintaining the light-load economy.

The principle of the Curtis steam turbine is susceptible of application to a variety of purposes. Within the scope of this paper I intend to give only a general idea concerning existing designs for its application to electric generators. Its development, even for this purpose, is very recent, and will doubtless be subject to important future improvements. In its present state, however, it embodies many important advantages, as has already been stated. The most important of these advantages is the high steam economy which it affords under average conditions of service. This economy is shown by the accompanying curves (Figs. 2 to 6, inclusive), which are derived from actual tests of the first commercial machine of this type which was completed. This machine drives a dynamo of 600-kilowatt capacity.

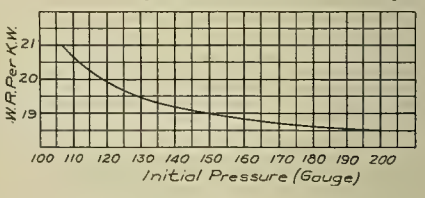


FIG. 4. CURTIS STEAM TURBINE.—CURVE SHOWING WATER CONSUMPTION.

The curves give its performance at a speed of 1,500 revolutions per minute, which is a safe and practical speed for commercial operation, and which corresponds to a peripheral velocity of about 420 feet per second. The results, with superheat, given in these curves are not derived actually from tests of this turbine, but are plotted from data obtained on smaller turbines. They correspond to the results obtained on turbines of other types, and are undoubtedly reliable.

Fig. 2 shows the steam consumption of this machine in pounds per kilowatt-hour output at various loads and with 140 pounds pressure and a vacuum of 28.5 inches, the lower curve giving the steam consumption at various loads with 150 degrees superheat, and the upper curve without superheat.

Fig. 3 shows the results which could be obtained from this turbine if it were operated with high

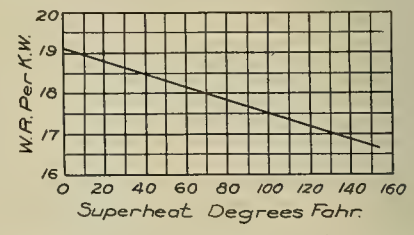


FIG. 5. CURTIS STEAM TURBINE.—CURVE OF WATER CONSUMPTION.

pressure and a high degree of superheat, these conditions of operation being perfectly practical with the machine, while with steam engines the use of such high temperatures would with ordinary constructions be prohibitive.

The results shown by these curves are better than any heretofore produced by steam turbines of any make or size, and are very much better than those obtainable from the types of steam engines generally applied to the production of electricity.

It should be noted that these curves show a very high efficiency at light loads, as compared with results obtainable from steam engines, and that the efficiency does not fall off at overload, as it must

1. A paper read before the Philosophical Society of Philadelphia.

necessarily do with all engines which operate economically under normal full-load conditions. This light-load and overload economy is an important feature of the Curtis turbine, and arises from the fact that the functioning of its working parts is virtually the same under all conditions of load.

Figs. 4, 5 and 6 show the effect upon steam consumption of changes in the steam pressure, the degrees of superheat and in the vacuum. It will be observed that the superheat and vacuum curves are straight lines, so inclined as to indicate a great advantage by the use of all degrees of superheat, and also an immense advantage in the use of very high

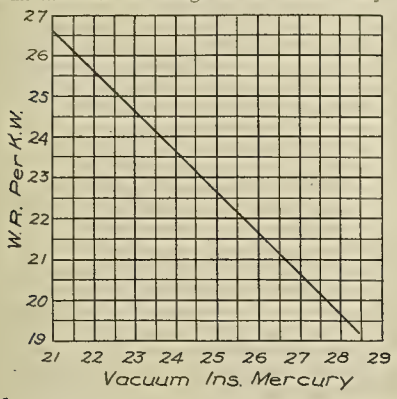


FIG. 6. CURTIS STEAM TURBINE.—CURVE OF WATER CONSUMPTION.

vacuum. The most important reason why the Curtis turbine so greatly surpasses the steam engine in economy is that it is adapted to use effectively the highest possible degrees of expansion, while in the steam engine it is practically impossible to provide for high degrees of expansion. As the exhaust pressure approaches a perfect vacuum, the volume naturally increases at a rapid rate—the volume of steam with a 29-inch vacuum being double that with a 28-inch vacuum. To handle high degrees of expansion it would, therefore, be necessary to make cylinders of steam engines very large, and this increase of size and weight of parts fixes a practical limit which cannot be passed without excessive cost

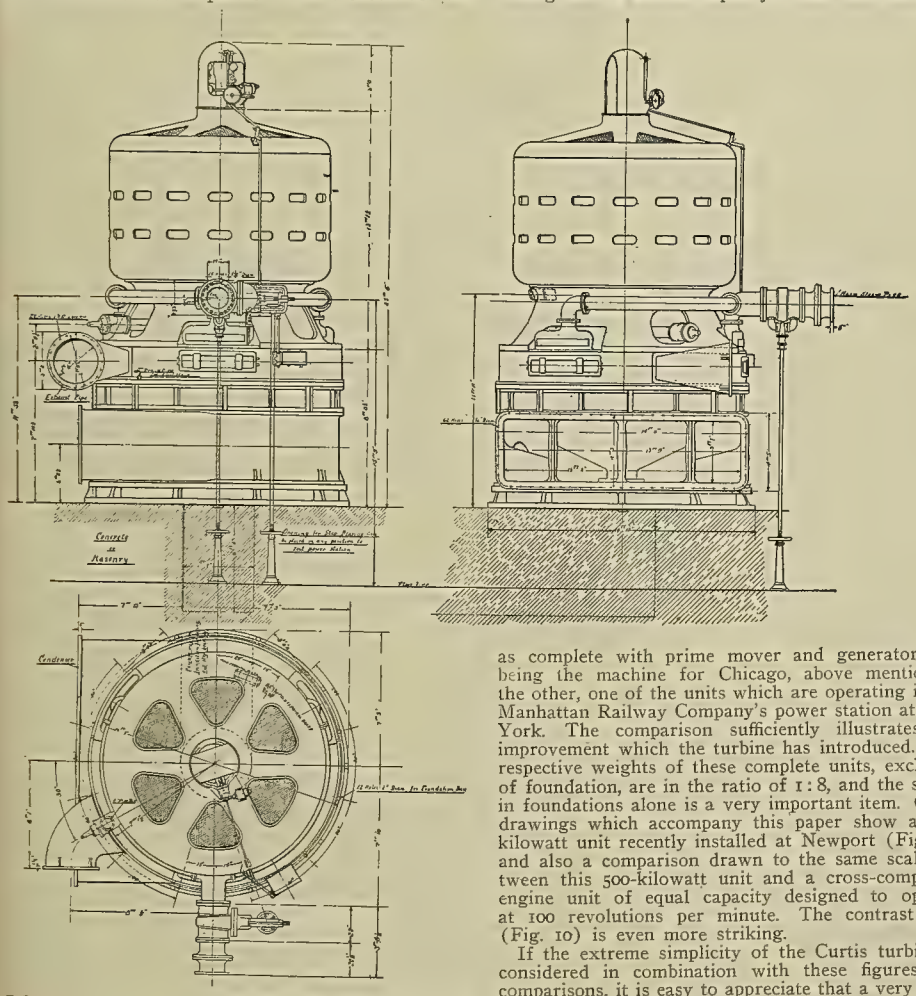


FIG. 7. CURTIS STEAM TURBINE.—5,000-KILOWATT UNIT WITH GENERATOR.

and complication. In the turbine the highest degrees of steam expansion are easily provided for, and consequently a much larger proportion of the total work in steam can be utilized by turbines than by steam engines.

There are other conditions in the Curtis turbine which make high degrees of vacuum more easily attainable than they are under ordinary conditions. The machine is so constructed that leakage of air into the vacuum chamber is easily rendered impossible. The leakage of air into condensing engines is considerable, and is generally not checked, owing to the small value of improved vacuum to an engine.

With turbines of the type here described no oil comes into contact with the steam, and, consequently, condensed water can be taken from surface condensers and returned to boilers. The use of surface condensers under such conditions renders unnecessary the introduction of air either in feed or circulating water, and consequently makes possible a very high vacuum with small air-pumping apparatus.

The results shown by these curves are obtained from a machine of 600-kilowatt capacity, and are naturally inferior to results which are expected from the very large units which are now being built. It is hoped that very soon after the reading of this paper a 5,000-kilowatt unit, which is now complete, will be put into operation in Chicago. This machine is expected to give considerably better steam economies than are shown by the accompanying curves,

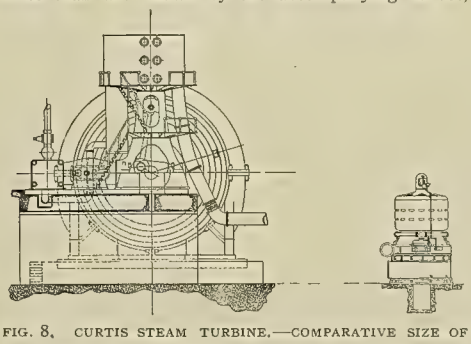


FIG. 8. CURTIS STEAM TURBINE.—COMPARATIVE SIZE OF 5,000-KILOWATT VERTICAL ENGINE AND TURBINE.

and will be superior particularly in the matter of light-load performance. The variation of efficiency in this machine, from half load to 50 per cent. overload, will not exceed 3 per cent.

The external appearance and dimensions of this 5,000-kilowatt unit are shown by Fig. 7, and Fig. 8 shows this unit compared with an engine-driven generating unit of similar capacity. Each unit is shown as complete with prime mover and generator, one being the machine for Chicago, above mentioned; the other, one of the units which are operating in the Manhattan Railway Company's power station at New York. The comparison sufficiently illustrates the improvement which the turbine has introduced. The respective weights of these complete units, exclusive of foundation, are in the ratio of 1:8, and the saving in foundations alone is a very important item. Other drawings which accompany this paper show a 500-kilowatt unit recently installed at Newport (Fig. 9), and also a comparison drawn to the same scale between this 500-kilowatt unit and a cross-compound engine unit of equal capacity designed to operate at 100 revolutions per minute. The contrast here (Fig. 10) is even more striking.

If the extreme simplicity of the Curtis turbine is considered in combination with these figures and comparisons, it is easy to appreciate that a very great engineering advance has been accomplished. It has been conservatively estimated that engine units, like those in the Manhattan company's station, can be replaced by turbines like that in Chicago, and that the cost of such replacement can be paid for by saving in operating expenses in three years.

Whenever an improvement has been effected in prime movers, the influence upon engineering and business conditions has been very marked. When the release cut-off principle was introduced by Corliss, a certain improvement in engine economy was effected, and although this improvement was accompanied by no diminution in cost, the change resulted in a very great activity in engine building and the renewal of most of the large mill engines in the country. It is, therefore, safe to predict that the influence of the steam turbine will be of radical importance. The steam turbine is, on account of its high speed, particularly adapted to the driving of electric generators, and its introduction will consequently

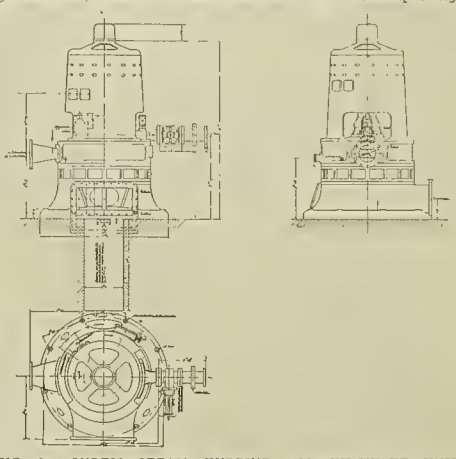


FIG. 9. CURTIS STEAM TURBINE. 500-KILOWATT UNIT WITH GENERATOR.

stimulate the use of electricity rather than other power transmitters.

In the past the most economical use of steam has been confined to the most expensive and elaborate plants, while in the future it will be within the reach of all where condensing water is available.

Westinghouse Companies in Europe.

Financially, the Westinghouse companies of Europe represent a share and debenture capital aggregating a total of $38,000,000, of which over $30,000,000 has been issued. Commercially the investment of this capital has proved profitable in itself, and has enabled the erection of six large factories, of which two are in England, two in France, one in Germany and one in Russia. The works at Trafford Park, near Manchester, where 27 acres are under roof, are considered the largest and at the same time the most perfect and up-to-date works of the kind in Europe.

The British Westinghouse Electric and Manufacturing Company has a share and debenture capital of £3,250,000, of which £2,750,000 has been issued. The shares and debentures stand at a considerable premium in the market. Among the important contracts which that company is now carrying out are those with the Metropolitan and Metropolitan District Railways of London; the Mersey Railway of Liverpool, the Clyde Valley Power Company of Glasgow, the Admiralty, the Savoy Hotel, the Manchester Town Council, etc. The Societe Anonyme Westinghouse of Paris has an issued capital of 20,000,000 francs, of which a large portion is placed with the leading financial houses of France. It has just secured an important contract with the Metropolitan Railway of Paris. There is a separate company for Russia, a separate company for Ger-

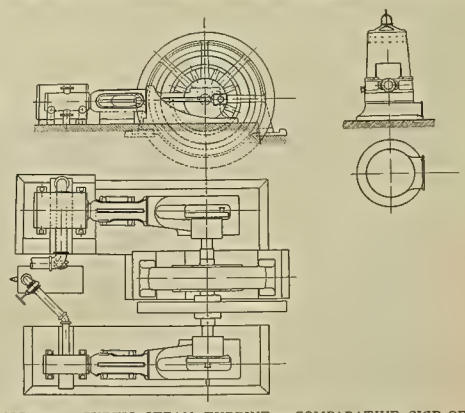


FIG. 10. CURTIS STEAM TURBINE.—COMPARATIVE SIZE OF 500-KILOWATT HORIZONTAL ENGINE AND TURBINE.

many, and the Westinghouse Brake Company, all of which are purely manufacturing concerns. The Traction and Power Securities Company is a financial company closely associated and co-operating with the different Westinghouse companies. Its capital is £2,000,000, of which at present about £1,000,000 has been issued. For the first period of its operation this company has paid a dividend of six per cent., after making ample provision for a reserve fund.

Mr. George Westinghouse, who directs the policy of all these companies, is chairman of most of them; and Mr. J. H. Lukach, who represents his interests on the other side, is on the board of all of them.

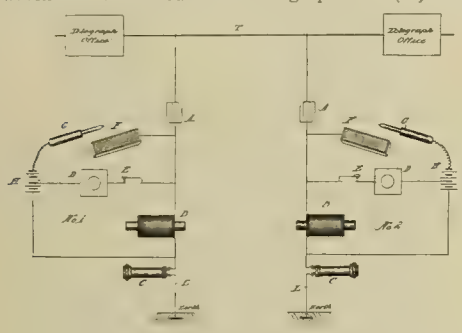
DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Attachment for Telegraph Lines.

In military operation in the field and in many other instances it is found desirable to have a simple, practical, and portable form of telephonic apparatus which is capable of being quickly adjusted to a telegraph line at any point, so as to utilize such line for telephonic purposes without impairing its value for telegraphic purposes and without any interference to the telephonic communications from the transmission of ordinary telegraphic messages. An arrangement which is designed to fill such want in a simple and practical way has been invented by Captain Edgar Russell of the United States Army. It consists in the particular arrangement of an inductance coil, a transmitter, a receiver, a local battery, a circuit interrupter and a condenser.

Referring to the accompanying drawing, (T) represents a telegraph line connecting more or less remote telegraph offices, to which line two sets of the telephonic apparatus are shown applied at any points along the line. The two sets of the apparatus shown at No. 1 and No. 2 are exact duplicates of each other, each comprising a calling, a sending, and a receiving device.

At (A) is a condenser, one set of the plates of which are connected to the telegraph line (T) and



TELEPHONE ATTACHMENT FOR TELEGRAPH LINES.

the other set to earth by wire (L), the insulation between the plates of the condenser preventing any direct contact between the telegraph line and the earth, and hence permitting the ordinary telegraphic impulses to pass over the line in the usual way without grounding at the temporary telephone stations.

At (B) is an inductance coil whose single coil is placed in circuit between the condenser and the earth; (C) is a telephone receiver; (D), the transmitter; (E), a push-button; (F), a roughened or file-cut plate; (G), a metal-pointed stylus, and (H), a local battery. The local battery has two circuits, one of which incloses a part of the cells of the battery, the transmitter, and the inductance coil for the proper operation of the transmitter and the other of which incloses the full strength of the battery, the inductance coil (B), and the circuit interrupter (F) (G), which constitutes the calling device. Both these circuits connect with the wire (L) at points between the condenser (A) and the receiver (C), which latter is placed next to the earth.

When station No. 1 wishes to call station No. 2 the operator at No. 1 drags the stylus (G) across the roughened plate (F), and the full strength of the battery circuit is rapidly made and broken through the inductance coil (B), which has somewhat the function of an autotransformer, and its self-induced discharges furnish the sudden variations in potential, which, acting through condenser (A), the telegraph line (T), and condenser (A) at station No. 2, produces on the diaphragm of the receiver (C) at station No. 2 audible vibrations that make the call. Having attracted the attention of operator at No. 2, the operator at No. 1 then separates the points (F) and (G) of the calling circuit and closing the push button (E) establishes the weaker talking circuit through the transmitter (D) and inductance coil. The talking vibrations in the transmitter now acting through the inductance coil (B) and condensers (A) (A) and telegraph line (T) are audible on the receiver (C) at station No. 2. The current fluctuations produced by the transmitter cause, in a manner analogous to the calling effect, high-potential variations in the condensers at the home and distant stations and effect the reproduction of audible speech in the distant receiver. The current impulses generated in calling are of such a brief character that they do not affect the relays of the telegraph line in their ordinary adjustments.

"In constructing the various elements of my apparatus for the best efficiency," says Captain Russell, "I make the inductance coil about four inches long, two inches in diameter, wound with No. 22 or 23 Brown & Sharpe insulated copper wire to a resistance of four or five ohms. The core is about five-eighths of an inch in diameter, built of soft-iron wires and projecting about two or three inches from each end of the coil. The coil thus constructed though of low resistance offers considerable impedance to fluctuating currents of telephonic frequencies, and by reason of this the impulses of the transmitter are not short-circuited, but pass to the earth and to the line. The transmitter should be of rather low resistance, and the receiver should be preferably an instrument of about 30 ohms resistance. The condenser for ordinary distances of 50 to 75 miles is about one microfarad capacity. The battery for distances stated should be about two cells of the ordinary dry type for the transmitter and four for the calling circuit. Preferably I employ a single battery coupled up for the two circuits, as shown; but it is obvious that two separate batteries may be employed."

Telephone News from the Northwest.

The Nicollet County Telephone Company has bought the local exchange at Gaylord, Minn. The company will install an exchange at Gibbon, Minn.

The Albert Lea Telephone Exchange of Albert Lea, Minn., is negotiating for the purchase of the Glenville (Minn.) Telephone Company.

The Eden Valley (Minn.) Telephone Exchange Company has been incorporated with $10,000 capital.

The Consolidated Telephone and Telegraph Company has reported gross earnings for the year ending November 30, 1902, at $2,156. This is the toll company of the Twin City Telephone Company and operates between St. Paul and Minneapolis and Duluth and Superior. The lines were opened in February of 1902.

The People's Telephone Company of Stewartsville, Minn., raised wages recently, voluntarily. Salaries are based on a certain per cent. of the company's earnings.

The Rocky Mountain Bell Telephone Company petitioned the council of Red Lodge, Mont., for a franchise for local and long-distance service. The Bell company recently sought to construct its lines in the city without permission, and was held up by the city authorities and fined heavily. The cases were appealed, and are now pending. The council refused the company the franchisie, but offered to allow it to run long-distance lines into the city over a toll line owned and controlled by the city.

The New Sharon Independent Telephone Company has been incorporated at New Sharon, Iowa, with $24,000 capital stock.

The Iowa Telephone Company will start work on extensive improvements to its system at Fort Dodge, Iowa. A new switchboard has been ordered and 1,400 feet of cable.

The Pottawattamie Mutual Telephone Company has asked a franchise for an Independent exchange at Council Bluffs, Iowa. This is the third Independent company to seek a franchise there.

A local company was granted a franchise for a telephone exchange at Sioux Rapids, Iowa. The Iowa Clark Automatic Switch Company of Sioux City was voted a franchise at Sloan, Iowa, as was the Peiro Telephone Company.

The Maple Valley Telephone and Telegraph Company has been formed at Mapleton, Iowa, with $100,000 capital.

The organization of the Commonwealth Telephone Company at Waterloo, Iowa, has been completed. The new company takes over the business of the Cedar Valley Telephone Company, and is capitalized at $900,000. The transfer was informally consummated in January, but has now been completed. The Waterloo exchange is to be entirely rebuilt on an automatic service furnished by the Automatic Electric Company.

The Twin City Telephone Company has awarded the contract to E. L. Dubois & Co. of Des Moines, Iowa, to construct 19 miles of subways in Minneapolis and St. Paul. R.

Indiana Telephone Notes.

Several telephone companies filed articles of association with the secretary of state last week. The Patriot and North Telephone Company (capital stock, $5,000) proposes to construct and operate telephones, telephone lines and exchanges in the towns of Patriot and North, connecting the two, and also extending the lines throughout Ohio and Switzerland Counties. Daniel Mead, E. E. Gregory and C. M. Douglass are the incorporators. The Perkinsville and Lapel Telephone Company (capital stock, $2,500) intends to build and operate a system in Perkinsville and Lapel, and in other portions of Madison County. The principal offices and exchange will be in Perkinsville. The incorporators are W. M. Garretson, O. A. House, J. F. Anderson and A. B. Hoffman. The Merchants' Telephone Company of Fontanet (capital stock, $15,000) proposes to construct and operate exchanges in Fontanet and throughout Vigo and adjacent counties. H. J. Lambert, Edwin King and W. J. Randall are the directors.

An important joint meeting of the officers and directors of the Logansport Home Telephone Company and of the Fort Wayne Telephone Company was held in Logansport on April 9th. Recently there was incorporated in New Jersey a company known as the Illinois and Indiana Long-distance Telephone Company, for the purpose of building and operating long-distance telephone lines. Steps were taken at the Logansport meeting to bring together soon representatives from all the Independent companies of Illinois and Indiana to confer relative to taking stock in the long-distance company. The directors of the Logansport Home Telephone Company have voted to expend $10,000 in extending its lines to Walton, Lincoln, Galveston, Young America, Burrows and other towns.

The Eureka Telephone Company will build an exchange in Corydon to connect with out-of-town lines. Lanesville is to have a new exchange and a new line is to be built from Breckinridge to Corydon.

The Crawfordsville Co-operative Telephone Company has asked the City Council for a franchise to use the streets for its system. The petition has been referred to a committee to investigate whether there is room for another system of poles. F.

Ohio Telephone Notes.

The Webster Telephone Company of Webster Township, Wood County, has been incorporated with a capital stock of $10,000 by Milan Jameson, J. S. Stebel, L. C. Fish, C. D. Hagerty, L. E. Philo and Antony Seifert.

The City Council of Springfield has issued a permit to the Springfield and Xenia Telephone Company to erect an exchange building on Center Street between Main and High Streets.

The London Telephone Company of Laurel County, Ky., has been incorporated with a capital stock of $10,000.

The London Home Telephone Company of London has been incorporated with a capital stock of $125,000. Ed. L. Barber, William M. Jones, W. J. Meech, Robert W. Boyd and Harry S. Mitchell are the incorporators. At the time of writing it could not be learned what the purpose of the new company is. The exchange at London is now operated by the Madison-Clark Telephone Company.

The Pratt Manufacturing Company, incorporated under the laws of West Virginia, has been authorized to do business in Ohio. The company will manufacture telephone appliances and will have its main office in Cleveland. Charles T. Pratt will be the agent and attorney. O. M. C.

Gossip of Telegraph and Telephone Merger.

From Cleveland a correspondent of the Western Electrician writes: "There seems to be a tendency on the part of some of the telephone men of Cleveland and other cities of Ohio to believe that the time for the telephone and telegraph merger is much nearer at hand than is generally believed. President F. S. Dickson of the Federal Telephone Company was reported in one of the Cleveland papers a few days ago in that light, and he gave as his reason that all the business of the telephone and telegraph companies can be done with one line of poles running into a town, whereas now there are from three to four. The expense of keeping up a line is large, and from two-thirds to three-fourths of the expense could thus be done away with. As to the charges, he says that all large corporations have learned that it is suicidal to their business to charge exorbitant rates, and that he believed that people would have no complaint on that score. While telephone people may believe that, there is a very strong tendency among the people of Ohio against mergers, and it would not be improbable that, were all the companies taken into one corporation, another lot of Independents would start up at once."

Lake Shore Railroad to Use Telephones.

Following the lead of the Illinois Central, Burlington, Alton and other western railroads, the management of the Lake Shore and Michigan Southern Railroad Company has practically decided to construct a private telephone system along its road to connect the division terminals. There will be 10 separate telephone stations between Chicago and Buffalo, and at the larger points, such as Chicago, Toledo, Cleveland and Buffalo, direct connection will be made with the company's private exchanges which serve the local offices in those cities. Two No. 8 copper wires will be used, they being strung on the telegraph poles now in use. The telephones will be used for general business that does not necessarily require a written record, and trains will be governed by telegraph, as at present. This plan, it is said, was first recommended by A. B. Newell when he was superintendent of the Chicago-Elkhart division four years ago, but it was never favorably acted upon until recently.

The Chicago City Council at a recent meeting granted a 20-year franchise to the Woodlawn Park Telephone Company, to operate in the district bounded by Fifty-seventh Street, Seventy-first Street, the lake and the Lake Shore and Michigan Southern tracks. The company is to furnish cheap telephones for strictly local business.

Wheatstone-bridge Telephone System.

Intercommunicating telephone systems that work efficiently and without interference between stations are necessarily rather complicated, and the ingenuity of inventors is frequently turned toward the simplification of the circuits and apparatus. John H. Mason of Philadelphia has recently devised a system of telephonic intercommunication between any number of pairs of stations disposed along a trunk line, by which a great saving of conductors is effected, besides avoiding all cross talk. A complete metallic circuit is used between each pair of conjugated stations, and still the number of line wires employed is reduced in such manner that when there are n stations the number of line wires used is only n+2. Fig. 1 illustrates in diagram six telephone stations connected in accordance with Mr. Mason's invention in such a manner that three pairs of intercommunicating stations may be worked simultaneously. Fig. 2 is also a diagrammatic view showing the system with six stations, each capable of communicating with every other one without cross-talk.

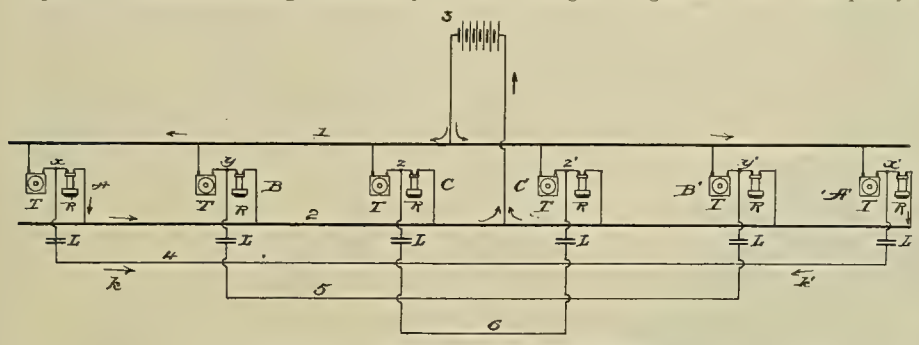


FIG. 1. WHEATSTONE-BRIDGE TELEPHONE SYSTEM.

The fundamental idea which underlies the invention is most readily understood by reference to Fig. 1. Two main lines (1) (2) are charged by a battery (3) or other source of current. In multiple-arc branches across the two main lines are arranged the telephone stations (A) (B) (C) (A′) (B′) (C′), the equipment of which is shown in the drawings as reduced to a transmitter (T) and a receiver (R) in series with each other. Transmitters are used, which in a state of rest have a rather high resistance. The receivers are also preferably made of comparatively high resistance. If the resistance of the receivers is comparatively low, an extra resistance should be added to the wire which connects it with the line (2).

Where the multiple-arc branches contain telephonic apparatus the variation of the resistance of one branch will not appreciably affect the other branches, and from this it follows that speech uttered against any one of the transmitters will not appreciably affect the receivers in the other branches. Under these circumstances, then, telephonic intercommunication cannot be practically carried on.

In addition to the two main lines (1) and (2), auxiliary lines are used, one extending between each pair of stations which are desired to be put into communication. These auxiliary lines are marked in the drawings (4), (5) and (6), each terminating at the respective stations between the transmitter and receiver, and in each may be placed one or more condensers (L), as indicated. Considering any one of two conjugated stations—say (A) and (A′)—the current from the battery divides upon the line (1), one branch running to the left and the other to the right, and each branch completed through a transmitter and receiver and one-half of the main line (2), as indicated by the unlettered arrows marked on the drawings. In this arrangement of circuit the left-hand half of the main line (1), together with the transmitter at station (A), forms one side of a Wheatstone balance, the right-hand half of the main line (1), together with the transmitter at station (A′), forming the other side of the Wheatstone balance which branches from the first. Similarly the left-hand half of the main line (2), together with the receiver at station (A), forms the third side of the Wheatstone balance, while the right-hand half of the main line (2), together with the receiver at station (A′), forms the fourth side of the Wheastone balance. The points (x) and (x′) are equipotential points, under the assumption that a balance of resistances exists as in the Wheatstone balance. Consequently in the normal condition of transmitters at stations (A) and (A′) no current will flow through the auxiliary line (4), which here constitutes the bridge wire of the Wheatstone balance, even if the condensers (L) were not placed in that line.

What has here been said about the auxiliary line (4) with reference to stations (A) and (A′) is also true of the auxiliary line (5) with reference to stations (B) and (B′) and is also true of the auxiliary line (6) with reference to stations (C) and (C′)—that is to say, each of the auxiliary lines constitutes a bridge wire of a Wheatstone balance, of which the portions of the main lines which extend from the battery to the pairs of conjugated stations with their transmitters and receivers form the sides. These sides must be balanced as respects resistance, in order that the best effects may be produced.

Under the assumption that the Wheatstone balances are in a state of practical equilibrium and that speech is uttered against any one of the transmitters—say against the transmitter of station (A)—the resistance on that side of the balance which extends from the battery along the left-hand half of the main line (1) and through the transmitter up to the point (x) is varied, is alternately increased and decreased. When this happens, the points (x) and (x′) will be at different potentials and current will flow through the auxiliary line or bridge wire (4) first in one direction and then in the other.

The resistance of the transmitter at (A) having been reduced, the current through the left-hand side of the Wheatstone balance will be stronger than that through the right-hand side. Consequently the potential of the point (x) will be higher than that of the point (x′), and a momentary electrical impulse will pass through the bridge wire (4) in the direction of the arrow (k), which will be added to the current already passing through the receiver at station (A′). The passage of this momentary impulse will not be impeded by the presence of the condensers in the bridge wire.

When the resistance at the transmitter at station (A) is increased, the current through the main lines will pass as before; but in this case the current passing through the right-hand side of the balance will be greater than that on the left-hand side. In consequence thereof the potential at point (x′) will be higher than that at (x) and a momentary impulse will pass through the bridge wire (4) in the direction of the arrow (k) and which will be added to the current already passing through the receiver at station (A). In this manner the current strength through the receivers is varied and speech is reproduced. Thus it will be seen that when speech is uttered against the transmitter at (A) both the home receiver and the distant receiver at (A′) are actuated by unidirectional varying currents, while alternating currents flow through the auxiliary line or bridge wire (4). During such operation neither of the intermediate stations is affected.

What has been explained with reference to the two conjugated stations (A) and (A′) is also true of the conjugated stations (B) and (B′) and of the conjugated stations (C) and (C′). Either of these pairs of stations may converse with each other without affecting the other, since each pair has its own auxiliary line or bridge wire.

In the arrangement so far described, where the system is a rigid one—that is to say, unalterable—owing to the absence of switches, each bridge wire or auxiliary line can only serve for two particular stations; but when the system is equipped as shown in Fig. 2 each bridge wire may do service for more than two stations. In fact, it may serve for connecting one station with any of the other stations of the system. While, therefore, in the arrangement shown in Fig. 1 it is possible only to converse between three pairs of stations, there being altogether six stations, it is, with the arrangement shown in Fig. 2, possible to establish intercommunication of each station with every other station on the system, and there being six stations altogether 15 different combinations are possible, although only three can work simultaneously. In Fig. 2 the main line (1) (2) is charged by a source of current (3) in the same manner as in the case of the arrangement shown in Fig. 1; but in this case the auxiliary lines (4), (5), (6), (7), (8) and (9) extend throughout the whole length of the main line, and branch connections from the same terminate at each station at the contacts of a switchboard, which contacts are marked (a) (b) (c) (d) (e) (f). The stations themselves are marked (A), (B) and (C) at one end of the line and (D) (E) (F) at the other end of the line. The equipment of the stations is identical.

Suppose any one of the stations desires to establish communication with any of the other stations. The rule of the system is that each party shall keep his switch lever normally upon his home contact. This is necessary in order that each party may be in condition to speak or be spoken to after it has received a call. If now station (F) desires to establish communication with, say, station (B), the operator at (F) will turn the switch lever upon contact (b), as shown, and will operate the push button (i). This sends a battery current through the call bell of station (B), as follows: From the main line (1) by conductors (g) (h), through push button (i), to switch lever (s), contact (b), auxiliary wire (8), to station (B), which it enters at contact (b) at that station and then passes to and through the call bell and by conductors (u^2) to spring contact (u), then by the telephone hook across to the spring contact (t), and from thence by conductors (h′) and conductor (g′) to the main line (2), and thus back to the battery. Having made the signal, the operator at (F) lifts his telephone from the hook, whereby the latter is allowed to rise and bridge the spring contacts (t′) (u′), as is usual in telephone systems, while the operator at (B), having received the signal, will likewise lift the telephone from the hook, which will also rise to bridge the spring contacts (t′) (u′). In this condition the two stations (B) and (F) are in speaking connection and in the same kind of speaking connection as is found between any of the two conjugated stations shown in Fig. 1—that is to say, the transmitter and receiver at each station are connected in series across the main line and a point between the transmitter and receiver at one station is connected with a point between transmitter and receiver at the other station by the auxiliary line or bridge wire (8). This closes the shunt across the main conductors, with the transmitter and receiver in series. Now one point of this branch circuit would be on the telephone hook, and since this latter makes contact with spring (t′) the upper point of that spring—the point (x′)—is also a point in the branch between the transmitter and receiver, and this point is connected with the switch lever, which in turn rests upon the contact (b), which is connected with the auxiliary line or bridge wire (8). Precisely the same connections are found at station (B), where the point (y) corresponds to point (x′) at station (F), so that it is true that these two stations are now in speaking

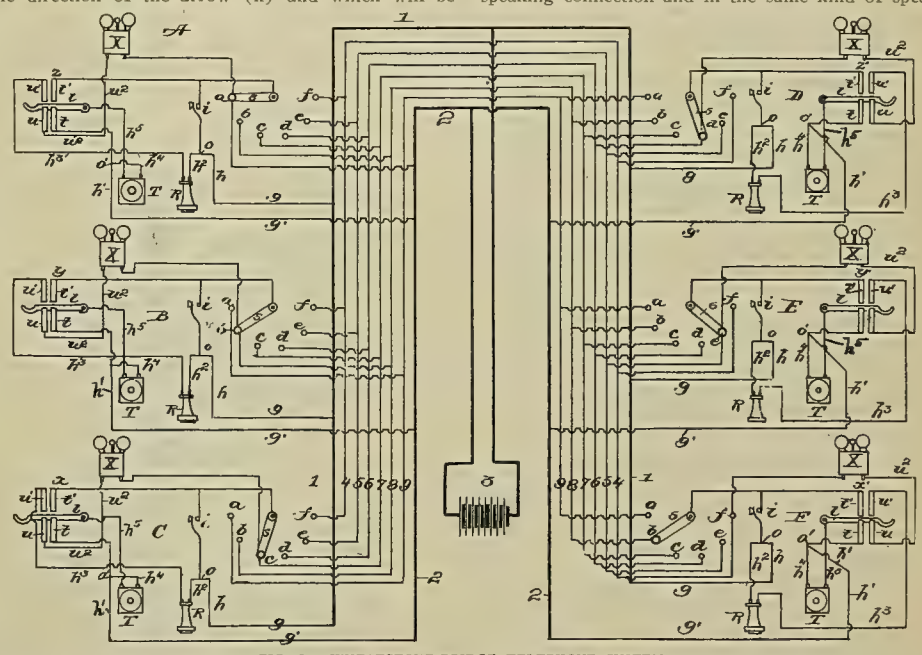


FIG. 2. WHEATSTONE-BRIDGE TELEPHONE SYSTEM.

connection in the same manner as any two con- [illegible] shown in Fig. 1.

It [illegible] understood that each station may call every other station by turning its switch lever upon the contact which is marked with the letter corresponding to that under which the station to be called is or may be known and then operating its push button.

The presence of the condensers (L) in the auxiliary lines while not impeding the passage of telephonic currents does prevent the passage of direct currents from accidentally crossing neighboring electric conductors or from other sources. Mr. Mason's invention is patented, the patent being assigned to the Wheatstone Bridge Telephone Company of Souderton, Pa.

Deadhead Nuisance in Telephone Service.

Every telephone manager will re-echo these sentiments of W. H. Butler of the Kent (O.) Home Telephone Company: "We are glad that telephone service is so popular and are doing everything in our power to increase the facilities to our subscribers, but there is one abuse of 'the telephone habit' to which we most strenuously object, and that is the free and indiscriminate use of telephones by non-subscribers. This works an injustice to the person paying for service, because while the aforesaid non-subscribers are using the telephone the line is busy and orders are lost in the case of business telephones, and legitimate subscribers are held out on important calls with residences. On the other hand, if non-subscribers impose on their neighbors continuously, one telephone may easily do the work of 10. The people thus imposed upon are annoyed and the company does not receive the natural fruits of its enterprise. Again, it is not within the province of the subscriber to give permission to the general public to use his telephone, for we have a written promise from everyone of our subscribers as follows: 'It is further agreed that no instrument shall be used except by the lessee, his immediate family or regular employes without the express consent of the company.' Our rates are based upon the promise contained in the above paragraph and there never was any intention of supplying an entire neighborhood with service from one telephone."

Rules for Long-distance Operators.

Chicago daily papers recently contained the statement that S. A. Crawford, the new Chicago manager for the American Telegraph and Telephone Company, had introduced a book of rules which Chicago telephone girls have been studying. The item further states that the book is full of formalities of diction such as Boston telephone operators are alleged to have been taught to use after a course of compulsory education and that the girls are wondering whether the Chicago man will approve the Boston way. When asked concerning the new rules to be adopted, W. E. Bell, district superintendent for the company, said: "This is another of those stories which originate in a reporter's head. We know nothing of the rules employed in Boston. It becomes necessary occasionally to overhaul the old rules and adopt new ones in order to keep abreast of the changing conditions of business. This we will do along the lines suggested by our own ideas. Mr. Crawford is distinctively a Chicago man, and the idea that he has adopted Boston rules is ridiculous."

TELEPHONE MEN.

H. W. Simmons of Hurley, S. D., is to be manager of the new telephone system to be constructed at Hudson, S. D., by the Hudson Telephone Company.

C. O. Duval has resigned his position as manager of the Findlay (Ohio) Home Telephone Company and has been succeeded by Irving W. Pope of New York.

A. E. Campbell has been elected secretary of the Strowger Automatic Telephone Exchange of Chicago. He was selected by President Elmer Washburn under the compromise plan adopted by the leading stockholders, who were contesting for control.

A reception was given for Dr. Alexander Graham Bell, the well-known telephone inventor, by the Chicago Oral Teachers' Club in the parlors of the Palmer House, on Saturday evening last. In addressing the club Dr. Bell emphasized the importance of speech teaching for instructing the deaf.

The report that the North American Telephone Company has acquired all of the Independent telephone properties in Texas, Oklahoma and Indian Territory is discredited in well-informed telephone circles. It is stated that the company in question has acquired some of the Independent telephone toll lines and local exchanges in Oklahoma, but that up to this time the Independent companies in Texas have not disposed of their holdings.

Fire-alarm Apparatus for Telephone Systems.

A fire alarm manufactured by the Illinois Electric Specialty Company of Chicago is put forth as a valuable auxiliary to telephone systems. The thermostat used in the apparatus is shown in Fig. 1. It can be so delicately adjusted, it is stated, that the slightest change in temperature can be detected. The thermostat is about the size of a watch-case receiver, and is made of brass, nickel-plated. A concave german-silver diaphragm centered with platinum is used, and the slightest change in temperature causes its expansion. The other point of contact is a platinum-tipped set screw, which is securely locked in position through the back of the case, from which it is thoroughly insulated. The case (X) thus forms one side of the circuit and the terminal (Y) the other side. The instant the temperature rises above the fixed point the connection is made and the alarm is given.

The diagram (Fig. 2) shows the method of connection to a telephone system. The apparatus does not require the change of a single wire on a switchboard or telephone, and works equally well on magneto-call or central-energy systems. The thermostats are connected in multiple and at the point marked (b) five cells of dry battery are used. This circuit terminates on the posts of the local alarm bell, as shown, the two lower posts of this bell being connected to the telephone circuit. The instant the heat rises above the danger point, the circuit is closed through the thermostat, the local bell rings and the drop is thrown at central, or, in case of a central-energy system, the signal lamp is lighted, the operator plugs in to answer the call, and, instead of getting a reply, gets a "howl" from the local alarm.

Slight changes in temperature can be detected if desired, but for fire protection the thermostats are usually adjusted to 140 degrees. The contacts being platinum, and enclosed in a dust and moisture-proof case, there is small danger of failure in the working of the alarm. As the system costs practically nothing to maintain and little to install, many companies are now furnishing and leasing this fire protection in connection with their telephone service and find it profitable. Large grain-elevator companies are installing the apparatus for detecting the heating of grain, and railroad companies and users of machinery use it for detecting the heating of bearings. It may also be used in dry rooms and kilns, in fact, in any place where it is desirable to detect a change in temperature.

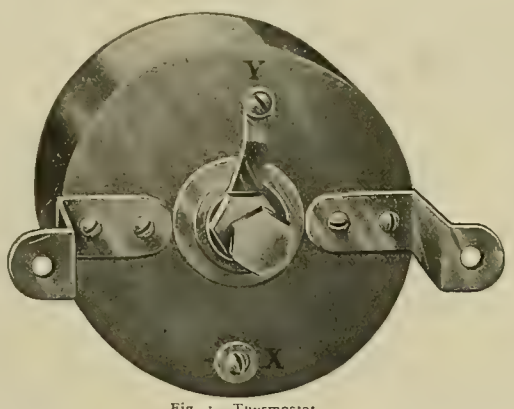


Fig. 1. Thermostat.

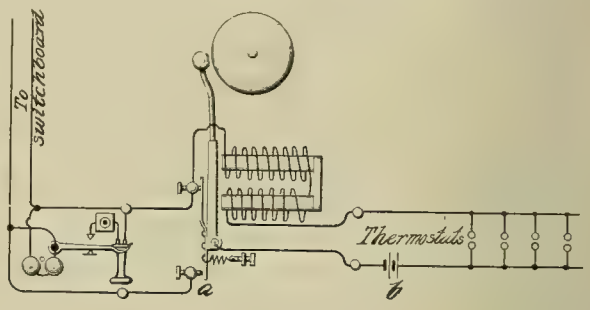


Fig. 2. Diagram of Connections.

FIRE-ALARM APPARATUS FOR TELEPHONE SYSTEMS.

NEW COMPANIES.

A new organization, the Montana Telephone Company, has been started at Chouteau, Mont., to place telephone lines through that section of the state.

The Goodhue Hill and Goldendale Telephone Company has been incorporated at Goldendale, Wash. A. B. Courtney is interested.

H. M. Swartwood of the Moscow (Idaho) State Bank, with a number of business men of that city, announce the organization of the Interstate Telephone Company. The new company will have headquarters at Moscow, and put overhead wires throughout the country.

The Marion Telephone Company of Marion, Ill., was incorporated recently. The object of the company, which has a capital of $15,000, is to construct and operate a telephone exchange. The incorporators are J. B. Bandy, J. C. Mitchell, A. F. White and Jacob Goodall.

On April 7th the City Council of Delphos, Ohio, granted a 25-year franchise to H. L. Canfield for the erection and operation of a telephone system. A complete and modern plant will be installed. Mr. Canfield also controls the interests of the Delphos Electric Light and Power Company.

The annual meeting of the Gainesboro Telephone Company at Gainesboro, Tenn., was held recently and all of the old officers were re-elected, with G. W. Stephens, president. The company has about 25 exchanges and 2,000 miles of toll lines. A number of new exchanges and toll lines will be built. The capital stock is $165,000.

Evansville Telephone Situation.

The interesting telephone situation in Evansville, Ind., was enhanced last week by the actual incorporation of the Evansville Municipal Telephone Company. This company has a capital stock of $390,000, of which $190,000 is preferred and divided into 7,000 shares of $25 each. Three hundred Evansville citizens have subscribed to shares of the preferred stock. The receipts from the sale of the preferred stock are to be expended for the installation and equipment of a telephone plant in Evansville and fitting it for service for at least 2,000 subscribers, with an ultimate switchboard capacity of 7,200. The preferred stock bears 3½ per cent. interest semi-annually, and is redeemable at par at the end of five years. Every holder of 40 shares of preferred may take also one share of common stock, but the common must be surrendered with the preferred at par. The city has accepted 7,900 shares of stock in the company. This sum is calculated to represent the value of the franchise granted by the council.

The success of the undertaking depends largely on the result of the suit to prevent the ousting of the Cumberland Telephone Company (Bell) which assumes to have a perpetual franchise in Evansville, and which is making elaborate plans for a protracted stay in that city. The Cumberland Company is erecting an imposing up-to-date telephone building on Sycamore Street, and asserts that it will install one of the finest telephone plants in the world. This company has, of course, the valuable Bell long-distance connections, and if the Federal Court sustains its contention, it will pit an established system, experienced management and unlimited capital against a new system and service, inexperienced political management with limited capital.

GENERAL TELEPHONE NEWS.

The Greenville Home Telephone Company of Greenville, Ohio, on April 1st purchased the Versailles plant. This gives the company connection with six towns, with about 1,800 telephones, in Darke County.

Arrangements have been completed for the consolidation of the Houston Telephone Company and the Home Telephone Company of Clarksville, Tenn. This will be one of the strongest Independent telephone concerns in the state.

It is announced that the long-distance telephone line which John Woessner of Saltillo, Mexico, is building between Monterey and Torreon will be completed and open for business about May 15th. The distance between the two cities is about 300 miles.

The Skamania Co-operative Telephone Company has been organized at Stevenson, Wash. The company proposes to construct and operate a line from Washougal, where it will connect with the long-distance line which extends on the Columbia to Carsin and Collins.

MANUFACTURERS AND DEALERS.

A letter has been received at the office of the Stromberg-Carlson Telephone Manufacturing Company, Chicago, from President Roosevelt, in acknowledgment of receipt of a gold paper weight, which was a reduced model of the Stromberg-Carlson receiver, mounted on a base. A small silver plate bearing the words "To the President," fastened to the base completed the attractive and appropriate souvenir, which was presented to the president on April 2d as a souvenir of his visit to Chicago.

President and Treasurer E. B. Overshiner of the Swedish-American Telephone Company, Chicago, announces that he has disposed of the telephone publication known as Sound Waves. It is stated that this paper will now be published by a firm that is not affiliated with any manufacturing concern. The Swedish-American Telephone Company during the last year has prospered and the fact that it will shortly occupy a new and much larger building on Jackson Boulevard, bears evidence of the continued success of Mr. Overshiner's enterprise. The Swedish-American company has always had for its motto "The best goods at fair prices," and to-day it stands among the leaders in the Independent telephone industry.

Standard Switchboards for Small Isolated Plants.

In most instances where small isolated electric plants have been installed for lighting one or two buildings, no standard lines have been followed, and consequently the switchboard had to be specially designed for the requirements of each case. No uniformity has prevailed, and the renewal of parts has caused great inconvenience. As a solution of this difficulty, the General Electric Company of Schenectady, N. Y., has recently placed upon the market a line of standard switchboards for small isolated lighting plants. The design includes a complete series of combination generator and feeder panels for direct-current service. Each of these panels is a separate and complete switchboard, and is not intended for combination with other panels. The greatest care has been used to determine the best and most economical form of switches and instruments for this class of service, and while the usual standard finish and efficiency have been maintained, the cost has been kept within reasonable limits. These small-plant switchboards are manufactured only for use on voltages of from 125 to 250 continuous current.

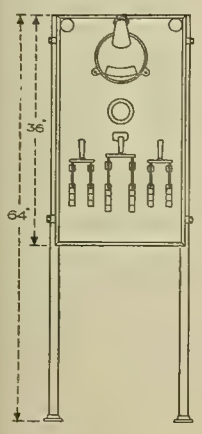


Fig. 1. Front of Board.

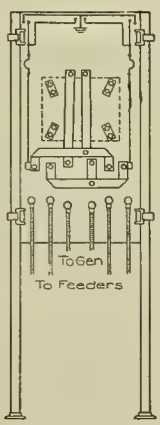


Fig. 2. Rear of Board Showing Electrical Connections.

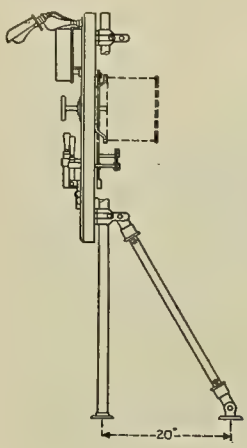


Fig. 3. Side View.

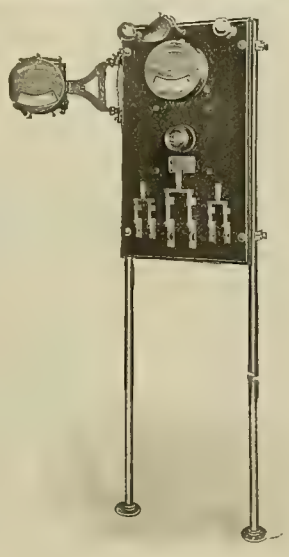


Fig. 4. Front of Board.

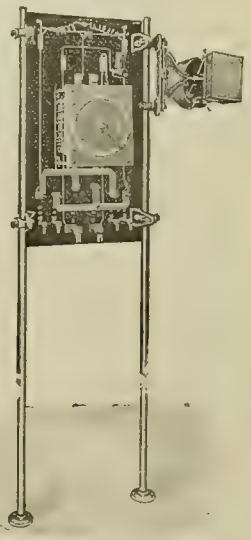


Fig. 5. Rear of Board.

STANDARD SWITCHBOARDS FOR SMALL ISOLATED PLANTS.

These standard switchboards provide for the generator and two feeder circuits. A careful investigation of the existing conditions in small plants indicates that this arrangement provides for all ordinary classes of service.

The material used in the construction of these switchboards is a fine variety of slate, which is selected with special reference to freedom from metallic or other impurities likely to impair its insulating qualities. The panels are hand finished to a perfectly smooth surface, after which several coats of lacquer are applied, thus producing a dull black, but extremely smooth surface. The slate is 1½ inches thick, has square corners and bevel front edges. The dimensions of the slate are 36 by 16 inches to 20 inches, depending upon the capacity. All exposed metal parts on the front of the switchboard, except the live copper, have dull-black finish.

The support of these panels consists of two one-inch gas pipes, each 64 inches long, the panels being fastened to the pipe by means of four cast-iron clamps, while the pipes are held in position by two cast-iron flanges, which are bolted to the floor by lag screws. Fastened to the center of each of these pipes is a tie rod, which permits the panel to be supported from the wall, from the machine frame, or to stand in the center of the room. These tie rods are provided with the necessary clevises, which have a hinged joint that will allow the flanges at the end to be bolted in a vertical, inclined or horizontal position.

The rheostats are not included with the standard switchboards. The panels are, however, supplied with four wrought-iron legs, which are so arranged as to support the standard rheostats used with the machine corresponding to the rating of each standard size of switchboard.

The switches used on all panels of this class are the well-known General Electric form-D lever switches. They conform to the underwriters' requirements, and have solid forged clip blocks and studs, and the blades are rigidly fastened to the cross-bars. The blades, clips, clip blocks and studs are of copper, and all the smooth surfaces have ground finish. The handles of the switches are hardwood, with a hard-rubber black finish.

Three complete sets of fuses are provided with all switches. Each feeder fuse has approximately 75 per cent. of the capacity of the generator fuse.

On all of these panels the current indicator is permanently connected to the generator circuit. This current indicator is the company's round-pattern, form-B. This instrument is particularly adapted for long continuous hard service. Its few parts are strongly constructed, and, having no spring, it is free from any element likely to change. The current indicator is mounted in a cast-metal case having raised letters and finish to correspond with the general finish of the board.

A potential indicator is not provided with these panels, since in some installations where they will be used, the illuminating lamp of the current indicator may serve sufficiently well as a pilot lamp. A potential indicator of the same type as the current indicator previously described, and provided with either a pivoted bracket supported at the top of the panel, as shown in Fig. 6, or with a swinging bracket supported at the side of the panel (Fig. 4) is, however, carried in stock as a standard extra part, and all panels are drilled for mounting these brackets. The manufacturer recommends that all panels be ordered with this item to facilitate good voltage regulation.

The standard two-lamp ground detector is used on the panels; that is, one lamp is connected from each bus-bar to the ground, the voltage of the lamp always being the same as the voltage of the panel. A 16-candlepower lamp supported on a curved lamp bracket with a half-round metal shade is included with each of the panels.

When a panel is installed and later it is desired to have a pivoted potential-indicator bracket mounted on top of the board, the lamp bracket should be removed from the panel. This will allow for the mounting of the pivoted bracket without any additional drilling of the panel. The lamp bracket may then be mounted on the pivoted bracket, which is so designed as to receive it.

The potential indicator mounted on a swinging bracket is not supplied with a lamp bracket, as the lamp on the panel will illuminate the potential indicator properly if the swinging bracket is swung at a slight angle.

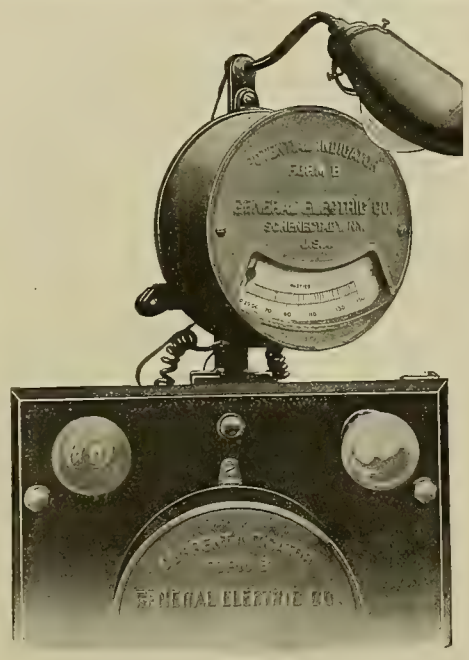


FIG. 6. POTENTIAL INDICATOR ABOVE SWITCHBOARD PANEL.

The electrical connections of the various parts of the panel are shown in the diagrams, Figs. 1, 2 and 3. All connections are made of bar copper, and terminals are provided for connections to the system. The board is illustrated in front and rear views is Figs. 4 and 5. The boards are made for capacities from 0.75 to 40 kilowatts, with current capacities from 10 to 200 amperes. Each board weighs 500 pounds.

A German View of the St. Louis Exposition.

To see ourselves as others see us is sometimes a salutary occupation. For that reason readers of the Western Electrician will be interested in the following article, written by Otto Waldau, and translated from a recent issue of the Zeitschrift für Elektrotechnik und Maschinenbau. The title of the contribution is "Shall Germany Exhibit at St. Louis?" The author says:

In 1904 the World's Fair at St. Louis will be opened, and already the attention of all the world is directed toward it. The Press Bureau of St. Louis is exceedingly active. Almost daily the papers are filled with glowing descriptions of the unlimited number of wonders to be seen there. In order that the public may have faith in these descriptions, an ingenious scheme has been resorted to. The International Press Congress, which met at Berne last year, was invited by the exposition management to visit St. Louis at its expense, and this invitation has been accepted. The convention for this year will therefore be held at St. Louis. The very least that the individual journalists can do in return for such uncommon hospitality will be to publish in their papers descriptions of the prospective exposition.

There will doubtless be many strange, interesting and new things to be seen along the banks of the magnificent Mississippi, even though these may not purposely be things of beauty, for the views of the Americans on this point hardly agree with ours. However, such a visit will well repay those who have never seen America and who are rich both in purse and in time. Of this much will undoubtedly be told as soon as the representatives of the various nations send in their respective reports. These representatives will not, of course, see very much of the exposition a year before its formal opening, but this is not absolutely necessary so long as they are possessed of a vivid imagination which will enable them to picture in completeness that which is now in a most unfinished state. If, however, any visitors, thus drawn to the exposition, should be disappointed in what they find there, a visit to the United States will fully satisfy them.

As regards German industries, the matter assumes a different aspect. The above-mentioned Press Bureau is emphasizing the fact that the three countries of highest culture, Germany, France and England, have officially signified their willingness to become exhibitors. However, the importance of this fact should not be overestimated. In view of the friendly relations existing between these countries and the United States, a refusal on the part of these countries to participate in the exposition would be little short of an insult. These nations naturally desire to maintain their friendly relations with America. In other ways the official heads of Germany, England and France have not encouraged their respective industries to become participants. This may be due to the fact that the various governments see no advantage to themselves by sending exhibits to the exposition, which exhibits ultimately become a loss to the exhibitors. An increase of European exports will hardly result while the present excessive import duties are maintained by the United States. We are not considering the unsettled question whether a direct profit will be secured by exhibiting, for considerable expense is entailed thereby. The experience

[illegible] indicates the negative of this. [illegible] discussion another point should be considered, and this would cause even the most optimistic to hesitate. As soon as the general plan of a World's Fair at St. Louis had been decided on our trade press attempted to ascertain what provisions would be made for protecting copyrights, and in general how similar matters were to be treated, which information is an absolute prerequisite to exhibiting. These attempts were unproductive of results, for, instead of a concise statement, the inquiries brought only vague promises and general statements. At the convention at Berne this matter was discussed in private, and at that time the American delegates promised faithfully that they would make a definite proposition within a few weeks. This was in July. It having become high time for our manufacturers to make necessary preparations, the American delegates were reminded of their promise, with the result of more promises and evasions. A few months ago a representative of the United States government from Washington came to Berlin to bring the negotiations between these countries to an issue. At that time Privy Councilor Lewald was appointed commissioner. A statement was now requested from the United States representative, Mr. Thomas Wilbur Gridler, who, however, declined in a most courteous way and referred the German commissioner to the delegates who had been sent to Berne. By the impartial observer but one conclusion can be formed; that the rights of the foreign exhibitor cannot be protected, and therefore our industries should refrain from exhibiting, at least until such time that a clear and definite statement of these conditions will be made. Whether or not it will then be too late for the German exhibitor is a different question, for if any advantage is to follow from an exhibit at St. Louis it will be only if sufficient time is available to plan each exhibit carefully.

Electric Street Lighting from the Central-station Viewpoint.

Mention has already been made in the Western Electrician of the report submitted to the mayor of New York city by Robert G. Monroe, commissioner of water supply, gas and electricity, in which he recommended the establishment of a municipal electric street-lighting plant. Representations were made in this report concerning the cost of street lighting in other cities and the claim was made that the cost to the city of New York for public lighting was greater than the cost in the other cities selected by Mr. Monroe as a basis of comparison. A bill is now before the New York state Legislature which, if passed, will enable the city to establish such a plant, and at a recent hearing on the bill John M. Bowers made an interesting statement on the lighting question on behalf of the Consolidated Gas Company. He answered Mr. Monroe's statements in regard to ordinary gas lamps, incandescent-mantle gas lamps and electric arc lights. An abstract of his remarks on electric lighting is given.

The main criticism of Mr. Monroe is directed to the cost to the city of electricity as an illuminant. He states that the prices paid in the Borough of Manhattan for a 2,000-candlepower lamp is $146 per year; that he has secured reports from 68 cities throughout the country showing the prices paid in those cities for supplying the same with lamps of 2,000 candlepower, and that the average cost is $88.60 per lamp per year.

Concerning the question of electricity, it is proper to say:

The electric-lighting companies in the city of New York have from time to time voluntarily reduced their rates to the city and private consumers without any pressure from the municipal authorities or legislative action.

The cost for arc lamps in the Bronx, involving nearly 1,000, was reduced in 1902 from 45 cents to 40 cents per lamp per night, and a number of lamps in special localities in the Borough of Manhattan, for which the city had previously paid 50 cents and 45 cents per lamp per night, was reduced to the uniform rate of 40 cents.

The Edison Company also reduced the price of electric current in 1898, and at the same time modified its price schedules, so that the smallest as well as the largest consumer could obtain a discount.

A second reduction was made two years later, and on September 1, 1902, the third in the series of reductions made and contemplated was announced, this change reducing the maximum price of electric current from 20 cents to 15 cents per kilowatt-hour. This reduction, in many cases 25 per cent. from former bills, will amount to nearly $400,000, the entire expense of electric street lighting in the Borough of Manhattan for one year.

This change will be the better appreciated when it is recalled that in Chicago and Boston, where many items of cost are lower than here, the maximum price is still 20 cents per kilowatt-hour.

On analyzing the table prepared by Mr. Monroe as a basis of comparison with bids made for electric lighting for lamps in the city of New York, we find:

The electric-light plants in some of the cities so selected are operated by waterpower; many of them have limited light schedules of 3,500, 3,650, and 3,800 lighting hours per year, instead of 3,950, as required by the New York schedule. In many of the selected cases the current supplied is far less than required in New York.

In almost every case the service is largely, if not entirely, overhead, with wooden poles or outriggers, and in but one case is the service entirely underground, as in the Borough of Manhattan.

It is, therefore, apparent that the general figures collected by Mr. Monroe form no basis for a comparison with the fair cost of electric lights in the city of New York.

The main basis of comparison, however, that is made by Mr. Monroe, both on the question of incandescent mantles and the question of electric lighting, is the cost to the city of Chicago. It is claimed in his report that the cost to that city by reason of the operation of its municipal plant in the year 1902 was, for electric lighting, a total cost per lamp of 2,000 candlepower the sum of $53.51.

An examination of the reports of the city of Chicago, as corrected by Haskins & Sells, as to the cost per lamp for its municipal system of electric lighting for the entire period of its existence, to wit, from the year 1888 to and including the year 1900, was at the rate of $165.62 per lamp.

It seems, therefore, scarcely reasonable to select a particular year in which it is claimed that the cost was way below the average as a basis of comparison. Neither can any comparison be safely made with such cost, for the reason that items aggregating a large amount are wholly omitted in preparation of the figures.

On examining this question, we find that careful and exhaustive investigations have been made of the same matters cursorily covered by Mr. Monroe by other municipalities, and especially by the city of Boston. The investigation made by that municipality which led finally to the making of a 10-year contract with the Boston Electric Light Company for the supplying of electric lights to that city, was in the year 1898. In the preceding year the estimate of the cost per lamps at Chicago was the sum of $87.38. Omitted items were estimated by the Boston authorities as raising this estimated cost of $87.38 to the sum of $153.03, and this latter cost, by the addition of certain items of difference existing between Chicago and Boston, was increased to the sum of $154.80 for Boston conditions. This latter item would have been $170.40, had the Boston system, as is the case in the Borough of Manhattan, been entirely underground.

Accepting as correct the claim that the city of Chicago did in 1902 supply itself at a cost of $53.51 and supplying omitted items, as was done in the Boston investigation, it will be found the real cost to that city would be the sum of $119.16, and then, by correcting the same figures so as to apply to the conditions existing in Boston and New York with an underground system, it will be found that the true cost, based upon the Chicago estimate, as above, is at the rate of $138.81, instead of $53.51.

There can be no doubt that the cost of supplying public lighting to the municipality of the city of New York is at least, as great, if not greater, than the city of Boston. The mere cost of the real estate essential for the use of the plants in the city of New York, as compared with the cost of land necessary for the same purposes in the city of Boston, will in itself considerably increase the cost of production. As an example, the land on which the Boston electric station is built cost at the rate of 30 cents per square foot, while the land on which the Water Side station of the New York Edison Company was built cost at the rate of $5.75 per square foot.

While Chicago is adopted as the main basis of comparison by Mr. Monroe, he also makes reference to the cost of the Detroit municipal plant. It may be stated that less than 10 per cent. of the Detroit service is underground, the current is less, and the lighting schedule is 3,744 hours, instead of 3,950 hours, as required by the New York contracts, and over 4,100 hours as actually delivered.

If based upon a comparison with the cost to the Chicago authorities during the entire period of the existence of their municipal plant at the rate of $165.62 per lamp, the bids made for electric lighting in the city of New York are $19.62 better.

If based upon a comparison with the cost in the year 1897, in the city of Chicago, and increased in accordance with the difference in cost by the difference in local conditions as between Chicago and Boston, or New York, the difference is between the sum of $170.40 and the sum bid in New York, to wit, $146, or $24.40.

And even when based upon the alleged cost to Chicago in the last year of $53.51, such cost when increased by omitted items and by comparisons with the differences in local conditions as between Chicago and New York, will be the sum of $138.81, or $7.19 less than the bid of the electric-lighting company in New York.

In considering the question of the cost of furnishing gas or of furnishing electric lights in the city of New York, there must also be borne in mind the exceedingly onerous conditions under which the corporations exercise their franchises in this city.

One thing is certain, and that is, that the cost at which electric light has been furnished to the city of New York by the Brush Electric Light Company, which uses three-fourths of its output for city lighting, is at a figure which, since that corporation placed its wires underground, has paid no dividends and has not produced a sum over operating expenses sufficient to meet even a reasonable allowance for depreciation.

Aside from the cities of Chicago and Detroit, Mr. Monroe's tabulation contains no city of any large size operating municipal plants. No statement whatever is made of the conditions under which these plants are operated, whether by waterpower and overhead or underground system, and, indeed, no reference whatever is made to any local condition. It cannot for a moment be seriously contended that any basis of comparison can justly be made upon such a small number of cities or with such meager information. No other city has ever pretended to act on such an investigation.

The five important cities that have undertaken or seriously considered municipal ownership are Chicago, Detroit, Boston, Philadelphia and Worcester.

The city of Philadelphia for many years managed its own public lighting plant. Notwithstanding that gas was sold to private consumers, giving to the city the benefit of profits derived therefrom, the result was that the manufacture and sale of gas was conducted at such an enormous loss that the city was glad to abandon the same and lease its plant to a private corporation.

In December, 1901, the city of Worcester investigated the question of municipal ownership. The committee appointed to make inquiries obtained reports from a number of municipalities engaged in supplying electricity with a municipal plant. The result of the inquiries made was that the average cost per lamp-hour of the street arcs furnished by the municipal plants in the state of Massachusetts, as shown by the reports of the board, was, for a 500-watt lamp, 4.58 cents per lamp-hour.

At the present bid of the New York Edison Company, a standard arc lamp at 4,100 hours per annum costs $3.56 cents per lamp-hour.

The result, therefore, of the Philadelphia, Worcester, and Boston agitation justifies the conclusion that the Consolidated Gas Company has in the past, and will in the future, supply the city with municipal lighting of every kind at a far less expense than would result from any municipal ownership.

In reply to Mr. Bowers' statement Commissioner Monroe is credited with speaking as follows:

"Mr. Bowers attacks the official reports of Chicago and Detroit, the two largest cities in this country which operate municipal electric-lighting plants for public purposes. During the entire period of the existence of the municipal plant in Chicago, viz., from 1887 to 1902, inclusive, the total appropriations both for construction and maintenance were $3,401,663.05. The total number of lamps used during this entire period was 26,795. At an average cost of $165.62 per lamp per year (the price given by Mr. Bowers), it would have cost Chicago over $4,400,000.

"According to Mr. Bowers' figures Chicago has expended merely on the maintenance of its municipal electric lights $1,000,000 more than was appropriated by the city government to build, operate and maintain the plant. Who can have provided this enormous sum of money? Mr. Bowers gives Messrs. Haskins and Sells as his authority for these figures, but I can find no such statement in the reports of these accountants.

"During the period mentioned Chicago could have rented its electric lights at the average price of $132 per lamp of 2,000 candlepower per lamp, very much less than Mr. Bowers tells us their own muncipal lamps have cost Chicago."

Wisconsin Summer School for Artisans.

The Summer School for Artisans, which is held under the direction of the College of Engineering of the University of Wisconsin at Madison, Wis., will be opened on July 6th next for its third annual session of six weeks. At the first session there were 44 students in attendance, and this number was increased to nearly 70 at the second session last summer. That there is a great demand for instruction of this grade is shown by the large number of men enrolled with the correspondence schools. Although such preliminary work is not essential in order that a student may derive the greatest good from the work given in the School for Artisans, those who have had correspondence-school work are in a much better position to profit by the laboratory work given there.

The Summer School for Artisans is in no sense a private commercial undertaking, but is a public enterprise conducted by the state of Wisconsin for its citizens and for men of other localities who may wish to benefit themselves by such a course of study. Courses are offered in steam, gas and other engines, applied electricity, machine design, materials of construction, fuels and lubricants, shopwork and surveying. The electrical work is in charge of Professor B. V. Swenson, J. W. Shuster and G. A. Scott. Information concerning the school may be obtained from F. E. Turneaure, acting dean of the College of Engineering, at Madison, Wis.

Fire and Police-alarm Telegraph and Electrical Inspection in Chicago.

During the year ended December 31, 1902, as shown by the annual report of City Electrician Ellicott, the Bureau of Fire-alarm Telegraph placed 239 miles of wire underground and rebuilt 141 miles of old lines with copper wire. The office equipment was rebuilt and improved and is now of the most modern character. The operation of the system as a whole was successful, and the failure of two boxes, which proved defective, did not cause any additional damage on account of the delay that ensued.

The total number of alarms received and transmitted aggregated 6,989, of which 3,427 were box alarms and 3,362 alarms by telephone. Eighty-eight second alarms, 35 third alarms, 28 second and third alarms combined, and 49 calls for special detail of apparatus, are included in the total given.

The total number of fire-alarm boxes in service on December 31, 1902, was 1,413, five new boxes having been placed during the year. There was 474,309 feet of cable and 6,742,163 feet of wire in use.

Practically no extension was made to the police-telegraph service during the year. The present equipment consists of 59 chemical recording circuits, 25 ink-recording circuits, 12 common-battery telephone circuits, 71 local-battery telephone circuits, 40 police stations and 1,007 patrol boxes on circuits. A total of 131 telephone operators is required. During the year 4,047,923 reports were received from policemen in district and 63,325 alarms responded to.

Harry H. Hornsby, chief electrical inspector, in his report to Mr. Ellicott, says that the character of work done at the present time by the Bureau of Electrical Inspection is materially better from a fire-protection standpoint than the work done in 1901. He comments on the new rule which forbids the installation of unprotected wires in concealed places and says that since metallic conduits have been in general use, not one case of fire has come to the attention of the department where such class of construction was used.

The revenue of the inspection bureau shows an increase of $12,834.31 over the preceding year, while the expenses are $42.47 less, showing a net increase in the profits for the year of $12,876.78. The number of fires attributed to electrical origin is 115, or 15 less than in 1901. The loss in 1901 was $2,735.10, and in 1902, $6,907; $2,225 of the loss for 1902 occurred on elevated railways not under the jurisdiction of the bureau.

At the time of the report there were 850 electric signs erected over sidewalks and 115 in process of construction and erection. The supports of 165 signs were found defective, and were required to be reinforced or repaired. Fifty-four sign permits were refused for various reasons, and a number of signs removed on account of dangerous conditions.

Mr. Hornsby says there is no excuse for the indiscriminate construction of electric signs, and the latitude allowed in the size and conditions under which they are erected. An ordinance regulating the size, manner of erection, maintenance and use as electric signs has been before a council committee for several months, but no action has been secured. As the matter now stands, the city assumes the liability for all accidents that may occur, and has not even protected itself to the extent of prescribing by ordinance reasonable and safe rules for the erection and maintenance of the signs nor a fee to provide for a necessary periodical inspection.

During 1902, 25,907 inspections were made. There were 5,053 motors inspected of 28,836⅞ horsepower. Certificates were issued for 18,959 incandescent and 397 arc lamps. The total number of isolated plants on December 31, 1902, is shown to be 1,045.

A summary of underground electric work for 1902 shows 8.38 miles of cable pulled, 4.95 miles of conduit placed and 4,723 feet of flexible cable used for lamp loops. Private companies did underground work as follows: Chciago Telephone Company, 628,567 duct-feet at cost of $141,113.29; Commonwealth Electric Company, 480,352 duct-feet at cost of $118,475; Chicago Edison Company, 225,131 duct-feet at cost of $79,713; Chicago City Railway Company, 409,611 duct-feet at cost of $102,402.75; city of Chicago, 51,979 duct-feet at cost of $14,486.40, making a total for all companies of 1,795,640 duct-feet at a cost $456,190.44.

Pennsylvania-Western Union Litigation.

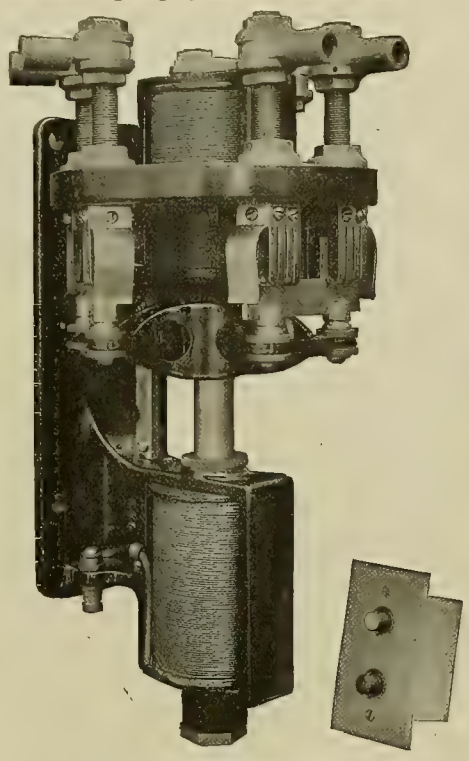
Injunctions issued in Pennsylvania and New Jersey restrain the Pennsylvania Railroad Company and the Postal Telegraph Company from interfering with the Western Union Telegraph Company in the possession of the right-of-way on the Pennsylvania company's road. The Pennsylvania and Postal companies are barred from moving to get new lines until the dispute with the Western Union is finally settled, which may take years. On the Maryland, Western New York and Pennsylvania divisions the railroad has no wires of its own, so that when the Western Union shall vacate, if the courts decide against its asserted right to remain, the railroad and its patrons will be left without a telegraph service during the time it will take to string new wire lines.

G. I. Automatic Switches.

The General Incandescent Arc Light Company's experience with automatic-switch apparatus in the last three years has demonstrated that such a switch can be made and can be installed with the greatest assurance that it will give absolute satisfaction. This company's switches of the type illustrated herewith are made with one, two or three poles, for service on voltages up to and including 250 volts, and to carry currents up to 200 amperes.

The demand, however, for these switches of larger sizes has necessitated the design of larger capacity switches for these voltages, and the company has now installed automatic switches, which are designed to carry continuously as much as 2,500 to 3,000 amperes. Of course, the design for the larger-size switches is different from that of the smaller size, and they are so made that the amount of current that can be handled thereby is not limited within any commercial requirement.

These switches of the smaller size are specially suited to installations where it is desired to cut out the entire lighting system of the building or the



G. I. AUTOMATIC SWITCH.

house by the mere pushing of a button, from one or more distant points from the switch.

It is stated that in lighting large public buildings enormous savings can oftentimes be made in the cost of wiring and the labor of installing it, by the use of automatic switches placed throughout the building. In one case it was estimated that $20,000 could be saved by using automatic switches of this kind, instead of following the usual methods of wiring.

In central stations, of course, the use of automatic switches is almost indispensable, especially in the case of a high-tension plant, where the high-tension apparatus is designed for remote control. In such plants the low-tension exciter systems oftentimes can be installed with low-tension automatic switches to great advantage, thereby carrying out the general scheme with consistency and at a considerable saving in the original cost.

Automatic switches have been used to great advantage in connection with other devices, such as pressure gauges, which are so arranged that when the pressure becomes excessive in any receptacle into which air or water is being forced by a motor, the pressure gauge closes a contact at such a time, opening the automatic switch, and thereby stopping the motor.

These "G.I." automatic switches are built on an iron frame, which is very substantial and strong, and which also serves to produce a strong magnetic field from the operating solenoids. The switch is intended for installing in a vertical position, so that gravity tends to open it, and the opening of the switch is accomplished by a hammer blow produced by the core in the lower solenoid having a lost motion, which is first taken up, before the burden of opening the switch is thrown upon it. This insures the switch opening at all times, as a large factor of safety is introduced thereby.

An eastern syndicate has secured control of the Springfield (Ill.) gas plant and the plants of the Springfield Electric Light, Heat and Power Company, the People's Hot-water Heating and Electric Company, and the Consolidated Railway system. These utilities will be consolidated and extensive improvements will be made.

BOOK TABLE.

THE ART OF ILLUMINATION. By Louis Bell, Ph. D. New York: McGraw Publishing Company. 1902. Pp. (5¾ by nine inches) 345, with 127 illustrations. Price, $2.50.

Dr. Bell has produced in this book a work that stands alone in the domain of technical literature. It is the only book published which deals directly with the scientific and artistic use of modern illuminants, electric and others. The purpose of the author is clearly outlined on the opening page to be "to set forth some of the fundamental doctrines, optical, physiological and æsthetic, which underlie the proper use of artificial illuminants, and to point out how they may be advantageously adapted to existing conditions." In carrying out this purpose the various forms of illuminants from the early historic lamps and candles, up to the modern electric lights are considered, the uses and advantages of each as an illuminating agent being discussed rather than the details of construction. For a technical treatise the book is singularly free from formulæ and algebraic expressions, there being only a few tables, and they so closely related to the text that their presence is scarcely noticed.

In the opening chapter the relations between light and the eye are dwelt upon. Chapter II. treats of the principles of color, effect of different tints, the composition of the spectra, color of light falling upon fabrics, quality of the various illuminants, etc. Regular and diffuse reflection or diffusion, with their coefficients for different materials, are considered in Chapter III. The two following chapters take up the various materials of illumination, including illuminants of combustion, such as candles, oil lamps, air gas, coal gas and acetylene, with their different types of burners, and then incandescent burners, special reference being paid to the Welsbach mantle.

The electric incandescent lamp is the subject of a very interesting chapter, the author dealing with the various types of modern incandescent lamps, discussing their efficiencies, quality of light, temperature, life, voltages, etc. The Nernst lamp, in both its European and American forms of development, is also treated and reference is made to the investigations on vacuum tubes, although no mention is made of the exceedingly valuable work of Mr. Peter Cooper Hewitt along this line. The chapter closes with an interesting consideration of firefly light. Chapter VII. handles in an instructive manner the electric arc lamp, in its open and enclosed, and direct and alternating-current forms. An important treatise on shades and reflectors follows.

In the next three chapters, which handle domestic illumination, lighting large interiors and exterior illumination, is given information that is most valuable, as it is not to be found elsewhere in such a collected and thorough form. Nearly every conceivable sort of room and exterior area is considered and scientific rules are laid down which should prove of great help to architects and engineers in general. Decorative and scenic illumination is thoroughly discussed in Chapter XII., the author mentioning Mr. Luther Stieringer's excellent work at the Pan-American Exposition, as well as the use of miniature lamps, searchlights, etc. In Chapter XIII. the writer speaks of the illumination of the future, discussing the tendency of modern lighting with its evils and advantages, and suggesting improved lines which should be adhered to. The chapter concludes as follows: "The illumination of the future ought to mean the intelligent use of the lights we now have, not less than the application of the lights which we may hope in the fullness of time to obtain." In the last chapter the various standards of light and photometry are treated sufficiently to enable one to use them understandingly.

Dr. Bell's work is certainly a classic in the field of technical literature and the handling of the subject from the artistic point of view makes it especially valuable to all engineers, designers and architects, in fact, anyone whose province it may be to influence in any manner the proper installation and use of artificial light.

New Cable Ships for the Far East.

Two fine new cable ships, intended especially for cable-repair work, have just been completed by the Eastern Extension Australasia and China Telegraph Company of London. They are appropriately named Restorer and Patrol, respectively, and are regarded by their owner, considered as maintaining and repairing ships, as the finest in the world. The length of each ship is 377 feet and the beam is 44 feet. They are twin-screw steamers and are fitted with the most approved engines of the triple-expansion type, and when fully laden attain to a speed of 14½ knots an hour, with a consumption of about 65 tons of coal a day. Each vessel will carry about 426 knots of intermediate cable, or about 790 knots of deep-sea cable. They are both fitted with the very best and most modern gear for paying out and picking up cable.

A particularly interesting feature of these ships is that they are fitted with the newest Lodge-Muirhead system of space telegraphy, which will be given a thorough test—a fact which is exceptionally significant in view of the attitude of the cable companies toward space telegraphy. The Eastern Extension company has also a permanent wireless in-

station at Porthcurnow, Cornwall, and expects to use space telegraphy to advantage.

The two ships have entered upon their first duty, that of laying 650 miles of cable for the Netherlands government, after which they will be sent to the Far East, the Patrol to Singapore and the Restorer to Adelaide, at both of which stations the company has depots for the storage of cable. Here they will be used for the purpose for which they were designed, that of repairing cables. It is not thought likely that the ships will ever return to England until they are worn out, when they will be relegated to the scrap heap.

Cable-code Vocabularies.

Exporters in this city and all over the world who use the cable are interested in the changes in the vocabulary which are likely to be made during the International Telegraph Convention which is to convene in London in May, says the New York Times. All the great cable companies will be represented in the convention, excepting only the Western Union and the Commercial Cable Company, and even these latter two companies will have indirect representation.

The proposition narrowed down to a brief summary will be whether or not the official "vocabulary" adopted at the convention at Berne, Switzerland, in 1896, shall be reverted to and made the standard, obligatory for all cable companies. There is a strong opposition to the proposed establishment of the obligatory standard, based principally on the contention that in view of the growing complexity of business it would tend to restrict the cable as an instrument of trade. Another argument against the resumption of the original "vocabulary" is that it would wipe out numberless private codes which have cost much money to compile, and that it would cause also much embarrassment to operators, clerks, etc. The United States government will not be a party to the convention, as it has no direct interest in telegraph or cable companies.

The Bureau of International Telegraphs at Berne adopted the "vocabulary" accepted by the convention, and which contained 250,000 words. The "vocabulary" now in use has as many as 1,250,000 words. Paradoxical as this seems, the larger "vocabulary" has come into vogue because of efforts at condensation.

The Berne "vocabulary" admitted, for the sake of condensation, these languages: English, French, Spanish, Italian, German and Latin. Even with this polyglot mixture there was some sort of a fundamental thread running through the "vocabulary," and the cable companies contend that it was possible quite generally to guess what an obscure or obliterated letter in a word might be through euphony merely. But the price of $2 or $2.50 per word, or thereabouts, varying according to distance, developed in all the countries a genius of condensation that is surprising, and is now the cause of the objection. Keys are plentiful which have reduced the original "vocabulary" by 75,000 words. It is these keys upon keys that it is proposed shall be abolished, and principally for this reason:

An entire normal sentence being sometimes included in a single word, each letter gains importance through the condensation. It occurs sometimes, even with the greatest care, that one of these letters in transmission becomes obliterated or that one letter is substituted for another, and then the receiver is, as one of the cable officials expressed it, "up in the air." He can neither rely upon the euphony of any language nor upon any principle running through all of them to help him out. The mistakes, vexations, etc., which have been caused through these so-called "spurious" words is at the root of the desire of the cable companies to go back to earlier principles.

It has been one of the arguments against the reversion to the old vocabulary that it had become too common for private business—that any man could get possession of it at a nominal price and use it ad libitum. This contention is met with this argument: In the Berne vocabulary each word is numbered. It is easy for two men to have an understanding about their messages by which when one receives a word he counts backward or forward 100 or 200 words in the Berne "vocabulary" to get the one which the sender really intended for him.

There is scarcely any computation possible of the volumes of codes which will go into the fire should the universal code become obligatory. A. R. Carmichael, who is the New York manager of the Western Union Telegraph Company, said, however, that, in spite of the opposition to the universal code that was likely to turn up at the convention, he believed that it would become a law.

"The International Telegraph Convention meets once a year, or once in every two or three years," he explained. "It was to meet in London last year, but owing to the king's illness it was decided to postpone it until this year."

Announcement is made that Senator Clark of Montana has made application to the City Council of Los Angeles, Cal., through a local real-estate broker, for a franchise for a complete system of street railways, to cover about 82 miles of the most important streets in the city. One of the conditions in the application is that the fare charged on the lines of the new system shall be three cents.

CORRESPONDENCE

London Letter.

London, England, April 4.—A new system of locating metal ores by electricity is being demonstrated in North Wales in which an alternating current of 30,000 volts or more is utilized to energize a piece of ground which it is desired to explore for the purpose of discovering any metal lodes which may lie under the surface. Two metal rods attached to the terminals of the coil are pushed an inch or two into the ground, and then the apparatus is set working. In ordinary circumstances, if the neighborhood is free from metallic deposit, the lines of force created have a normal arrangement which is ascertained by a telephonic receiver connected to a second pair of iron rods which can be transported and planted in the ground at any desired spot. By sounds, therefore, can be detected the presence of metallic deposits, a faint sound telling the explorers they are near the vicinity of ore, and by shifting position until the maximum of sound is obtained, comparative accuracy of location is claimed. Demonstrations have been given during the week at a mine in North Wales, and at one mine the correctness of the data obtained by the method and which was subsequently worked upon was proved.

A good deal of tramway extension is now taking place in Great Britain, and one or two additional lines command more than ordinary attention. The South Lancashire Tramways Company, which has powers for the construction of a large system in Lancashire forming a connecting link with many important towns, including St. Helens, Bolton, Liverpool etc., has been opening its lines piecemeal hitherto, so that little notice has been taken of the progress which has been made. An important percentage of the total has now been constructed, and a demonstration over the system was recently given. The power house is equipped with Continental machinery, and on some portions of the line waiting rooms have been erected. Another important electric tramway extension has taken place in connection with the London United Tramways Company, London, which has now opened a new section which serves some of the best country within 10 miles of London.

The Royal Commission, inquiring into London traffic, is making very poor progress, and if the present rate of one meeting a week is maintained, we shall not probably see the completion of its labors before the end of the year. At present only the question of the present state of legislation is being gone into, and comparisons made with the procedure in Scotland and France. Incidentally it may be mentioned that a more or less serious check upon Mr. Yerkes' schemes to amalgamate under one management all the tube railways which have come under his control, has been made this week by a committee of the House of Commons. Mr. Yerkes has formed a company termed the Underground Electric Railways Company of London, which will supply the electric power for working all the tube railways, as well as the District Railway Company. All the separate tube companies have this year promoted bills asking Parliament to lease their undertakings in perpetuity to the underground company. To the very first proposal of this character the committee said no, a decision largely influenced by a spirited opposition on the part of the London County Council, which argued that it was unprecedented to hand over a statutory company, as each of the tube companies are, to a company not sanctioned by Parliament, such as the Underground company.

The telephone department of the general post-office is growing so rapidly that the whole of the premises hitherto occupied by the savings bank department are to be taken over by it. W.

New York Notes.

New York, April 11.—The consideration of certain bills by the state Legislature at Albany which have to do with the powers of the Rapid Transit Commission has created a good deal of discussion among the city officials and prominent citizens. It is stated that one bill, if passed, will be especially favorable to the Belmont syndicate, which controls the present rapid-transit road. Another bill was drawn up by the Citizens' Union, and permits the Rapid Transit Commission to proceed with the building of subways, but retains to the city the control of the operation and class of service on new subways or extensions. It provides that the new roads built must be susceptible of competition with the Belmont syndicate subways. At a mass meeting last night, held under the auspices of the Citizens' Union, the Civic Club and various other bodies, the so-called railway "grab bills" now before the Legislature were roundly denounced. A resolution was also passed denouncing the State Railroad Commission as incompetent to solve the traffic problems of this city, and demanding the passage of a law creating a local railroad commission, whose members shall be appointed by the mayor and be directly responsible to the people of this city.

There is still general dissatisfaction among the men in the Elevated Railroad Employes' Union, and it is stated that if the men are not granted a nine-hour day and a new schedule of wages by the Interborough Rapid Transit Company, a general strike will be instituted.

A large gathering in Cooper Union Hall on Thursday evening listened to speakers at the mass meeting called for the purpose of urging the Legislature to pass the bill for city electric lighting and to protest against the alleged extortion of the gas monopoly. A street parade preceded the meeting, and the men in line carried transparencies setting forth in trenchant sentences the object of the meeting, the salient points of the bill, and the alleged practices of the electric and gas combination. The men and women assembled in the auditorium, judging from appearances, were householders who have to do with the paying of bills for electric lights and gas, and the views of the various speakers were received with vociferous applause.

The scheme of merging the trolley interests in New Jersey, which has been pending for some time, will probably be perfected early next week. The railways considered are the North Jersey, which controls a number of subsidiary lines and is shortly to have access to New York by the Hoboken tunnel; the Jersey City, Hoboken and Paterson; the Elizabeth, Plainfield and Central Jersey, and the Orange and Passaic Valley lines. The merger, however, contemplates a combination of not only street railways, but also electric-light and gas plants throughout territory including Jersey City, Hoboken, Passaic, Paterson, the Oranges, Newark and Elizabeth.

The Board of Building Trades, representing 60,000 men, including electrical workers, engaged in building construction in New York city, and said to be the strongest labor organization in the United States, is said to be ready to declare a general strike on May 1st, unless increases of wages averaging 15 per cent. are granted. O.

New England News.

Boston, Mass., April 10.—Pittsfield (Mass.) advices report that the General Electric Company has sent officials to Great Barrington, Mass., to look over the property of the Stanley Instrument Company, with the view of obtaining control thereof. The Stanley company employs about 250 persons and owns one of the largest and most prosperous industries in Southern Berkshire County. It manufactures small electrical supplies. William Stanley is the largest stockholder, and his associates include John Kelly, chief consulting engineer of the Stanley Electric Company of Pittsfield, and W. H. Browne, who recently went from Montreal to Great Barrington to assume the general managership of the company. The company is rushed with business.

Edward Miller & Co. of Meriden, Conn., will soon begin the manufacture of electric fixtures.

If the New Milford Power Company obtains a charter for building a dam on the Housatonic River at Kent, Conn., it will supply power to a number of electric railways in that state, which will mean the abandonment of a dozen or more generating plants. The Connecticut Lighting and Power Company will obtain power from this company and will furnish power to the Meriden, Southington and Compounce road, which covers the territory about Meriden, Conn., 50 miles from Kent. The New Milford company will also transmit power to Waterbury, Naugatuck, Derby, Bridgeport, New Britain, Southington and Cheshire. The plants at these places will be used as storage stations. The multiphase system will be used. Factories will also be supplied with power. The machinery is at Kent awaiting legislative action on the charter. B.

Michigan.

Detroit, April 11.—The council of Ford has decided to submit to the people the question of bonding the village for an electric-lighting plant. The amount of the proposed bonds is $5,200.

Charles H. Fisk of Detroit has recently organized, in connection with the General Electric Company and Detroit capitalists, a power-plant company at Nashville, Tenn. The plant will be located between Nashville and Chattanooga, and cost about $4,000,000. A maximum of 50,000 horsepower will be developed.

It is expected that the work of making the preliminary survey for the West Michigan interurban railway will be begun next week. The exact route from Grand Rapids to Muskegon and from Muskegon to Hart has not yet been determined. The rights-of-way, which were secured from the township boards two years ago, have expired, but this makes little difference, as they were highway rights, and the company has determined to use a private right-of-way, except in villages. The farmers along the line are enthusiastic over the project because of the benefits that will accrue to them, and there will be no difficulty in securing the rights-of-way. There will be 100 miles of line, and it is planned to be of the best in the state.

The Michigan Central Traction Company, which will operate an interurban road between Battle Creek and Lansing, stole a march on the Michigan Traction Company on Sunday. The latter company runs the local street-car line of Battle Creek and has wires strung and material on hand for extension on North Avenue. The interurban line has a franchise to enter the city coming in on North Avenue part of the way. During the night this company

put a large force of men at work and laid 135 feet of track on the short stretch of North Avenue so as to be ahead of the city company. What the latter company will do is not known, but trouble is in sight.

The Legislature has under consideration a joint resolution allowing the people to vote on a constitutional amendment permitting the people of Detroit to own and operate street-railway lines in their city. But it is said that the resolution has little prospect of adoption.

It has been discovered that, by means of a clause attached to a charter-amendment bill, the Legislature has authorized the Common Council of Bay City "to acquire works by purchase or otherwise, for the purpose of supplying said city and its inhabitants with electric light, power or heat." It is said that this clause was smuggled through and that it will be repealed. C. G. W.

From the Buckeye State.

Cleveland, Ohio, April 11.—Following the refinancing of the Lake Shore Electric Railway Company, the offices have been moved from Toledo to Cleveland, and space has been fitted up on the seventh floor of the Electric Building for them. General Manager F. J. Stout will have his headquarters in the general offices.

John G. Webb of the Columbus, Delaware and Marion road has purchased the properties of the Marion Street Railway Company, operating the local street-railway lines in Marion, and the Marion Electric Light and Power Company, operating the electric-light plant in the town. It is stated the purchase price of the two properties amounts to $181,000.

The Springfield, Troy and Piqua Railway Company of Springfield has been incorporated with a capital stock of $700,000 to connect the towns named by electric line. Governor Asa S. Bushnell of Springfield is the chief stockholder and promoter of this new company.

The Cincinnati Car Company, which is owned by the Cincinnati Traction Company, will shortly deliver 50 cars to the Providence Street Railway Company, Providence, R. I., and 16 to the Anderson (Ind.) local company. The company, it seems, is looking to the outside for a large amount of business, though the primary object was to do the work for the Cincinnati Traction Company.

It is rumored that the Dayton and Troy Electric line will in a short time be made a portion of the Cincinnati, Dayton and Toledo, through the purchase made some time ago by the Mandelbaum-Pomeroy interests. The syndicate is pushing work in Western Ohio, in order to have cars running from Cincinnati to Lima as soon as possible, and it is estimated that this result will be achieved within two months from this time.

The Springfield Railway Company, Springfield, will build a large addition to its power house to give room for an immense storage battery, which will be installed as soon as it is completed.

The City Council of Sandusky has granted a franchise to the Central Heating and Lighting Company, the conditions being that a large and thoroughly modern plant be constructed.

J. R. Foraker and other prominent Cincinnati men are securing franchises in Indiana towns from the proposed line from Cincinnati to Richmond. It is believed that there is a plan on foot, in connection with the Union Traction lines in Indiana, to connect Cincinnati and Chicago by way of Richmond and Indianapolis.

It is said that Mayor Tom L. Johnson will begin a crusade for a three-cent fare again, and will make all his campaign work in the future hinge in part, at least, on this idea.

The town of Athens has voted to issue $15,000 in bonds for the purpose of building a municipal light plant.

The Lawrence-Hall Electric Company of Cincinnati has increased its capital stock from $20,000 to $50,000. O. M. C.

Southern Developments.

Charlotte, N. C., April 11.—Chicago capitalists are interested in a proposed electric line from Madisonville, Ky., to Earlington. The road is now said to be almost assured and a franchise has been requested from the former town.

Dr. George E. Coughlin of Indianapolis, Ind., has visited the town of Anderson, S. C., to investigate the feasibility of an electric line from Anderson to several neighboring towns.

The town of Laurinburg, N. C., has sold $10,000 worth of electric-light bonds, the contract for a lighting plant has been let and work will be started at once.

It is reported that the electric-street railway company of Greensboro, N. C., may build a 12-mile extension.

The Birmingham (Ala.) District Coal, Light and Power Company has paid the city $7,500 for a franchise. The company will furnish electricity, gas and the by-products of coal.

A new electric-light plant will be erected at Lewisburg, Tenn.

A water and electric-light plant costing $35,000 has been installed at Dunn, N. C. L.

Texas and Mexico.

Austin, Texas, April 10.—The Mexican government has granted a concession to Dwight Furness of the City of Mexico, to build and operate an electric road between Ocotlan and Jamay. The latter place is a pleasure resort situated on Lake Chapalpa, a short distance from Guadalajara, Mexico.

It is stated that the railroad which G. B. Cameron and associates will construct between Cordoba and Tierra Blanca, in the state of Vera Cruz, Mexico, will be operated by electricity. The power will be supplied by the company of which F. P. Hoeck of the City of Mexico is the head. The road will be about 70 miles long. Andrew Mackenzie, president of the San Rafael and Xico Railroad, is interested in the enterprise.

At a recent meeting of the stockholders of the street-railway company which owns and operates the line between the city of Puebla, Mexico, and the town of Cholula it was decided to substitute electric power for mules. New equipment will be purchased and the line greatly improved.

A. J. Dull of Harrisburg, Pa., and Thomas Pierce of Boston, Mass., have been investigating the feasibility of building an electric interurban railway between Seguin, Texas, and New Braumfels, a distance of about 14 miles. Power for the proposed line will probably be obtained from the Seguin Milling and Power Company. The route will be down the valley of the Guadalupe River. Mr. Dull says that the building of the road is practically assured.

An electric-light plant is to be installed at Acatlan, state of Vera Cruz, Mexico. The necessary material will be imported free of duty.

The electric interurban railway which is being constructed between the city of Queretaro, Mexico, and the town of Tequisquiapam, is to be operated by power furnished by a large electric generating plant which will be erected on the Tequisquiapam River by the Compania Explotadora del Tequisquiapam.

The Mexican government has just published statistics showing that during the first 10 months of the year 1902 electric machinery to the value of $300,000 was imported into that country. Most of this machinery came from the United States. H.

Information from Indiana.

Indianapolis, April 13.—The Fort Wayne, Elkhart and Chicago Traction Company has filed articles of incorporation with the secretary of state. The company's initial capital stock is $10,000. The company proposes to build an electric line from Fort Wayne to Elkhart. A. H. Beardsley, C. H. Winchester, F. K. Ferland and C. S. Burhans are the directors.

Franchises were granted last week to the Union Traction Company to enter Newcastle and to H. D. Hall and E. O. Adams to construct a line in the streets of Brazil. The commissioners of Knox County granted a franchise to the Western Indiana Traction Company for an interurban line from Vincennes to Sullivan. The commissioners of Bartholomew County granted to L. H. Wright, C. E. Massie and A. B. Gossett of Columbus permission to build an electric line on the west side of White River from Columbus to Brownstown. The commissioners of Blackford County will permit the Montpelier, Warren and Portland Traction Company to construct a line through the county.

The Union Traction Company of Indiana has asked the City Council of Valparaiso for a right to pass through the city with its Logansport-Chicago line. This line is in reality an extension of the Indianapolis and Northern line now being built from Indianapolis to Logansport. This extension will give Indianapolis and Chicago direct trolley connection, with ultimate trolley connection between Chicago and Cincinnati, by way of Logansport, Anderson, Richmond and Hamilton, Ohio. The distance between Indianapolis and Chicago is less than 200 miles, as planned by this route, and the line will pass through a large number of enterprising cities.

It is announced that a deal will be consummated this week for the consolidation of the Muncie, Hartford City and Fort Wayne Traction Company, which now has its line in operation between Muncie and Hartford City, and the Muncie and Newcastle Traction Company, which has secured a valuable right-of-way for an electric line from Muncie to Newcastle. It is the purpose to buy outright the interests of the latter company, and, after completing the line to Newcastle, the company may build on to Richmond. It is asserted that this is one of the few interurban lines in this section of the state that the Union Traction Company is supposed to have nothing to do with.

The City Council of Anderson will arrange with private capitalists to rebuild and install the local electric-lighting plant, with the understanding that the city can then buy the plant on the installment plan. This method is necessary because the city has already reached its limit of indebtedness.

The city of Wabash is ready to enter into a five-year contract for electric lighting. The Wabash Electric Light Company, whose contract will soon expire, offers a proposition of renewal at an advance of $8 a light. The present rate is $72. The City Council thinks better terms can be had by competitive bidding.

Gas City, Ind., thinks that municipal ownership of electric-light plant has proven a success in that city. All told, there are 2,000 domestic and street lights in use. F.

Northwestern Notations.

Minneapolis, Minn., April 11.—Colonel W. G. Bronson of Stillwater, Minn., has secured options on the property of the Stillwater Gas and Electric Company, and the Apple River Power Company for Chicago capitalists, who will probably take them over. Application has been made to the council for an extension of the electric company's franchise for 30 years. If granted, the new owners expect to install a complete new plant there at a cost of $50,000. The Western Gas and Investment Company of Chicago is the company for whom the deal is being made. The company expects to further develop the waterpower at Apple River.

The Glencoe Electric Light Company has contracted with Glencoe, Minn., to pump the city water for 90 per cent. of the water rent receipts up to $1,333 and 60 per cent. of the excess of that sum. The company has a minimum of $800, which the village agrees to pay if the receipts should fall short of that amount.

The Iowa, Illinois and Wisconsin Interurban Railroad Company has been organized at Dubuque, Iowa, with a capital of $750,000. The company will build a line from Dubuque to Platteville, Wis., a distance of 30 miles. Work is to be begun about the first of May.

The street-railway company of Marinette, Wis., will erect a large brick car barn and will enlarge the power station at a cost of $25,000 to $30,000.

The General Electric Company of Duluth, Minn., has reduced rates 20 per cent.

The Sioux City Traction Company of Sioux City, Iowa, will make improvements and extensions to the street-railway system which will cost complete $1,500,000. They will include making the entire system on a standard gauge, extending the five city lines, double-tracking one line, building a line to South Sioux City, Neb., and to Crystal Lake, Neb., besides enlarging the power plant and car barns.

South Stillwater, Minn., will install an electric-light and waterworks plant. Professor J. J. Flather of Minneapolis has been engaged to prepare the plans and specifications. R.

Among the Rockies.

Salt Lake City, Utah, April 9.—Bonds to the amount of $65,000 will be issued for an electric-lighting plant at Logan, Utah.

An electric-lighting plant, to be run by waterpower, will be installed at Fillmore, Utah, by C. S. Pulver of Ogden, Utah.

Electric pumps have been installed in the shaft of the Consolidated Virginia and California Mining Company, at Virginia City, Nev.

The Supreme Court of Utah has reaffirmed the decision of the lower court in the case of the Salt Lake and Utah Canal Companies against the Salt Lake City Water and Electrical Power Company. The suit was decided in favor of the defendant, and involves the title to very valuable water rights.

An electric railroad will be built immediately from Cripple Creek, Colo., to Gillett, at a cost of $75,000.

The Consolidated Railway and Power Company at Salt Lake will install many new improvements, among them trucks and motors for new engines, and wheel-boring mills.

The proposition to give a 25-year franchise to John D. Ryan, who recently bought the control of the Boston and Great Falls Electric Light Company at Great Falls, Mont., will be submitted to a vote of the people on April 25th. G.

On the Pacific Slope.

Seattle, Wash., April 9.—A bill drawn in the interest of the Snoqualmie Falls Power Company, and intended to protect that company's interest in the fight for the control of the White River, was overwhelmingly defeated in the Senate by the Stone & Webster forces. This bill was also designed to give the Snoqualmie Falls Power Company and other companies the right to condemn lands for laying flumes and to enable them to construct their plants without much hindrance. The Stone & Webster Company of Boston, which has control of the Seattle and Tacoma street-railway system and the interurban line, and which has made extensive purchases and has valuable water rights on the White River, has strongly opposed the Snoqualmie Falls company in its effort to get in on the White River, and the two companies have been involved in litigation.

Two companies, the Tacoma Industrial Company and the Pierce County Improvement Company, have been organized for the development of the White and Puyallup Rivers for electrical purposes. The former company will erect a plant on the White River, 25 miles from Seattle, and the latter will build a similar plant on the Puyallup River, 40 miles from the city. It is said that these plants will be the largest electrical power plants ever erected upon the Pacific Coast, and will represent an expenditure of several million dollars. Both companies are being financed by Stone & Webster of Boston. The uses

[illegible] will be put will be to operate the street railways of Seattle and Tacoma, the interurban line between Seattle and Tacoma, and to fur- [illegible] facturing plants in the two cities [illegible] interurban line. The White River plant will be in operation by the end of the year, and the Puyallup River plant some time early in the [illegible]

The council of the city of Seattle has passed an ordinance granting what is known as the Baker franchise to the Seattle Cataract Company. The company is permitted to engage in the general busi- [illegible] of furnishing power and light throughout the city.

The Dominion government is considering the advisability of continuing the Yukon telegraph, which now ends at Ashcroft, connecting there with the Canadian Pacific wires, into Vancouver. The cost from Ashcroft to Vancouver would be $25,000, but the building of this line would place the government service independent of any other line.

L. E. C.

PERSONAL.

Henry Van Brunt, well known as an architect and as the designer of the Electricity Building at the Chicago World's Fair, died after an illness of some months in Milton, Mass., on April 8th.

Charles Curds, chief electrician of the Mackay Cable Company, is on his way to the Orient to meet the cable ships that are to lay the cable between Manila and Honolulu. He says the work will begin at Manila and will be completed by July 4th.

Albert K. Ellis has been appointed superintendent of the Appleton-Neenah and Appleton-Kaukauna interurban electric railways of the Wisconsin Traction, Light, Heat and Power Company. He succeeds W. H. Holcomb, who has resigned to go into other business.

C. V. Weston, formerly chief engineer of the Union Elevated Loop and the Northwestern Elevated Railroad Company, and now of the firm of Weston Bros., Chicago, has been appointed chief engineer of the South Side Elevated Railroad Company, to direct that company's proposed extensions and betterments.

Dr. Walther Nernst, professor of electrochemistry at the University of Göttingen, Germany, has arrived in this country and is expected to participate in this week's meeting of the American Electrochemical Society at New York. Dr. Nernst is well known for his investigations along physical and chemical lines and especially for his invention of the electric lamp that bears his name.

Thomas A. Rockwell, president of the Fox River Valley Gas and Electric Company, which has plants at Neenah, Menasha and Appleton, Wis., will remove some time in May from his present home in Oshkosh, Wis., to Chicago, where he will be more advantageously situated to attend to his duties as chairman of the executive committee of the United Gas and Electric Corporation of Chicago, a company organized about two months ago to purchase and operate gas and electric companies.

ELECTRIC LIGHTING.

The electric-light plant at Ruston, La., will be improved at a cost of $20,000. B. F. Thompson is mayor of the city.

The electric-light trustees of Miamisburg, Ohio, are arranging to purchase a new dynamo to furnish current for 1,500 incandescent lamps.

The trustees of DuPauw University, Greencastle, Ind., will soon arrange for the installation of an electric-light plant for the university.

Anderson (Ind.) officials have decided to borrow $75,000 with which to make improvements to the electric-light palnt, instead of selling it.

The Prather & Walker Manufacturing Company of Athens, Tenn., owner of the local electric-light plant, is about to install additional machinery.

B. A. Peirce has purchased the mills of the New River Mineral Company at Ivanhoe, Va., where he will install an electric power plant and furnish light for the town.

At the recent election in Brown City, Mich., the proposition to bond the city for $5,000 for the purpose of erecting an electric-light plant and operating it under municipal ownership, was carried.

C. C. Radabaugh and associates will erect an electric-light plant at Campbell, Mo. They are in the market for a 1,500-light alternator, 100-horsepower high-speed engine and the necessary inside and outside supplies and equipments. Address C. C. Radabaugh, Malden, Mo.

The electric-light plant erected several years ago at Livingston, Mont., by A. O. Newton, was sold by H. L. Frank on April 4th. C. S. Hefferlin, representing the Livingston Water Power Company, was the purchaser, and the plant will be consolidated with the Livingston Light Company, under the management of Mr. Hefferlin. The plant is situated in the center of the city and has a large patronage. Extensive alterations and improvements will be made.

The Barnum & Bailey "Greatest Show on Earth" has recently arranged for 70 Nernst lamps, ranging in size from the one-glower to the six-glower type, for the purpose of illuminating its large canvas pavilions. To furnish current for operating the lamps, the show people have purchased special engines to generate power. They will also use the Nernst lamp exclusively for display advertising.

The Philadelphia Electric Company of Philadelphia reports for the year ended December 31, 1902, an increase in gross earnings over the previous year of $126,440, and a decrease in operating expenses to the amount of $12,803. The gross earnings for 1902 amounted to $3,422,411, and the operating expenses and charges reached $2,967,968. The amount of dividends paid during the year was $337,552.

ELECTRIC RAILWAYS.

The Common Council of the city of Jamestown, N. Y., at a recent meeting granted permission to the Warren and Jamestown Electric Street Railway Company to construct and operate a street railway on certain streets of the city.

The new Bergen Turnpike electric railway, between Hoboken and Hackensack, N. J., has been completed and opened for traffic. It is a fine piece of engineering, costing nearly $1,000,000. The road was constructed under the supervision of Ralph D. Earle of Jersey City, N. J.

The directors of the Metropolitan West Side Elevated Railroad Company of Chicago have re-elected the retiring officers as follows: President, D. MacAllister; vice-president and secretary-treasurer, George Higginson, Jr.; assistant secretary and assistant treasurer, P. D. Sexton; general counsel, W. W. Gurley; auditor, C. W. Hillman; general manager, H. M. Brinckerhoff.

Governor Bates of Massachusetts has signed the bill authorizing street-railway companies to act as common carriers of freight and baggage. The Boston and Worcester Street Railway Company and the Worcester Consolidated Street Railway Company have already arranged to enter the freight business and will soon have freight cars running over their lines at regular intervals.

A charter has been granted by the Vermont Legislature for an electric railroad from Bennington, Vt., to the Massachusetts state line at Williamstown, where a short extension of the Hoosac Valley Street Railway would connect the line with North Adams and Pittsfield. Terminals will be at Great Barrington, Mass., and Bennington, and the road will extend a distance of 60 miles, principally through the Berkshires.

The Suburban Railway Company of St. Louis has succeeded in replacing the equipment destroyed in the recent fire, and has begun running a line of the new cars from Sixth and Locust Streets to Forest Park, the end of the line being at the Union Avenue entrance to the park. The equipment on the main line of the Suburban is complete, and the new cars are said to be the handsomest ever run on a street railroad.

It is stated that John W. Gates will make Paris his headquarters in the near future, during the negotiations for a proposed consolidation of the street-car systems of Paris by him and associates. The names of Westinghouse, McDonald, Gates and de Braga are connected with the company, which, it is said, will consolidate the omnibus company, the steam-tramway company, the Thomson-Houston Electric Company and one or two minor companies.

The Milwaukee and Southern Railway Company has filed articles of incorporation with the secretary of state of Wisconsin, its purpose being to construct and operate a railway from Milwaukee to East St. Louis. The motive power is not specified in the articles, but it is understood that an electric line is proposed. The company is capitalized at $50,000. The incorporators are Earl Parcells, Roy B. Tabor and Robert A. Peet of Chicago, and John B. Wallace and Harry A. Porter of Mukwonago, Wis.

SOCIETIES AND SCHOOLS.

The Northwestern Electrical Association, through its efficient secretary, Thomas R. Mercein, has issued the Journal of Proceedings of its eleventh annual convention, held in Milwaukee, Wis., last January. The journal contains a stenographic account of the proceedings, with papers and discussions, and also lists of officers and members.

About 30 of the engineering students of the University of Michigan are making a 10-day inspection trip to some of the important manufacturing centers in the East under supervision of members of the faculty. Among the cities visited will be Toledo, Pittsburg, Philadelphia, New York and Niagara Falls, where the principal plants of an engineering interest will be visited.

The thirty-third annual catalogue of the Worcester Polytechnic Institute, Worcester, Mass., for the college year 1902-1903, has recently been issued. It is a book of nearly 200 pages and contains information concerning the organization of the school, its general plan, subjects of instruction and outline of courses, and also lists of faculty, students and alumni and other data pertaining to the equipment of and work offered at the school. Harold B. Smith is professor of electrical engineering at the Institute.

The semi-annual meeting of the American Society of Mechanical Engineers is to be held in Saratoga, N. Y., beginning June 22d, the week preceding the meeting at the same place of the American Institute of Electrical Engineers. Interesting visits and excursions will be made by the American Society to Schenectady and Lake George. It has been thought desirable that papers on shop management and kindred topics would make a line of discussion of special interest and value, in connection with the large establishments which are to be visited at Schenectady.

It is said that officials of the General Electric Company are contemplating the establishment of a school for draftsmen at the company's works at Schenectady, N. Y. The young men who desire to take the course will be obliged to take up the study and qualify in arithmetic, algebra, geometry and trigonometry. They will then be sent to the machine shop, and after a term there will be put through an examination, and will then go to the drafting room. It is thought the plan will work well, and the school will probably be established as soon as the necessary arrangements can be made.

The engineering school of Union College, Schenectady, N. Y., is one of the oldest technical schools in the country. Founded in 1845 with Prof. William M. Gillespie at its head, it at once took a high rank, and for many years was one of the few engineering schools in America. From the first the evident policy of the school was to adapt the thorough training of l'Ecole des Ponts et Chaussees, where Professor Gillespie had finished his technical education, to the demands of professional practice. The school has kept pace with the wonderful development in American technical education and in the increasing demands on professional training. Recently a course in electrical engineering, now being greatly extended under the supervision of Prof. C. P. Steinmetz, was undertaken.

W. M. Anthony of Chicago, reporter on office methods and accounting for the twenty-sixth convention of the National Electric Light Association, to be held in Chicago, May 25th, 27th and 28th, has sent out a letter to members, asking for forms, etc., used by them in connection with meters, billing, ledgers, purchases, vouchers, classification of accounts, expenditures, and general information as to matters relating to this department of their business. From responses received a very complete report is being compiled. The association has already done excellent work in helping central stations to systematize their accounts, the standard classification presented two years ago by a committee of which Mr. Anthony was a member having been widely adopted. His present work will cover a somewhat broader field, and is sure to be welcomed by central-station managers and accountants.

TELEGRAPH.

Seventeen employes of the Commercial Cable Company left San Francisco on April 11th on the steamer Alameda for Honolulu with 350 tons of freight and provisions. These men include three chief operators for the Midway, four for Guam and a number of carpenters and electricians. In the freight which they took with them is included the unframed houses, tents, cable instruments, batteries and all the necessary paraphernalia for installing instruments and establishing quarters at the landing stations at Midway and Guam.

At a recent meeting of the Chicago City Council two rival fire-alarm telegraph companies were granted 20-year franchises. The United Fire Alarm Telegraph Company has been operating without a franchise for several years, but was recently ordered to obtain a franchise. Then the General Fire Alarm and Watch Service Company was incorporated, and offered higher compensation to the city. Both these companies are now granted franchises. The compensation is 2½ per cent. of the gross receipts for the first 10 years, five per cent. for the next five years, and 10 per cent. for the remainder of the term.

PUBLICATIONS.

The Sprague Electric Company of New York city has issued March bulletins descriptive of its direct-current generators of the single field-coil type and its direct-current generators of the split-pole type.

"How to Pack Gas-engine Cylinder Heads," is an interesting leaflet, giving full directions for cutting gaskets, preparing the flange and applying the gasket, so that the most efficient service may be obtained. The leaflet is issued by the H. W. Johns-Manville Company, 100 William Street, New York.

The Sterling Electric Manufacturing Company of Warren, Ohio, has issued a neat booklet entitled "Sixteen All-ways," in which are aptly set forth the merits of the Sterling special incandescent lamp and its claims on the lamp-consuming public. The Ster-

ling lamp is described as the one that gives 16 candle-power "all-ways always."

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., is distributing price lists and a descriptive bulletin, covering its new C. & H. dynamo-field regulators for insertion in its perpetual catalogue. Anticipating a heavy demand for these instruments, the company has put in a stock of 2,000 of them, and is therefore in a position to make prompt shipments.

MISCELLANEOUS.

The new fire-alarm telegraph equipment purchased of the Star Electric Company of Binghamton, N. Y., by the city of Cleveland, has been installed and is nearly ready for service. Fire Director Lapp says the equipment is very satisfactory, bringing the total number of boxes operated in the city up to 421.

It is proposed, according to recent newspaper accounts, to build a line of pneumatic tubes across the English Channel from Dover to Calais. The tubes would be about three feet in diameter and would be suspended by pillars about 800 yards apart. Mail, small parcels and even passengers, it is predicted, could be transported across the channel by this means in about 15 minutes. Telegraph and telephone cables could also be carried on the structure.

Arthur Hultqvist, assistant engineer in the workshops of the electric street railways of Gothenburg, Sweden, has recently constructed a brake for electric motors which consists of a small automatic reversing switch (omkopplare), which is fastened near the motor. On every machine is a pendant handle bearing the words "emergency brake" in red letters. If a workman should happen to be caught in the machinery or any other accident should occur, the machinery can be quickly stopped by pulling the handle, which sets the brake in action. It is expected that this brake will be found very useful in every establishment where electric motors are in use.

TRADE NEWS.

Bedford City, Va., wants to purchase a compound engine of Corliss type, 150 to 175 horsepower, for use in its electric-light plant. Address J. A. Clark, Bedford City.

The Jacksonville (Texas) Electric Company is in the market until May 1st for dynamos, rheostats, switchboards, meters, wire, belting, electric fans, cedar poles and insulators.

The Electric Contract Company, formerly of 51 Maiden Lane, New York city, announces that it has moved to new quarters at 202 and 204 Center Street, where with largely increased facilities it will be able to handle its rapidly growing business to greater advantage.

Although the Canadian tariff permits the introduction of products from the United Kingdom on payment of only two-thirds the duty which goods from other parts of the world, including the United States, must pay, the imports of electrical apparatus from the United States are much larger than from Great Britain.

The General Electric Company is now employing between 10,000 and 11,000 hands in its Schenectady works. The weekly payroll amounts to nearly $125,000. These figures do not include the plants at Lynn, Mass., and Harrison, N. J.

A new electrical supply house is to be opened in Portsmouth, Ohio, by John A. Grimes. This, it is said, will be the only supply house of the kind in the vicinity, and as Mr. Grimes has had much experience in the electrical business, it is thought he will do an extensive business.

C. J. Field, 29 Broadway, New York city, announces that he can supply vitrified glazed-clay conduits of both the single and multiple-duct types. Mr. Field has had a wide and extended experience in the conduit business, and states that he is ready to contract for complete installations of conduit systems or to furnish the conduits separately.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 12th, for the construction, including plumbing, heating and electric wiring and conduits, of the extension to the United States postoffice and courthouse at Beaumont, Texas, in accordance with the drawings and specifications, copies of which may be had at the office of the supervising architect, or at the office of the custodian at Beaumont, Texas.

The cedar-pole trade will be interested to know that the Holcomb-Lobb Company has retired from the cedar business and that the William Mueller Company of Chicago has purchased the former company's entire stock of cedar posts and poles; also its principal yards at Marinette, Wis., and Masonville, Mich. The William Mueller Company feels that this deal places it in a very advantageous position, giving it, in conjunction with its own yards, local connection with all the trunk lines on the Northern peninsula. In addition, it has yards at Metropolitan, Felch Junction, Escanaba, Spalding, Masonville, Blaney and Raber, Mich.; Marinette, Wis., and also Chicago, Ill. James Jeffrey is the assistant manager of the Mueller company.

BUSINESS.

Before placing fan-motor orders for next season, the trade is asked by the G. I. Company of 572 First Avenue, New York city, to "be sure and see the Paragon black fan and get prices."

A. C. Becken, the well-known jeweler of Chicago, owing to his constantly increasing business, has found it necessary to seek larger quarters and is now located in the new Powers Building, Monroe Street and Wabash Avenue. In addition to his extensive jewelry business, Mr. Becken supplies the trade with the familiar Paillard non-magnetic watch, which is extensively used by electricians and others who come in contact with dynamos and motors.

Owing to the rapidly increasing demand for Peirce hammer drills and expansive lead bolts, C. L. Peirce, Jr., will on May 1st remove his factory to larger quarters at 12 South Jefferson Street, Chicago.

The Electric Appliance Company, Chicago, selling agent for Gutmann alternating-current wattmeters, is especially enthusiastic just now over the large sales of its glass-case meter. The company maintains that this meter is the neatest in appearance, lightest in weight and smallest in dimensions of any meter on the market; that its superior workmanship guarantees maintenance of accuracy and of service. It will send its new wattmeter catalogue to anyone interested.

The Whitehead Machinery Company of Davenport, Iowa, is offering for sale three General Electric alternators of 150, 120 and 60-kilowatt capacities, and a 75-kilowatt Thomson-Houston direct-current generator. These machines are from the plant of the People's Light Company of Davenport and were in operation up to last month. They are guaranteed without electrical or mechanical defect and in first-class condition. The Whitehead Company also offers a Buckeye cross-compound and an Atlas tandem-compound engine.

The Federal Electric Company of Chicago is distributing special colored card advertising, with the idea of still further interesting central-station men in the money-making powers of the Federal electric sign. It urges the purchase of Federal signs as an inducement for the central-station customer to increase his bill for current. A sign that runs three or four hours a night is practically the same as a motor taking the same amount of current and running at full load all the time. The Federal company states that over 100 cities now have Federal signs in service, and offers this fact as a most excellent argument why others should also push this branch of central-station business through the aid of Federal signs.

The Electric Storage Battery Company of Philadelphia, manufacturer of the Exide battery, has added a number of new Exide-battery depots to the list of stations hitherto announced, the complete list at present embracing the following stations: New York, 148 West Eighteenth Street; Philadelphia, 250 North Broad Street; Boston, 39 Stanhope Street; Buffalo, 200 Pearl Street; Chicago, 264 Michigan Boulevard; St. Louis, 3937 Olive Street; Rochester, 158 South Avenue; Toledo, 715 Jefferson Street; Detroit, 265 Jefferson Avenue. The increasing use, and the great convenience of these depots to users of electrical vehicles equipped with the Exide battery has encouraged the company to increase them as rapidly as favorable locations can be secured. New stations will therefore be announced from time to time.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 7, 1903.

724,451. Signaling Apparatus. Francis W. Dunbar and William W. Dean, Chicago, Ill., assignors to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 26, 1900.

724,478. Switch Mechanism for Telephone Transmitters. Charles Holmok, Cleveland, Ohio, assignor of one-half to Walter Kroelling, Cleveland, Ohio. Application filed April 30, 1902.

The disconnecting lever of a telephone receiver is combined with spring conductors secured thereto, contact strips arranged to engage with the spring conductors when the lever is raised and a fulcrum point for each spring.

724,484. Field-magnet Core. Charles R. Meston and Thomas M. Meston, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed June 14, 1902.

The core is built up entirely of laminations having polar projections, at which polar projections the laminations are of varying widths.

724,498. Electrical Motor for Ceiling Fans. Walter F. Phelps, Dayton, Ohio. Application filed February 2, 1903.

The motor has a tubular shaft inclosed by a carrier. A revolving fan-blade holder moves with the carrier, and switch mechanism and resistance devices are mounted upon a stationary part of the motor below the moving parts of the motor. (See cut on next page.)

724,507. Electrical Protector. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, Chicago, Ill. Application filed June 6, 1900.

The device consists of a spring carrying an electrode at its free end, a fixed electrode, and a pin of softenable material engaging the electrodes and holding the spring against action.

724,527. Electrical Control of the Flow of Water to Basins of Washstands, etc. Isaac G. Waterman, Santa Barbara, Cal. Application filed February 27, 1902.

A self-closing electromagnetically opened valve governs the water supply and means operated by the rise of the water in the receptacle are adapted automatically to open the switch when the water reaches a predetermined height, thereby causing cessation of the electric current, whereby the valve will thereupon automatically close on the cessation of the electric current and the supply of fluid be cut off. (See cut on next page.)

724,528. Electromagnetic Valve-controlling Apparatus. Isaac G. Waterman, Santa Barbara, Cal. Application filed February 27, 1902.

Combined with a valve having a valve stem are an electromagnet, an armature applied to the valve stem, and means for adjusting the armature and electromagnet relatively of each other.

724,544. Electric Brush-holder. Niels A. Christensen, Milwaukee, Wis. Application filed May 16, 1900.

The device comprises a metal housing in which the brush loosely fits and is movable endwise, an arm pivoted to the housing and connected therewith by a tension spring, and a polygonal block eccentrically pivoted to the arm and adapted to bear against the outer end of the brush.

724,553. Process of Preserving Perishable Food Products. Charles E. Davis, Chicago, Ill., assignor to Elmer A. Sperry, Cleveland, Ohio. Application filed February 9, 1901.

The process of treating perishable products consists in placing them in a confined chamber, electrolyzing air, and bringing the electrolyzed air into contact with the perishable products while the gases in the electrolyzed air are in an active and nascent state. (See cut on next page.)

724,554. Apparatus for Preserving Perishable Food Products. Charles E. Davis, Chicago, Ill., assignor to Elmer A. Sperry, Cleveland, Ohio. Application filed February 9, 1901.

The apparatus comprises a confined chamber to receive the products, means for electrolyzing air, and means for bringing the electrolyzed air into contact with the perishable products while the gases in the electrolyzed air are in an active and nascent state.

724,570. Art of Manufacturing Armored Electric Cables. Edwin T. Greenfield, Monticello, N. Y. Application filed July 31, 1902.

The described method of armoring an insulated electric cable consists in continuously rotating the armoring material around the cable and simultaneously causing it to be forced into successive spirals about the outer surface thereof with a "set" which prevents it from unwinding.

724,571. Machine for Making Armored Electric Cables. Edwin T. Greenfield, Monticello, N. Y. Application filed July 31, 1902.

Mechanism for the above process is described.

724,572. Thermo-electric Battery. Benjamin J. Hall, Barnes, England. Application filed July 16, 1902.

In the apparatus are a series of thermo-electric couples, an air-inlet arranged to conduct cold air between the proximate ends of the couples, and an air outlet spirally surrounding the ends of the couples and adapted to conduct heated gases, and a source of heat with which the air inlet and air outlet communicate.

724,580. Electrolytic Cell. Rudolph Johanns, Brooklyn, N. Y., assignor to Friedrich Junge, Silverlake, N. Y. Application filed December 11, 1902.

The cell comprises an anode, a cathode, an inverted trough above the cathode, and a conduit extending from the trough to a point beyond the limiting surface of the electrolyte.

724,594. Telephone System. John H. Mason, Philadelphia, Pa., assignor to the Wheatstone Bridge Telephone Company, Souderton, Pa. Application filed April 12, 1902.

See page 311.

724,611. Controlling Device for Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 13, 1898.

In the controller are combined with the switch an actuator therefor, and a resilient connection between the actuator and the switch so constructed and arranged that the initial movement of the actuator will cause the switch to move simultaneously at a different rate of speed.

724,613. Low-water Alarm for Steam Boilers. Stephen H. Ralph, Marion, Ind. Application filed July 31, 1901. Renewed June 19, 1902.

A low-water condition actuates a circuit-closer which electrically opens the steam whistle and operates an alarm bell.

724,619. Electric Accumulator. Albert Schmidt-Predari, Weimar, Germany. Application filed July 24, 1902.

The accumulator consists of lead plates, a magma applied to the negative-pole electrode and composed of a mixture of lead oxide, red lead, calcium hydroxide, alkali thiosulphate and a suitable binding material, a magma for

[illegible] two-pole electrode, composed of a mixture of lead [illegible] lead, porous spongy lead and a suitable binding [illegible] a suitable electrolyte in which the plates are [illegible] after formation.

724,627. System for the Electrical Propulsion of [illegible] Noram D. Swegle, Fayette, Mo., assignor of one-half to Daniel A. Swegle, Galesburg, Ill., and Isaac L. Swegle, Fairview, Ill. Application filed July 18, 1902.

In the system are a carrier, a motor supported thereby and suitably geared with the traction wheel thereof, an electromagnetic brake device supported by the carrier, circuits including the motor and brake magnet, means for supplying the circuits with current, a device adapted to operate reciprocally for controlling the circuits and means for automatically operating the device at a predetermined point. (See cut.)

724,628. Telegraph Key. Edwin T. Thorpe, Dickerson Run, Pa. Application filed December 12, 1902.

An improved telegraph key is described.

724,645. Means for Preventing Fluctuations in Rotary Motors. James J. Wood, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 31, 1900.

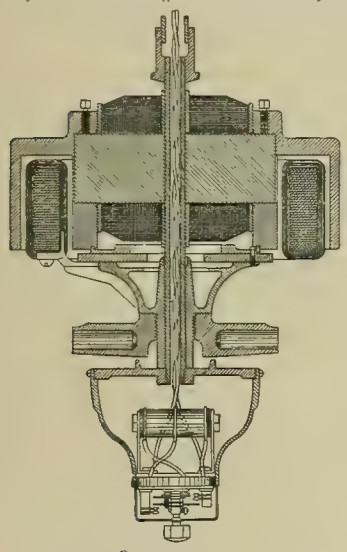
Combined with a rotary motor are a fly-wheel driven thereby, free to turn relatively thereto, a spring interposed between the fly-wheel and motor for producing the effect described, and a guide for the spring comprising a ring concentric with the axis of rotation of the fly-wheel.

724,654. Coin-controlled Electric Meter. Ralph E. Bates, Winchester, Mass., assignor of two-fifths to Horace Van Everen, Cambridge, Mass. Application filed January 14, 1901.

The meter has in combination, metering mechanism, a main switch, a coin-receiver, means to hold the main switch closed, means to release the holding means connected with the metering mechanism and disconnected from the holding means by the coins in the coin-receiver.

724,662. Controlling Device for Elevators. Albert H. Buckelew, Newark, N. J., assignor to the Otis Elevator Company, East Orange, N. J. Application filed November 17, 1897.

In the device are circuit-breakers, mechanically operated locking device, means for operating the same controlled by the movements of the elevator, and an electrically controlled locking device controlled by the circuit.



NO. 724,498.—CEILING FAN MOTOR.

724,679. Electrostatic Separator. Clinton E. Dolbear, Boston, Mass., assignor to the American Mining and Metal Extraction Company, Boston, Mass. Application filed March 25, 1901.

See page 305.

724,690. Controlling System for Railway Vehicles or Trains. George Gibbs, New York, N. Y. Application filed April 11, 1902.

An operating and controlling system for railway vehicles and trains is described. It comprises an electric power circuit embodying a controller and a controlling circuit embodying a governing switch, an air-brake system, a signal system having a tripping device and means engaged by the tripping device when the signal is in danger-indicating position to set the brakes simultaneously and interrupt the power circuit.

724,704. Circuit-breaker. Samuel T. Hutton, Chicago, Ill. Application filed March 15, 1902.

The device comprises a metal receptacle for a conducting liquid and a rotative shaft which passes through one of the walls of the receptacle and is provided with a contact arm adapted for immersion in the liquid during the rotation of the shaft.

724,721. Electric Tool Holder. Max Loewenthal, New York, N. Y., assignor to the Prometheus Electric Company, New York, N. Y. Application filed July 24, 1902.

The holder has normally open co-operating contacts carried by the holder and adapted to be actuated by insertion of the tool, and other contacts electrically connected to the first-named contacts and adapted to complete circuit to the tool when engaged by the latter.

724,722. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y., assignor to the Otis Elevator Company, borough of Manhattan, New York, N. Y. Application filed July 23, 1896. Renewed March 24, 1897.

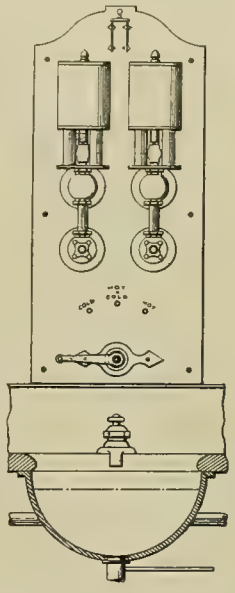
In the system are the controlling circuit, floor switches automatically operated by the car, and a series of switches in the car corresponding to the several landings and each connected to the floor switch of its respective landing.

724,730. Cut-out Switch for Electric-lighting or Other Circuits. George W. Nistle, Chicago, Ill., assignor of two-thirds to Everett W. Brooks and Robert L. Gifford, Chicago, Ill. Application filed April 28, 1902.

The switch comprises a bed plate, a pair of standards mounted theron, a U-haped switch member pivotally mounted intermediate its open and closed ends in and between the standards, spring contact blades secured to each of the arms of the switch member on opposite sides of its pivotal point, and a pair of contact posts mounted on the base plate adjacent and co-operating with the spring contact blades on each side of the switch pivot.

724,762. Third-rail Electric-railway System. William G. Wagenhals, Cincinnati, Ohio. Application filed January 28, 1903.

A continuous protecting cover with depending sides is secured to the supporting chairs of the rail, and insulating blocks are grooved to receive and sustain the rail. The blocks are provided with petticoat flanges to prevent moisture accumulating on the lower surface of the insulators.



NO. 724,527.—WASHSTAND CONTROL.

724,778. Electrical Smelting Apparatus. Robert L. Barnhart, Charleroi, Pa. Application filed May 14, 1902.

Two oppositely situated orificed heads adapted to be charged with electricity and insulated from each other are combined, and means for forcing the plastic minerals through the orificed heads, forming meeting rods or bars of the minerals, and an insulating box lying between the heads and covering the adjacent ends of the heads.

724,827. Electric Motor. Arthur C. Eastwood, Cleveland, Ohio. Application filed January 15, 1903.

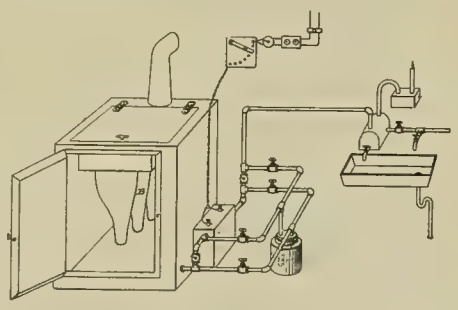
One claim reads: In an electric motor, the combination of a frame, two reactive elements supported thereby, one of the elements having tubular extensions journaled in the frame, the second of the elements being carried on a shaft held in the extensions of the first member, with means for retarding to any desired extent the speed of rotation of one of the members.

724,842. Voltameter for the Electrolysis of Water. Pompeo Garuti and Riccardo Pompili, Tivoli, Italy. Application filed April 11, 1902.

The voltameter comprises a chamber having conducting walls acting as electrodes, an apertured diaphragm dividing the chamber into two compartments insulated from each other and from the diaphragm, and pervious metallic coverings on both faces of the apertured portion of the diaphragm.

724,848. Insulator. Ferdinand W. Gregory, New York, N. Y. Application filed August 9, 1902.

A hollow knob-like insulator has upon its exterior a vertical face spanning the width of the insulator and longitudinally across the face a groove of sufficient depth to house a line wire.



NO. 724,553.—PRESERATION OF PERISHABLE FOOD PRODUCTS.

724,856. Secondary-battery Electrode. Josef Hahmann, Berlin, Germany. Application filed July 19, 1902.

The electrode consists of a base frame having a continuous lip on its inner wall flush with one of its faces, a back of strands connecting the continuous lip, and cross bars flush with both sides of the frame connecting the back strands and dividing the back into compartments.

724,860. Attachment for Overhead Electric Carriers. Henry M. Harding, New York, N. Y. Application filed April 21, 1902.

The device combines with the conductors for the electric current, a protective casing surrounding the conductor in such a manner as to prevent the falling of sparks or the like.

724,869. Electrical Cloth-cutting Machine. Patrick Howe, Boston, Mass., assignor of five-sixths to the Fenno Cloth Cutting Machine Company, Boston, Mass. Application filed August 2, 1901.

The machine comprises a rotary cloth cutter carried by swinging arms and driven by an electric motor.

724,917. Automatic Audible Fire-alarm Transmitter and Signal. John H. Munchausen, Brooklyn, N. Y. Application filed February 25, 1902.

Parts of the invent on are a bell, a hammer, means for actuating the hammer, a spring-contact, a fuse mechanically connecting and restraining the hammer and spring contact, a second contact from which the spring contact is spaced by the hammer and fuse, and a normally open electric signaling circuit including both contacts, the hammer and spring contact being simultaneously released from each other upon the melting of the fuse.

724,927. Trolley. Charles A. Olsen, Pittsburg, Pa. Application filed December 24, 1902.

The trolley pole is formed of two sections with a knuckle joint connecting the sections.

724,928. Electric Controller. Carl T. J. Oppermann, London, England. Application filed February 18, 1903.

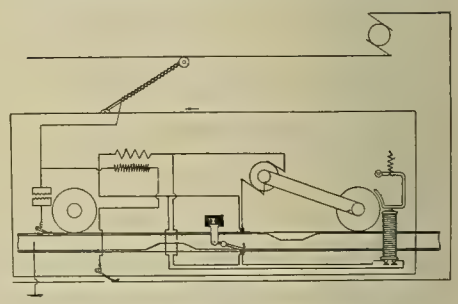
A controller switch for electrically propelled vehicles is described. It comprises a cylindrical part rotatably mounted in rubbing contact with two stationary sets each of four spring contact fingers which are electrically connected to the poles of two equal sets of battery cells, to the armature brushes of the motor, to a resistance, and to the one terminal of the motor field coils whereof the other terminal is connected to the one pole of one of the sets of battery cells.

724,948. Ventilator for Electric Motors for Cars. Horace B. Rowland, Philadelphia, Pa., assignor to the Electric Motor and Generator Ventilating Company. Application filed March 25, 1902. Renewed February 3, 1903.

In a car are a plurality of motors, a casing surrounding each of the motors, exhaust openings in the casings, a hood and pipes leading from the hood to each of the motor casings.

724,949. Ventilating Device for Electric Motors for Cars. Horace B. Rowland, Philadelphia, Pa., assignor to the Electric Motor and Generator Ventilating Company. Application filed April 19, 1902. Renewed February 3, 1903.

In the device are a casing surrounding the motors, hoods on each end of a car, a pipe communicating with each of the hoods and with the motor casing and valves in the pipe, adapted to be operated in order to cause the air to enter the motor casings and drip outlets between the valves and casings.



NO. 724,627.—ELECTRICAL PROPULSION OF CARRIERS.

724,950. Ventilator for Motors for Cars. Horace B. Rowland, Philadelphia, Pa., assignor to the Electric Motor and Generator Ventilating Company. Application filed May 13, 1902. Renewed February 3, 1903.

Combined with a number of motors and their casings are a pipe connecting the casings, a pipe communicating with the pipe intermediate the casings, and a hood on the pipe constructed to collect air and direct the same to the casings regardless of the direction in which the car is moving.

724,951. Automatic Electric Elevator. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing Company, Chicago, Ill. Application filed June 28, 1901.

In an automatic elevator are combined a car-hoisting mechanism, a slow-speed motor for actuating the car-hoisting mechanism and a high-speed motor for also actuating the hoisting mechanism, and means for transferring the load from the high-speed motor to the slow-speed motor as the car approaches its stopping point.

725,001. Indicating and Controlling Apparatus. Cyprien O. Mailloux, New York, N. Y., assignor to the Otis Elevator Company, New York, N. Y. Original application filed July 23, 1890. Divided and this application filed August 8, 1899.

One claim reads: The combination with the case provided with a base of insulation and with a cover transversely divided near one end, a partition across the case at the division, binding posts at one side of the partition, indicating and controlling mechanism at the other side of the partition, a buzzer or audible signal located on the cover over the binding posts, and push-buttons and semaphore windows in the other portion of the cover.

725,010. Automatic Circuit-opener or Closer for Electric Bells, etc. Carl C. Rasmussen, Harlan and Hans P. Rasmussen, Callender, Iowa. Application filed September 26, 1902.

In the circuit-closer and breaker are a rotatable case, a contact fixed in each side of the center of the case, adjusted circuit-closers in the case, and means for rotatably mounting the case for opening and closing an electric circuit.

REISSUE.

12,104. Electric Furnace. Edward G. Acheson, Niagara Falls, N. Y. Application filed February 11, 1903. Original No. 718,892, dated January 20, 1903.

The furnace has a carbon electrical conductor with a protecting layer of refractory carbide and electrical connections at the ends of the conductor.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, APRIL 25, 1903 No. 17

Power and Lighting Plant for British Columbia Mines.

About 30 miles directly west of Rossland, B. C., and 12 miles east of the town of Grand Forks, is the small town of Cascade. The town is situated on the Kettle River, which at this point descends 120 feet in passing through a half mile of narrow rocky gorge in a series of rapids and falls. For the utilization of this natural power, the Cascade Water, Power and Light Company has built a large dam, waterway, pipe line, power house and transmission line from Cascade to Phœnix, where the largest and most productive copper mines in the "Boundary District" are situated. The Cascade company is owned by the London and British Columbia Goldfields Company and the plant represents an investment of approximately $500,000.

The dam, placed just above the entrance to the gorge, is of timber cribwork, with a 40-foot base and 24-foot top. The mid-section is 50 feet high, tapering to 25 feet at the sides, while the total length is 400 feet. It is built on a solid rock bed to which the foundation timbers are bolted, 10,000 cubic yards of rock being used for filling. This dam raises the water 36 feet above the natural level, giving an effective head at low water of 156 feet.

The permanent water level is 10 feet below the top of the dam, and is controlled during high water by 12 sluiceways, which can be opened to 12 feet below the natural river level, giving a passway of about 2,000 square feet. These sluices are closed by means of 12 by 12-inch squared timbers in grooves, operated by a traveling winch running on a track over the top of the dam.

From dam to power house the water first passes through a 225-foot open rock cut, from which it enters a tunnel driven through 410 feet of solid rock, passing under the track of the Canadian Pacific Railway, and then into another open rock cut, 500 feet in length, at the end of which the bulkheads and controlling gates are located. These cuts and tunnel, representing an excavation of about 35,000 cubic yards of rock, are of dimensions liberal enough to avoid any appreciable loss of head, delivering the water with a head almost equal to that at the dam level.

From the gates the water is conveyed through a wooden pipe, 7 feet in diameter, for about 1,400 feet. This pipe is constructed of Oregon-fir tongued and grooved staves, 2¾ by 7 inches, cut in circular segments and machined to the radius of the pipe. The staves are looped at 12-inch intervals with three-fourths-inch round steel bands, cast-iron connecting shoes being used for clamping. Provisions have been made at the bulkhead and in the width of the cut for the installation of a similar and additional pipe.

From the stave pipe the water is carried through 250 feet of circular steel pipe, 7 feet in diameter, resting on concrete piers and anchored into solid rock to avoid end thrust. Where this pipe passes alongside of the power house, three four-foot pipes and one two-foot pipe are taken off below the floor level of the power house to supply three 36-inch turbines for generators and two 12-inch turbines for exciters.

Fig. 1 is a general view of the power house, showing the standpipe at the junction of the stave and steel pipes. This standpipe relieves the pipe line from excessive water-ram strains, and incidentally voids any air taken into the pipes. About 10,000 cubic yards of rock was removed for the site of the power house, in a natural bay at the foot of the falls. This building is of substantial fireproof construction 150 by 50 feet, with stone foundation 22 feet deep on the lower side, and brick walls 30 feet above floor level, the height to peak of roof being 45 feet. It has been designed with a view to lengthening it when required.

Figure 2 shows the interior of the power house and the generating plant. The three generators are standard Westinghouse, three-phase, two-bearing, direct-coupled, 2,200-volt, 750-kilowatt machines at 80 per cent. power factor, or 940 kilowatts at 100 per cent. power factor, 60 cycles per second, 300 revolutions per minute. The two exciters, each capable of exciting all three generators at one time, are 45-kilowatt, 120-volt, shunt-wound dynamos, self-contained. They are of the two-bearing type, and are direct-coupled to independent turbines, operating at 500 revolutions per minute. The turbines are S. Morgan Smith wheels made at York, Pa., and the governors are the Escher-Wyss make from Switzerland.

Fig. 3 shows the transformers, nine in all, three in each bank, which are of the standard Westinghouse, self-cooling, oil-insulated type, having a capacity of 250 kilowatts at 80 per cent. power factor, or 312½ kilowatts at 100 per cent. power factor, star connection, and wound for a ratio of 2,000 to 20,000 volts, on both high and low-tension windings, with full-load efficiency of 97.6 per cent. As the taps are brought out near the neutral point, which is grounded, it is impossible to maintain a dangerous voltage in the auxiliary circuit.

The current from the high-tension side of the transformers is carried to a row of high-tension fused circuit-breakers, situated alongside of the building behind the main switchboard, as shown in Fig. 3. These switches are placed on independent marble slabs, with marble barriers between. The current leaving these switches enters a high-tension bus and is carried to the line switches at the rear of the building. These line switches are grouped switches, opening all three wires at the same time. Each switch is furnished with a time-limit tripping device, and reversed-current tripping coils, so that overloads can be carried for a period of from one to 10 seconds, as the local conditions call for, or either line can be cut out automatically in case of trouble.

The switchboard for the low-pressure side consists of seven panels of blue Vermont marble, one panel for each generator, one for the two exciters, and a feeder panel for each group of transformers. The six lightning arresters, located just above the switches in the gable of the roof, are the "low-

Fig. 1. Power House at Cascade.
Fig. 2. Interior View of Power House.
Fig. 3. Transformers and Rear of Switchboard in Power House.
Fig. 4. Interior of Sub-station at Phoenix.

POWER AND LIGHTING PLANT FOR BRITISH COLUMBIA MINES.

equivalent" Westinghouse style, giving protection against lightning discharges for transmission at 20,000 volts.

A [illegible] 132 feet wide is cleared, and transmission lines erected from Cascade via Grand Forks to Phœnix, a distance slightly over 21 miles. The high-tension circuit consists of two separate three-phase transmission lines, each carrying three No. 3, B. & S. copper wires, with room on each line for another circuit. Throughout it is one of the most substantial and well-constructed lines in the Dominion.

The poles are of heavy cedar, and on tangents are spaced not over 100 feet apart, and on curves at less distances, in some cases as low as 50 feet. No angles are turned, but all changes in direction of line made with easy curves. No side or head guys have been used except at extra heavy spans across rivers, etc.

The work on this line, as well as all construction of the plant, is a decided credit to the company's local engineer, William Anderson, who has designed and executed the work, and to the constructing engineer, W. G. McConnon.

A three-mile feeder is taken off at Grand Forks, 12 miles from Cascade, to the Granby smelter of the Granby Mining and Smelting Company, where current is used for driving Westinghouse induction motors of sizes ranging from three to 700 horsepower, and of an aggregate capacity of 2,400 horsepower.

The sub-station at Phœnix is located at an altitude of about 3,500 feet above the power house. The building is of brick, with one end left for future extension, and contains the transformers, line switches, fused circuit-breakers, switchboards, etc., substantially duplicating those at the power house. Fig. 4 shows the interior of this sub-station, which, for the immediate present, will be called upon to supply current for two 700-horsepower, Westinghouse, type-C motors for driving two large compressors, a 100-horsepower motor for stone crusher, and a 150-horsepower motor for hoist, as well as furnishing the current for lighting the town of Phœnix.

The Cascade Water, Power and Light Company estimates that it will have a supply, at low water, for about 6,200 horsepower. This will enable the doubling of the present output. All the plans were made and carried out with the view of extending the plant to its full capacity, and from present indications it would seem that the company will have a demand for all the power it can furnish.

P. Junkersfeld, Local Honorary Secretary of the Institute.

In selecting Mr. Peter Junkersfeld to succeed Mr. R. H. Pierce as its secretary, the Chicago chapter of the American Institute of Electrical Engineers has chosen wisely and has honored one of the most promising of the younger electrical engineers of the West. Mr. Junkersfeld is a prominent member of the engineering staff of the Chicago Edison and Commonwealth Electric Companies, his title being assistant to mechanical engineer. The high character of his professional work has attracted attention, and a pleasing personality adds emphasis to well-balanced mental attainments.

PETER JUNKERSFELD.

Mr. Junkersfeld is a native of Illinois, having been born near Champaign on October 17, 1869. Gifted with an in-born taste for mechanics, he naturally found his way to the engineering department of the University of Illinois, so near his boyhood home. He graduated from the electrical-engineering course of that institution in 1895, and since that time has made his home in Chicago.

Soon after graduation Mr. Junkersfeld entered the service of the Chicago Edison Company. His experience with that company and also with the Commonwealth Electric Company, which is closely allied with it, has been a varied and fruitful one. Beginning in the Harrison Street station, Mr. Junkersfeld had two years of station work, followed by one year as a draughtsman at the general offices, one year as chief draughtsman, and has now been four years in his present position. He has devoted particular attention to alternating-current work, and was in charge of the reconstruction of the Commonwealth plants, being one of the first to employ the four-wire, three-phase system of primary distribution on a large scale. Particularly for the Chicago Edison Company, Mr. Junkersfeld, under the direction of Mr. L. A. Ferguson, second vice-president of the company, has had charge of the development of the present system of high-potential, alternating-current generation and transmission and distribution through sub-stations by direct current.

In addition to his membership in the Institute, Mr. Junkersfeld is vice-president of the Chicago Electrical Association. He has read papers before these societies and also before the Association of Edison Illuminating Companies and other technical bodies.

Grounding of Alternating-current Systems.[1]

By G. N. Eastman.

On any alternating-current system which is well insulated from earth the relative pressure which exists between any part of the system and ground normally depends upon the distribution of electrostatic capacity throughout the system. Any change which takes place in the distribution of condensance produces a relative change in the earth potentials. Shunting the condensance of any part of the system

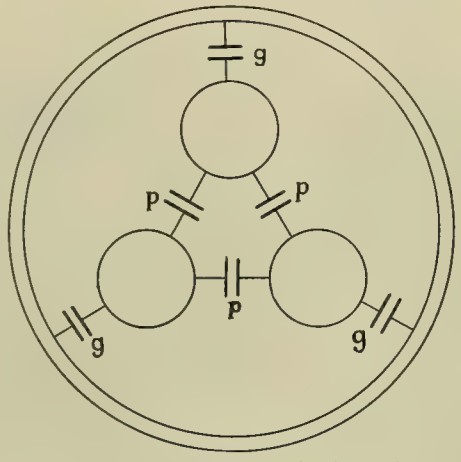


FIG. 1. GROUNDING OF ALTERNATING-CURRENT SYSTEMS. —DISTRIBUTION OF CONDENSANCE IN THREE-CONDUCTOR LEAD-COVERED CABLE.

with an ohmic resistance or inductive reactance will also produce a change in earth potentials. It is the object of this paper to show the effects produced when the latter conditions are obtained and present a few problems with diagrams showing conditions which will arise and produce very disastrous results.

In January of last year Mr. Nies gave a talk before the Chicago Electrical Association on the subject of "Grounding of High-potential Systems." He pointed out that, leaving the effects of static capacity out of consideration, a system not grounded was entirely free from difference of potential relative to the earth, and could be grounded with impunity through the human body. He presented a method of treating the subject which was entirely original, and developed formulæ by the use of which it was made possible to determine the relative pressures which would exist between any conductors and ground, when one conductor of a system was grounded through an ohmic resistance. With the assistance of Mr. Nies the formulæ given in this paper have been developed for determining the relative ground potentials when electrostatic capacities are not balanced on the system, and when one conductor of the system is grounded through an inductive reactance.

The electrostatic capacity of any system is always shunted by the insulation resistance. The value of insulation resistance, however, is so much greater than the reactance of condensance that it can be entirely disregarded. The following example shows the relation of these values:

The insulation resistance of a circuit one mile in length, consisting of two No. 0000 conductors, placed 12 inches apart in the air, would normally exceed 500 megohms. The reactance of condensance between these two conductors with 60 cycles would be 159,800 ohms. The insulation resistance of a 10,000-volt No. 0000 paper-insulated lead-covered cable should exceed 500 megohms per mile. The reactance between conductors and lead of this cable will be approximately 14,000 ohms.

Throughout this paper a four-wire, three-phase system has been considered. Relative conditions will arise on any alternating-current system, and the conclusions drawn from the problems presented will hold equally well for any other system.

Before presenting the problems, in order to give a clearer idea of their value, it is advisable to show the distribution of condensance in a three-conductor cable and give the values of condensance and reactance for the three-phase systems operated by the Chicago Edison Company and the Commonwealth Electric Company.

Fig. 1 represents the distribution of condensance in a three-conductor lead-covered cable. It can be readily seen from the figure that in measuring the condensance between conductors or between conductors and lead a value is not obtained which represents the true condensance between these two surfaces that can be used in calculating the charging current of the system. The derivation of a formula for obtaining the true condensance is given below. The value obtained in measurement made between conductor and ground and between conductors is represented by Cg and Cp. The values of condensance which can be used in making three-phase calculations are represented by g and p.

From Fig. 1:

$$Cg = g + \frac{1}{\frac{1}{p}+\frac{1}{g}} + \frac{1}{\frac{1}{p}+\frac{1}{g}} = \frac{p g + g^2}{p + g} \qquad (1)$$

$$Cp = p + \frac{1}{\frac{1}{p}+\frac{1}{g}} = \frac{3\,p + g}{2} \qquad (2)$$

Equating (1) and (2)

$$g = \frac{Cp\ Cg}{3\ Cp - Cg} \qquad (3)$$

$$p = \frac{2\ C^2p - Cp\ Cg}{3\ Cp - Cg} \qquad (4)$$

The 9,000-volt, three-phase, 25-cycle distribution system of the Chicago Edison Company consists of a generating system supplying energy to rotary-converter and motor-generator sub-stations. The 9,000-volt transmission lines now in operation have a total of 28.88 miles of three-conductor, paper-insulated, lead-covered cable, varying in size from No. 0 to No. 0000. The total condensance between one conductor and lead (represented in Fig. 1 as g) is 5.24 microfarads. The total reactance of condensance between two conductors with 25 cycles is 3,900 ohms. The total reactance of condensance between one conductor and ground is 1,260 ohms. The charging current per line, three-phase at 9,000 volts is 8.11 amperes, with 25 cycles. The total charging energy required is 126.3 apparent kilowatts.

The diagrams which follow were worked for the three-phase, four-wire, 60-cycle system in the southern district of the Commonwealth Electric Company. The system operates at a star pressure of 2,300 volts. Values for condensance given were taken for the system in October, 1901. The condensance of the lead cable used throughout the system was measured. The condensance of the overhead lines was calculated, it not being possible to obtain direct measurements. Assuming that circuits were evenly balanced between the phases, the total length of the overhead conductor on each phase is 64 miles. The total length of underground conductors is 2.87 miles. The total length of underground neutral conductor is 5.95 miles. The total length of overhead neutral conductor is 157 miles. The total condensance between any two-phase conductors is 2.21 microfarads and the reactance of condensance between any two-phase conductor is 1,700 ohms. The total condensance between each phase conductor and neutral

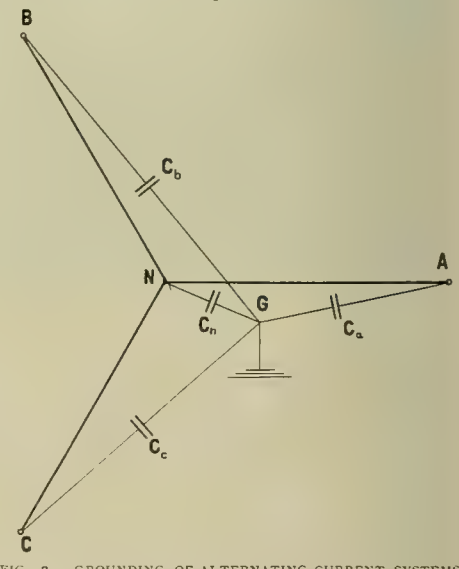


FIG. 2. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

is 4.3 microfarads. The reactance of condensance is 900 ohms. The total charging current, three-phase per line would be 7.05 amperes. The total energy required for charging the system would be 28 apparent kilowatts.

This system can be represented by Fig. 2, (AB-CN) representing the star diagram of pressures. Condensers are connected in, as shown, (Ca) (Cb) (Cc) representing the condensers on the phase conductors and (Cn) representing the condensance of the neutral conductor. It is evident when the condensance is balanced Ca = Cb = Cc, and the voltage impressed on each condenser will be the same. There will then be no difference of potential between the neutral of the system and the ground.

Fig. 3 represents condition which is apt to arise. One phase conductor is grounded through an ohmic resistance. It is evident that this will change the relative ground potentials of the system. Substituting values for the reactance of condensance, an

1. Paper read before the Chicago Electrical Association on April 3, 1903. Mr. Eastman has charge of the testing laboratory of the Chicago Edison Company.

equation giving the potential between neutral and ground can be derived as follows:

In Fig. 3, let Ca, Cb, Cc, and Cn, represent the reactances of (Ca), (Cb), (Cc), and (Cn), respectively, and r represent the resistance of (r).

Let Ia, Ib, Ic, and In, represent the current which will flow through the condensers (Ca), (Cb), (Cc) and (Cn), respectively, and Ir, the current which will flow through the resistance (r). Since the sum

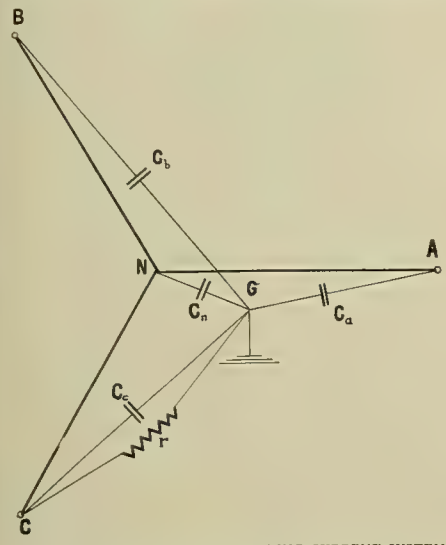


FIG. 3. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

of all the currents meeting at a mesh point is 0, then

$$Ia + Ib + Ic + In + Ir = 0. \quad (5)$$

$$Ia = \frac{GA}{j\,Ca} = \frac{GN + NA}{j\,Ca} \quad (6)$$

$$Ib = \frac{GB}{j\,Cb} = \frac{GN + NB}{j\,Cb} \quad (7)$$

$$Ic = \frac{GC}{j\,Cc} = \frac{GN + NC}{j\,Cc} \quad (8)$$

$$In = \frac{GN}{j\,Cn} \quad (9)$$

$$Ir = \frac{GC}{r} = \frac{GN + NC}{r} \quad (10)$$

Substituting current values in (5) and solving

$$NG = \frac{r\,Cn\,[2{,}300\,Cb\,Cc - 1{,}150\,Ca\,Cb - 1{,}150\,Ca\,Cc] + 1{,}992\,Ca\,Cb\,Cc\,Cn - j\,Cn\,[1{,}150\,Ca\,Cb\,Cc + r\,(1{,}992\,Ca\,Cb - 1{,}992\,Ca\,Cc)]}{r\,Cn\,Cb\,Cc + Cn\,Ca\,Cb + Cn\,Ca\,Cc + Ca\,Cb\,Cc + j\,Cn\,Ca\,Cb\,Cc.} \quad (11)$$

When Ca = Cb = Cc.

$$NG = \frac{1992 - j\,1150}{r\,\frac{3}{Cc} + \frac{1}{Cn} + j\,I} \quad (12)$$

From equation (12) an expression can be obtained for the tangent of the angle ANG. It is easier

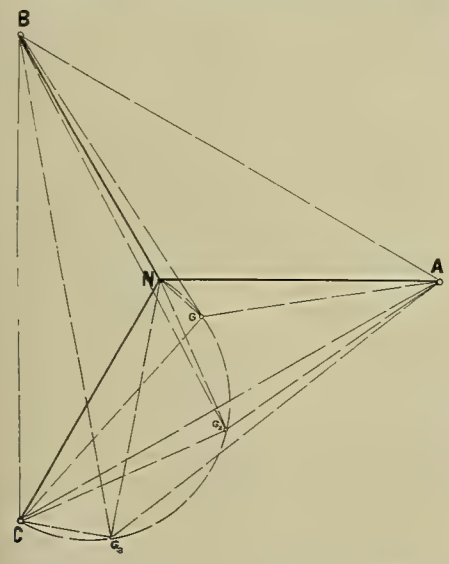


FIG. 4. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

to substitute in equation (12) and lay the angle off graphically.

In the above equation, taking for the values of Ca, Cb, Cc and Cn, the value of reactance of the condensance in the case cited above, "the southern district of the Commonwealth Electric Company," the pressures to ground have been determined for values of r varying from infinity to 0.

When r = inf. NG = 0 AG = 2300 BG = 2300 CG = 2300
When r = 2000 NG1 = 394 AG1 = 2020 BG1 = 2675 CG1 = 2265
When r = 500 NG2 = 1315 AG2 = 2115 BG2 = 3610 CG2 = 1885
When r = 125 NG3 = 2165 AG3 = 3450 BG3 = 4190 CG3 = 755
When r = 0 NG = 2300 AG = 3980 BG = 3980 CG = 0

Fig. 4 represents these conditions. It can be seen from this that with the balanced condition of electrostatic capacity, one condenser being shunted by an ohmic resistance, it is possible to obtain potential greater than the delta pressure of the system.

Referring to Fig. 2, it can readily be seen that if the electrostatic capacities are not balanced on each phase the neutral will not operate at the ground potential. Taking the condition where the total electrostatic capacity of the system is the same as in the example previously cited, but considering that an unbalance has taken place, such that Ca = 1,150 ohms, Cb = 2,270, Cc = 2,270, and Cn = 900 ohms, assuming the same values of r as in previous example, and substituting these values in equation

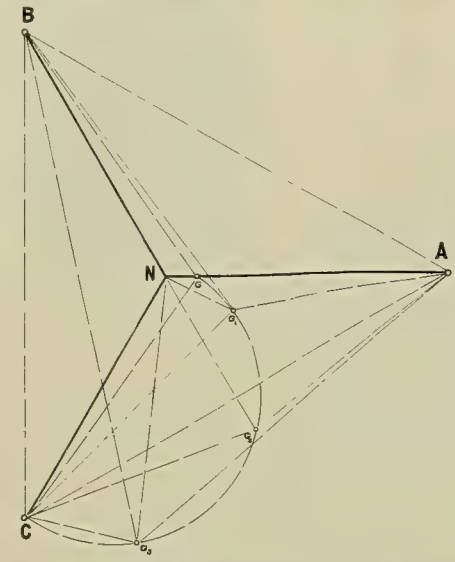


FIG. 5. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

(11), the relative pressures to ground given in the table below were obtained.

When r = inf. NG = 345 AG = 1955 BG = 2495 CG = 2495
When r = 2000 NG3 = 710 AG3 = 1690 BG3 = 2915 CG3 = 2460
When r = 500 NG5 = 1570 AG5 = 2030 BG5 = 3870 CG5 = 2050
When r = 0 NG = 2300 AG = 3980 BG = 3980 CG = 0

Fig. 5 represents these conditions, and in connection with the table given shows that with the unbalanced electrostatic capacity, pressures to ground will exceed the pressures obtained on a system having balanced electrostatic capacity.

In the preceding examples it has been considered

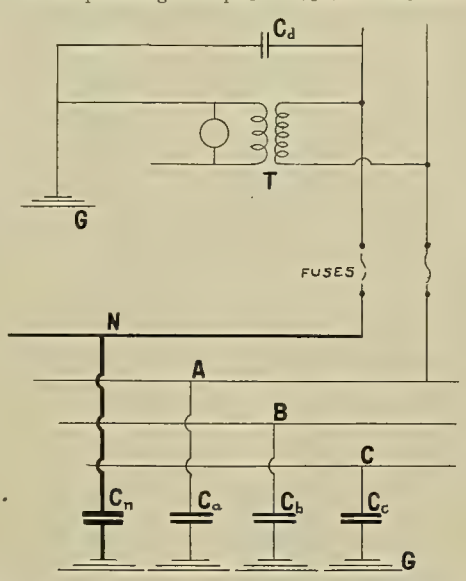


FIG. 6. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

that the phase condenser was shunted by an ohmic resistance.

Fig. 6 shows a condition which may be obtained where the ground is of an inductive character. (N) (A) (B) (C) represent the bus-bars of a four-wire three-phase system. One circuit is shown connected to the bus-bars (N) and (A). The capacity of the neutral of this circuit is represented by the condenser (Cd). The capacity of the rest of the system is represented as (Cn) (Ca) (Cb) and (Cc). In a case where the neutral fuse blows and the fuse on the phase wire remains intact, a circuit is completed from bus-bar (A), through phase wire of circuit, through primary of transformer (T) and through condenser (Cd) to ground. In case the neutral had become grounded, short-circuiting the condenser (Cd), the ground would have been obtained through the primary of the transformer only.

Fig. 7 represents the condition when a phase wire is grounded through an ohmic resistance in series with an inductive reactance. It is evident that ohmic resistance will always shunt the inductive reactance instead of being connected in series with it, as shown. The series condition was chosen on account of its simplicity.

Following is the derivation of formula for obtaining the pressure from neutral to ground for any given values of L and r. The condensance on the system is assumed to be balanced, and the reactance of each phase condenser is represented by x. The

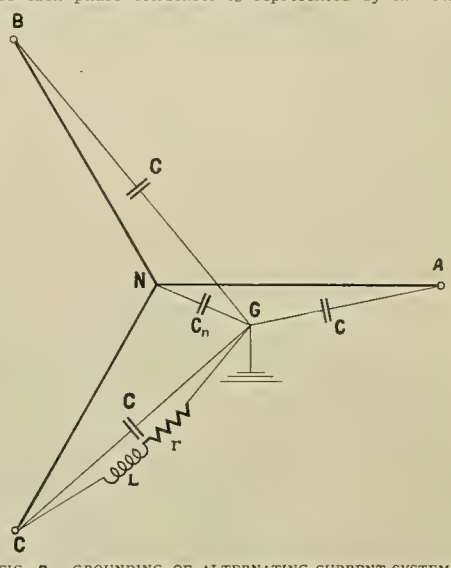


FIG. 7. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

reactance of the neutral condenser is represented by y. The ohmic resistance is represented by r and the inductive reactance of L is represented by w.

Let Ia represent current in (A) phase condenser, Ib current in (B) phase condenser, Ic current in

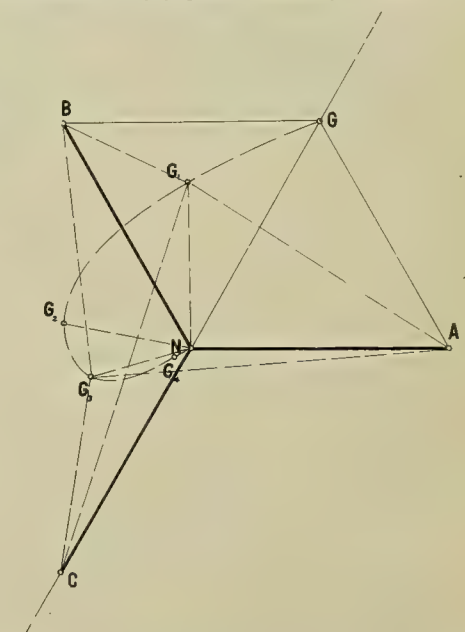


FIG. 8. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

(C) phase condenser, In current in condenser (Cn), Ir current in (rL).

$$Ia = \frac{GA}{jx} = \frac{GN + NA}{jx}$$

$$Ib = \frac{GB}{jx} = \frac{GN + NB}{jx}$$

$$Ic = \frac{GC}{jx} = \frac{GN + NC}{jx}$$

$$In = \frac{GN}{jy}$$

$$Ir = \frac{GN + NG}{r - jw}$$

$$Ia + Ib + Ic + In + Ir = 0. \quad (13)$$

Substituting current values in (13) and solving

$$GN = NC\,\frac{xy}{w\,(3y + x) - xy + jr\,(3y + x)}$$

Substituting for GN its vector value (— a —jb)

a = 1150
h = 1992

$$G\,N = \frac{-\,xy\,(a + jb)}{w\,(3y + x) - xy + jr\,(3y + x)}$$

$$\text{Tan. angle(ANG)} = \frac{(bw - ar)\,(3y + x) - bxy}{(aw + br)\,(3y + x) - axy}$$

Substitute in this equation a value of 1,700 ohms for x and a value of 900 ohms for y, and assume the resistance in series with the inductive reactance is 0. When w is equal to infinity GN is 0, when w has a reactance of 348 ohms GN is infinity, when

a reactance of 0 ohms GN is 2,300. A study of this condition will show that when the phase-wire is grounded through a purely inductive reactance, and the reactance is varied from infinity to 0, the pressure from neutral to ground follows the direction of the line (NG) shown in Fig. 8. With a reactance of 348 ohms, the line swings through infinity, and as the reactance decreases the voltage travels back on the path of the line (NC) until GN = CN.

Fixing the value of inductance at 695.5 ohms, and varying the value of resistance from 0 to infinity, it is found that the ground potential follows the curve shown in Fig. 6. With r = 0, GN = 2,300 volts; with r = 200, GN = 1,386; with r = 500, GN = 1,085; with r = 1,000, GN = 907; when r = inf., GN = 0. These points are shown in the curve as (G1), (G2) and (G3).

The examples which have been presented all show that when the resistance or reactance grounding any phase conductor bears certain ratios to the condensance reactance of the system excessively high potentials will be obtained between the system and ground.

Another effect which adds new complications to the problems given may be best illustrated by the actual results obtained from experiment. A conductor, as shown in Fig. 9, was connected to a 60-cycle alternator generating 2,300 volts. One side of the alternator was grounded, the other side being connected to the line through a lamp and the spark gap (S). An ammeter was connected in series with the spark gap and lamp and an electrostatic voltmeter was connected between the line and ground. With the spark gap closed the charging current taken by the line was 0.125 ampere, which corresponds to a reactance of 18,400 ohms. Opening the spark gap 0.05 of an inch the 16-candlepower lamp burned steadily above its rated candlepower and the ammeter indicated a current flow of 0.87 ampere, showing an increase of practically seven times the original current. The static voltmeter showed no increase in voltage. Apparently the reactance of the condensance dropped from 118,400 ohms to 2,640 ohms. There appears to have been an increase in frequency. This, however, could not be definitely ascertained, as there was no means at hand to determine the wave form of the current.

Assuming the above conditions were due to an increase in frequency, such as a higher harmonic or combination of harmonics, it will be seen that if the phase-wire fuse of the circuit shown in Fig. 6 ruptures, the conditions shown in this experiment may be obtained. Excessive voltages might then

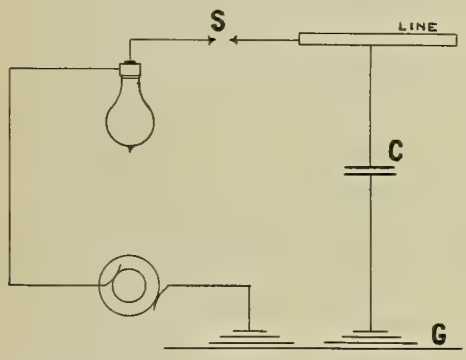


FIG. 9. GROUNDING OF ALTERNATING-CURRENT SYSTEMS.

result, due to the change in the ratio of the inductive and condensance reactance included in the circuit.

The conditions considered show conclusively the necessity of grounding any alternating-current system to eliminate the high potentials which otherwise would be obtained between the system and ground.

Detroit Edison Company to Mine Salt.

The Detroit Edison Company will receive bids on May 4th for constructing the conduits to carry the feeder mains from the new power plant near Fort Wayne, Mich., to Detroit. The conduit line will come from Woodmere, a suburb of Detroit, along Fort Street to Eighteenth Street, and thence by other streets to Cass, where it will connect with the present city conduits.

Alex Dow has just announced for the first time that the company has plans for the mining of rock salt. It proposes to sink a shaft about 1,000 feet deep, to the deposits of rock salt, and to mine the salt on a large scale. In these mining operations electricity from the new power house will play an important part, being used in all cases for drilling and blasting out the salt in the mine, for hoisting the rock to the surface and for crushing the rock salt into various sizes for commercial uses. The company further contemplates the manufacturing of chemical products from the salt by means of electrolytic processes. The actual cost of the buildings situated along the river front will be about $250,000.

The Washington Water Power Company of Spokane is now extending its 50,000-volt transmission line into the Cœur d'Alenes in Northern Idaho, a distance of approximately 90 miles.

OBITUARY.

S. Morgan Smith.

York, Pa., April 20 [Special Correspondence].—S. Morgan Smith died at Los Angeles, Cal., on April 12th. The immediate cause of his death was fatty degeneration of the heart. The news of his death was heard in this city with great sorrow, and his loss will be deeply felt by the small army of employes who have surrounded him at his extensive works which bear his name. The deceased was born February 1, 1839, in Davie County, N. C. He attended the Moravian College at Bethlehem, Pa., from which institution he graduated in 1861. He prepared himself for the ministry, and after serving as pastor of the Moravian church in this city, he was elected chaplain of the Two Hundredth Regiment, Pennsylvania Volunteers, in which capacity he served until the end of the war. In 1866 he went to Canal Dover, Ohio, where he had charge of a congregation for five years.

S. MORGAN SMITH.

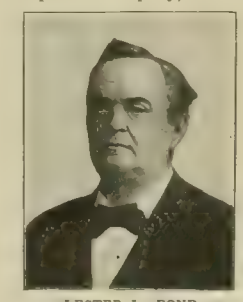
Mr. Smith was forced to quit his ministerial work in 1871, due to a serious throat trouble which had developed. He then returned to York, where he began giving his attention to the invention of the turbine waterwheel and the manufacture of milling machinery. He achieved notable success, building up one of the largest manufacturing plants for the erection of turbine appliances in this section of the state. He gave the closest application to business and was active in the direction of his great plant, even to the time of his death. He was a member of General John Sedgwick Post, G. A. R., No. 37. He was president of the Society for the Prevention of Cruelty to Animals. He was the president of the S. Morgan Smith Company and also president of the Atlanta Water and Electric Power Company of Atlanta, Ga., at present constructing a large plant for the purpose of furnishing electric light and power for manufacturing purposes for the city of Atlanta.

The deceased was a man of genial disposition, a large and charitable nature, and loved generally for his courteous demeanor. He had done much to upbuild and advance the interests of York. The large manufacturing plant which he built up will continue to be operated under his name and the many important changes and advancements which he desired to make had he lived will be matured by his two sons, Elmer and Fahs, who are by his death placed at the head of the institution.

Mr. Smith was married in 1862 to Miss Emma R. Fahs. He is survived by the widow and six children. The funeral services were held at the First Moravian Church on April 19th, and the funeral sermon was preached by Bishop Edward Rondthaler of Winston Salem, N. C., a former college classmate. The employes of the S. Morgan Smith Company's plant, numbering more than 300, attended in a body. O. P. W.

Lester L. Bond.

Lester Legrand Bond of Chicago, one of the leading patent lawyers of the country and the western patent attorney of the American Telephone and Telegraph Company, as successor to the American Bell Telephone Company, died at his home on West Monroe Street on April 15th in his 74th year. Mr. Bond had been engaged in the practice of patent law for over 40 years, and was the oldest practitioner of this specialty in the West. He was born in Ravenna, Ohio, October 27, 1829, and was admitted to the bar in that state in 1853. The following year he came to Chicago and engaged in general practice, turning his attention to patent law a few years later. At the time of his death he was senior member of the legal firm of Bond, Adams, Pickard & Jackson. Much of Mr. Bond's practice was in agricultural-implement cases, but he was also connected with the telephone suits in the earlier days, and for many years he received an annual retainer from the American Bell Telephone Company and its successor. So late as last week testimony was taken in the Strong case in Boston, in which Mr. Bond's firm represented the telephone company.



LESTER L. BOND.

Mr. Bond was chairman of the section on patent, trademark and copyright law of the American Bar Association and was the first president of the Patent Law Association of Chicago. He had held many other positions of trust and honor and was a member of several clubs and social organizations. He was an able, kindly and upright gentleman and was greatly respected. As dean of the patent bar in Chicago he was often called up to act as arbitrator in disputes between the patent lawyers, and his decision was invariably accepted as final. He was ever ready to give his services as a mediator in such cases, but would not consent to accept remuneration. He was an intimate friend of F. P. Fish, president of the American Telephone and Telegraph Company, and, in fact, enjoyed the respect and esteem of all the more prominent patent lawyers of the country. Mr. Bond is survived by a wife and one daughter. The funeral took place from Centenary Methodist Episcopal Church on April 17th.

European Street-railway Practice.

Richard McCulloch, assistant general manager of the Chicago City Railway Company, gave an interesting address before the Western Society of Engineers on April 15th. His subject was "Notes on European Tramways," and he gave results of observations made during two years which he spent in Continental Europe. He said there was not in the whole of Europe a tramway system which gives anything like the service given by the street railway in the average American city. Berlin came the nearest to it, while Glasgow's much-vaunted municipal system consisted of only 100 miles of track. American cities of the same size have over 400 miles, and Denver, one-fifth the size of Glasgow, has 142 miles of track.

The chief reason of the backwardness in transportation is that the topography and street construction of most European cities do not lend themselves readily to tramway building, the cities being located for defensive and not commercial reasons as are the American cities. Concessions for building street railways vary in different countries and are most favorable on the continent, although a great deal of red-tape has to be gone through before a concession is approved. Often two or three years elapse, and the system has to be started with material and equipment that has become obsolete.

The electrical equipment closely resembles that used in America, although some engineers design their own motors. The styles of cars vary. In England the double-deck car is almost universal and it is largely used in Paris. The usual car on the continent is a small box car mounted on a single truck, cheaply constructed and of an awkward, dry-goods-box appearance. Overhead-trolley systems are used extensively, but in cities the open-conduit, storage-battery and surface-contact systems are used to some extent, the last two with but little success.

Mr. McCulloch described the work that has been accomplished and is now being done in London and Paris on underground and overhead roads. An interesting feature of the service of all systems was that there were no heavy morning and evening peaks as in the United States, the habits and customs there being different. The service, as a rule, is poor as compared with that in this country. He said there was not in all Europe a counterpart of the modern American electric interurban railway with its private right-of-way, elegant cars, high speed and frequent service. The rates of fare there are small, but carry only short distances. While the passenger in Chicago pays five cents for an average ride of between four and five miles, under European rates he has to pay eight cents for the same distance.

In conclusion, Mr. McCulloch said that many American engineers and contractors were now engaged in installing tramways in Europe, especially in Great Britain, and many roads are now being built entirely with American apparatus or apparatus modeled after the American type. It was difficult, however, to operate these roads in the American fashion, on account of what is politely termed the conservatism, but what the builder is more apt to term the stupidity of state and government boards of control.

The Union County Traction and Power Company, recently incorporated at Anna, Ill., with a capital stock of $50,000, will erect and operate electric railways and install cold-storage, light, heat and power plants. The incorporators are W. Underwood, J. B. Jackson and F. S. Peabody.

Braun System of Space Telegraphy.

Although results obtained thus far are not all that might be wished, the Signal Corps of the United States Army is continuing its tests of space telegraphy with unabated energy. Six portable space-telegraph carriages have been ordered from Germany, and will soon be put in operation at military posts and will be employed in the army maneuvers. The wagons are said to be especially adapted for use in the mountainous western regions of the United States and two styles of carts are used, one containing the wireless apparatus and the rear carriage a benzine motor. Fifteen of these carriages will ultimately be employed if the tests prove successful. It is proposed at present to send the messages a distance of 60 miles, although it will be possible to telegraph for a greater distance if necessary.

The system to be employed is that invented by Dr. F. Braun of the University of Strasburg, Germany, and used at the last German maneuvers in the presence of Generals Corbin, Young and Wood. An illustrated description of the Braun system was given in the Western Electrician of September 13, 1902.

In a recent popular article Dr. Braun himself comments on the present status of space telegraphy as follows:

"Of the present state of wireless telegraphy, omitting attempts to bridge the ocean, it may be said that it is possible, by comparatively simple means, to send messages more than a hundred miles, and that communication is easier over water than over land. It is also possible to tune a few pairs of stations so that each may have secrecy of communication. Finally, it is possible to communicate at a great distance with an incoming vessel by dispensing with sharp tuning and to establish the latter, and therefore secrecy, when the ship comes nearer.

"So a large field is already open. Incoming, outgoing, and passing ships, islands a hundred miles or more off shore, lightships—all may, and some do, employ wireless telegraphy to advantage. For some years the Hamburg pilot service has been carried on by means of wireless messages sent to Cuxhaven from a lightship 21 miles out. The applicability of wireless telegraphy to military purposes was well shown in the recent German maneuvers, in which kites and captive balloons served as supports for the sending and receiving wires.

"Recently wireless messages have been sent to and from moving trains on the Berlin-Zossen military road. It is not probable that perfect secrecy ever will be attained. The message is, so to speak, trumpeted out to the world, and all who may have ears may hear it. And these ears—the receiver—if not already in tune may be attuned without much difficulty. Indeed, by the use of a sensitive microphone contact, any message may be read without tuning. The waves may perhaps be confined to a definite direction by mirrors and lenses, but it will be long before they can thus be kept together as well as the beam of a flashlight, and even that scatters widely. Dr. Zenneck has proved that a second vertical wire as long as the sending wire, erected near it and connected to earth, intercepts the waves and hence prevents them from reaching distant stations in that direction, and I have found that two receiving wires receive signals only when their plane nearly coincides with the direction of the incoming waves. In this way the bearing of the sending station can be determined to within 10 degrees—a result of special importance for nautical and military purposes.

"Last summer I also succeeded in determining the direction approximately by substituting a horizontal for the vertical receiving wire. A few weeks ago I laid before the Strasburg society the results of experiments which proved the possibility of sending out almost unlimited energy in the form of electric waves. The difficulty is not to produce powerful oscillations, but to produce oscillations both powerful and rapid enough. Other difficulties are those of sharp tuning and definiteness of direction, already mentioned.

"I recently received a telegram inquiring whether I could transmit any desired amount of electrical power without wires to any given distance. I answered that I would consider that problem after I had succeeded in heating a room in Munich by a flashlight in Nuremberg.

"An international congress for the regulation and unification of wireless telegraphy is soon to be held. Among the subjects which should be considered, in my opinion, are the compulsory exchange and forwarding of messages by stations and ships having apparatus, the feasibility of regulating the wave lengths used, and the prohibition of powerful stations covering great distances spanned by ordinary telegraph, except where they do not interfere with the proper and peculiar use of wireless telegraphy in its legitimate field.

"It is also to be hoped that no governmental regulations will be adopted that will retard the development of this new method of communication."

Charles Smay and Martin Surratt, employed respectively as conductor and motorman on the Elwood-Anderson Interurban railway in Indiana, have exceptional records to their credit. They have served the company about five years, during which time each one has traveled a distance of nearly 250,000 miles. Their run is a very fast one, but they have never had a serious accident.

Space-telegraph Repeater.

The possibilities of communication over considerable distances by means of space telegraphy have induced inventors to try and perfect apparatus by which messages could be repeated and thus sent over greater distances, or even diverted at any specified angle from the direct initial course, thus establishing cross lines of communication. Marconi has demonstrated that the distance limit of wireless transmission is only a question of energy. He estimates that a distance of 5,000 kilometers can only be overcome by an energy equal to 40 horsepower; so that for considerable distances the cost of an installation would be high, if not almost prohibitory, and the transmission would necessarily be slow. The space-telegraph repeater would, to a great extent, overcome these objections.

After many experiments, E. Guarini and his associates have adopted in successful trials at Malines, France, and between Antwerp and Brussels the form of apparatus which is illustrated in Fig. 1, and shown by diagram in Fig. 2. The receiving antennæ end at a source of infinite capacity (the earth, for example) and are connected to the dead binding post of a high-current relay, and thence to the primary of a transformer, in the secondary of which is inserted a coherer and condenser, the whole constituting what Marconi terms the "jigger." Leading off from the two terminals of the condenser-coherer on the one part, and the secondary coherer, on the other, are placed two self-induction coils, a battery and a relay. The relays form the circuit of a source of energy which actuates a striker and the relay for high currents. This latter at the same time that it interrupts the communication between the receiving antennæ (and the transmitting apparatus at the same time) and the primary of the transformer (jigger), closes the circuit of the primary of an induction coil (transmitter), of which the secondary is connected on one side with the transmitting antenæ (the same which serve for the receivers of the waves) and to one of the balls of an oscillator; on the other part the current leads to the earth and the second ball of the oscillator.

A metallic box is connected to earth, containing the jigger, coherer, condenser, feeble-current relay with battery and self-induction coils, the hammer, the shunts and the battery actuating the high-current relay and the hammer. One of the wires connecting with the second (high-current) relay is protected at its entrance into this box, by a self-induction coil, wrapped in tin, enclosed in a metallic box and connected to earth. This last box is fixed to that which protects the receiving apparatus, and which is attached to the other wire connecting with the manipulating relay. The wire from the dead terminal of the manipulator to the receiver (jigger) is enclosed in a metallic tube connected to earth, extending up to its entrance into the box containing the transformer.

Suppose now that the repeater is placed between a transmitting and a receiving post, too far distant for direct communication with either; and suppose, also, that the signals are the Morse dots and dashes. When a wave reaches the receiving antennæ, the coherer, the anti-coherer and any other imperfect contact is affected. Contact is established between the armature of the second relay, as in the Morse relay, and its front stop, closing the circuit, and at the same instant that a spark is produced at the oscillator the conductor connecting the antennæ of the receiver (and consequently the antennæ themselves) is separated from the receiver, because the armature of the second relay is now disconnected from the dead terminal of this. All direct action of the oscillator and the transmitting antennæ on the receiver is impossible—first, by reason of the impedance of the self-induction coil at one of the terminals of the manipulating relay, and afterward by the metallic boxes and the pipe enclosing the conductor connecting the dead terminal of the manipulating relay to the receiver. The repeater will thus reproduce a short signal—a dot—and then rest. This signal actuates the distant apparatus, which repeats the impulse.

If the signal sent is a dash, the repeater sends a dot, the armature of the second relay falls back against its stop, and a second dot follows the first, and so on to the length of the dash, the dots being close enough to form such a signal.

Where two or more repeaters are placed on the same line, while repeater No. 2, for example, repeats to No. 3, the armature of the second relay of the repeater (the manipulator) No. 1 is open at its terminal; that is, it is not ready to receive a signal, and will not be until No. 2 has finished repeating to No. 3.

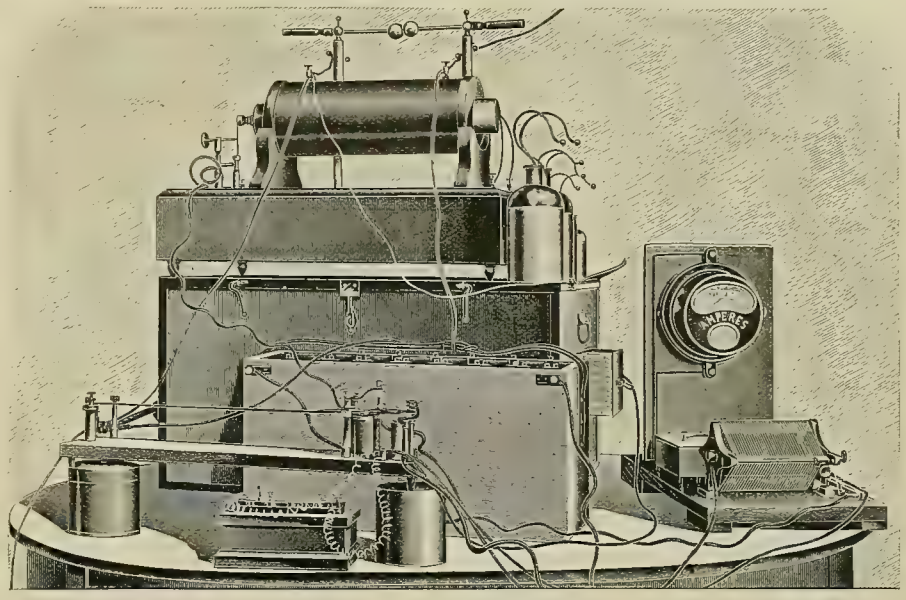


FIG. 1. SPACE-TELEGRAPH REPEATER.

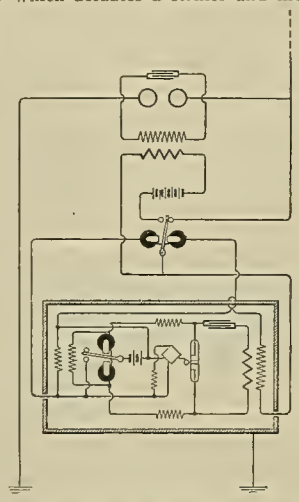


FIG. 2. SPACE-TELEGRAPH REPEATER.—DIAGRAM OF CONNECTIONS.

Buffalo-Cleveland Electric Railway.

It is announced that the Buffalo, Dunkirk and Western electric railway, which is practically owned by Cleveland men, will be built as soon as possible. It is the intention to make Buffalo and Cleveland the termini, but it is probable that the roads already built over a portion of the route between the two points will be utilized either by purchase or traffic arrangements. The capital stock of the company has been increased to $3,500,000 to cover the cost of building the line. For some distance the road will parallel the Lake Shore steam road, and a power house with a capacity of 8,000 or 10,000 horsepower will be required to operate the line. On account of the purchase of firms in the gas belt by some of the owners, however, it is expected to use that fuel instead of coal for fuel. Luther Allen, president of the Bankers' National Bank of Cleveland, is the president of the company, and there are several other Cleveland men in the board of directors. The Buffalo men on the board are Truman G. Avery, Albert J. Meyer, W. J. Conners and C. M. Bushnell.

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DATES AHEAD.

National Electric Light Association, Auditorium Hotel, Chicago, May 26th to 28th.
Canadian Electrical Association, Toronto, Ont., June 10th to 12th.
American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.
National Electrical Contractors' Association, Detroit, Mich. July 15th to 17th.
American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.
American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

THE unconfirmed report from Russia that a deposit of the newly discovered element radium has been found in that country is interesting—if true. From all accounts of the new element that have been published one is inclined to fear that the statement attributed to the unnamed Russian engineer, alleging the discovery of a deposit of natural radium in the Russian steppes, near the Asiatic border, is unfounded. As one of the natural elements, it is impossible to say, of course, that such a deposit may not be found, but, from the extraordinary characteristics of radium, it seems probable that the element occurs only in minute quantities and in composition with other elements. Were it otherwise, it is likely that long before this radium would have been discovered, and, if available in appreciable quantities, would have been put to such uses in the arts as its remarkable properties indicate.

To what extent noise is inseparable from the necessary and proper operation of street and elevated railways in cities and to what extent it is a nuisance for which abutting property owners can recover is an interesting and, to those immediately concerned, important question. The Supreme Court of Massachusetts has handed down a decision in the case of Edward F. Baker against the Boston Elevated Railroad Company, in regard to damages assessable on account of noise. The case was originally heard in the Superior Court, the chief justice of which, who heard the case without a jury, deciding "that the noise occasioned by the operation of the respondent's railway was such in general character and extent as, but for the statutory authority, would constitute a private nuisance of a grave character to the petitioner's estate," and that the petitioners were entitled to recover the sum of $2,000, one-half of which is for the damage from noise. This decision is now upheld by the higher court by unanimous agreement. In Illinois, we believe, it has been held that the noise of street-railway operation, whether elevated or surface, is a necessary evil in the use of the streets for transportation purposes where franchises have been granted by the proper authorities. This would seem to the mere layman to be reasonable doctrine, but especial complaint has been made of the Boston Elevated, and the Supreme Court of Massachusetts has taken the position that the allegation of nuisance is well founded. Noise can never be entirely eliminated from street-railway operation, although proper details of construction and operation do much to decrease it. It is to be hoped that the intention of the Massachusetts court was to hold that only excessive and unreasonable noise constitutes such a nuisance as will sustain an action for damages.

ELECTROCHEMISTS have reason to be proud of their organization, the American Electrochemical Society, which held its third general meeting in New York city last week. From the report of the convention given in this issue it will be seen that much useful work was accomplished. The papers presented and the discussions were, in general, of a high order, and the society demonstrated—as, indeed, it had done at Niagara Falls—its right to rank with the older organizations of similar aim in Europe.

An interesting feature of the gathering was the presence of Prof. Walther Nernst of the University of Göttingen, Germany, who was the guest of honor at the banquet of Thursday evening. Professor Nernst is a distinguished inventor as well as a scientific investigator, and, like Thomson, Edison, Bell, Crookes, Hertz, Röntgen and several others, has given his name to a type of electrical apparatus known all over the world. He read a paper before the society and expressed the friendly wish that the German society and the young American organization might act in closer unison.

The society's election resulted in the retention of the old officers, which was perhaps wise in view of the fear expressed by some that industrial jealousies might be engendered as the result of the election. Like all scientific and engineering societies, the American Electrochemical Society should be resolutely kept free from the furthering of private ends and business ambitions. The societies should be the common meeting places of all engaged in similar pursuits, where the combats of trade should be forgotten and only the good of the industry as a whole remembered. As between different manufacturing or operating companies, the society administrations should be rigidly non-partisan. It does not follow, of course, that to obtain such neutrality it is necessary to exclude high-minded and honorable men connected with various business enterprises. Fortunately, no such restriction is necessary in dealing with the professional men who constitute the bulk of American technical societies. But the societies should be like Cæsar's wife in this respect, and, where the issue has been raised, it is perhaps wiser to avoid even the appearance of evil. So the American Electrochemical Society has apparently done well to retain a college professor as its president.

In all respects the New York convention was worthy of the vigorous and influential young association which held it.

As stated by the Western Electrician's London correspondent in our issue of last week, some little interest is being manifested in England in an electrical system for locating ores, which is said to have been successfully demonstrated at some lead mines in North Wales. The system has been devised by Alfred Williams and Leo Daft, the latter gentleman being well known to American engineers. In operation the system is said to be extremely simple and requires no expert knowledge of either electricity or mining. The transmitting apparatus consists of a large induction coil, the secondary of which is earthed and shunted by a condenser. The coil is energized by secondary batteries, and the potential at the terminals of the secondary winding is between 30,000 and 40,000 volts. The receiving circuit comprises a transformer with two telephone receivers. In operating the system the two terminals of the transmitting apparatus are earthed by means of steel spikes driven in the ground a short distance apart, and, similarly, the two terminals of the receiving apparatus are earthed at about one-fourth of a mile distant, there being no wire connection between the two stations. The inventors hold to the belief that electric impulses or waves are radiated from the transmitting apparatus in all directions, and that when a metallic lode is in the neighborhood the waves are deflected from their normal course, producing in the telephone receivers an abnormal effect which can be readily recognized. The exact direction or location of the ore is determined by varying the positions of the transmitting and receiving apparatus and noting the effects.

It is interesting to compare this English system with a somewhat similar metal-locating apparatus invented by Fred H. Brown of Chicago and used with much success in this country. Mr. Brown's device was described for the first time in the Western Electrician of November 16, 1901, and at that time attracted considerable attention in the foreign press. If anything, the system is simpler than the English one, the principle used being that of the Wheatstone bridge. Only two earth terminals are used, and they are connected by a wire, the resistance of the return circuit being measured by the apparatus. When the resistance drops to a few ohms it is an indication that the circuit has been completed through a metallic lode, and by varying the positions of the terminals the ore may be accurately located. This system has been demonstrated as practical in many instances and, moreover, it enables not only the position but the depth of the ore to be determined and in some instances the nature of the mineral. These last advantages, it is believed, are not put forth for the English system, and, in addition, it is probable that the Daft-Williams apparatus is much more bulky to transport and handle than the Brown equipment. One advantage, however, for the English system is that no great length of wire is necessary, but this, on the other hand, has been found of advantage with the American apparatus, as by means of the wire the operators at the two stations can communicate with the aid of a telephonic attachment. The relative commercial advantages of the two systems could probably only be obtained through a competitive test, and such a test would be of some interest.

AMERICAN ELECTROCHEMICAL SOCIETY.

The third general meeting of the American Electrochemical Society was formally opened on Thursday morning, April 16th, in the Assembly Hall of the Chemist's Club, 108 West Fifty-fifth Street, New York city. Many prominent engineers and chemists were present, including Prof. W. D. Bancroft of Cornell, Dr. Samuel Sheldon, Polytechnic Institute of Brooklyn; Dr. William McMurtrie, president of the Chemist's Club, New York; Prof. Henry S. Carhart of Ann Arbor, C. O. Mailloux of New York, Carl Hering of Philadelphia and Prof. C. A. Doremus of New York. The attendance included 50 members and their guests. During the day about 125 names were registered.

The meeting was called to order by Prof. C. A. Doremus, chairman of the local committee, who announced what arrangements had been made for the reception of the society and its guests. Professor Doremus then introduced President J. W. Richards, who thanked Dr. McMurtrie for the kindness and forethought of the Chemists' Club in offering its clubhouse as a center for the convention. Dr. McMurtrie responded by extending to the members and guests of the Electrochemical Society a most cordial welcome.

The secretary reported that the present membership of the society amounted to 512 members, 53 of whom were foreign. The treasurer reported a balance of $2,172.72 in the treasury.

Thursday's Papers.

Papers were then presented and discussed. "Constant Voltage and Constant Current Separations," was the subject of Dr. Wilder D. Bancroft. Professor Bancroft spoke of an extended research he had performed upon the electrolytic separation of metals. He stated that all of the best separations were made at a temperature of 60 degrees C., and that constant current was usually employed. A tabulated list was presented, showing the order in which various metals came out of solutions.

In the absence of H. T. Barnes, Ph. D., his paper entitled, "Experimental Study of Some Electrode Effects," was read by Dr. Bancroft. Mr. Barnes found experimentally that the gases dissolved in a solution had an appreciable effect upon the electrodes and that if the solution was boiled those effects would be obviated.

A paper entitled "The Electrolysis of Water" was presented by President J. W. Richards. This paper embodied a series of experiments which tended to show that the decomposition of water, slightly acid, was due to the presence of dissolved gases, and that when these gases were liberated from the solution no current would pass. The writer stated that in the decomposition of such a solution the number of coulombs of electricity necessary to develop the amount of gas which a given solution contained was numerically equal to the number of coulombs the solution would pass before electrolytic action would cease. Considerable discussion took place after the reading of this paper, during which Dr. Richards stated that he had endeavored to pass a current through H_2SO_4, dilute, in a thermometer tube completely filled, sealed at both ends, with platinum electrodes enclosed, and that he had failed; but upon admitting air to the tube electrolytic action took place instantly.

"Experiments with Metallic Diaphragms" was the title of the next paper, read by Dr. Bancroft. He found as a result of his experiments with these diaphragms, which were inserted in the solution between the electrodes, that copper sulphate could be decomposed at one-half of the normal voltage usually employed for such purposes.

C. J. Reed read his paper on the "Protective Action of Zinc Chloride on Metallic Iron." It related to a series of experiments performed upon metallic iron to test the protective action of zinc chloride. Mr. Reed noticed that when iron was left in zinc chloride there was no tendency for the iron to oxidize, in which case it would have lost the brilliancy which it retained.

A very interesting paper, entitled "Insulating Materials, a Field for Chemists," by Mr. Von Recklinghausen, Ph. D., was presented by the author. The paper covered the field of insulating materials very thoroughly. Some of the important points suggested were the desirability of a high flash point for oils which were to be used for transformers or circuit-breakers and the disadvantages of rubber compounds which deteriorate with age. The author mentioned the fact that insulators which were mixtures were not homogeneous and that asphalt compounds were being experimented upon.

H. B. Coho gave a "Historical Review of the Storage Battery." Mr. Elmer A. Sperry presented a paper on "The Use of Pyroxyline in Electric Storage Batteries." Pyroxyline is cheesecloth treated chemically. This cloth is wrapped around the positive plate and consequently retains the pasted material in place. This enables grids to be constructed of much less material than formerly, which increases to a marked degree the watt-hours per pound of cell.

A chemical paper was read by W. H. Walker on "The Concentration Changes in the Electrolysis of Brine." The paper related to the changes in concentration which took place during the electrolysis of brine in the production of caustic soda.

"The Thermo-electromotive Force of Cells" was presented by Professor Henry S. Carhart, one of the greatest pioneers in the field of standard cells. Dr. Carhart proved mathematically that a concentration cell was a purely dynamic engine which would convert heat into electrical energy indefinitely. This was equivalent to stating that the electromotive force produced by a standard concentration cell did not consume the ingredients of the cell, but that the cell simply acted as a reversible dynamic machine, converting the heat of the atmosphere into electrical energy.

The meeting for the day closed with the reading of a paper on the "Corrosion of Metals by Electrolysis," by A. A. Knudson. The author mentioned that he had examined several hulls of vessels and had found that corrosion had taken place wherever two dissimilar metals, close together, had come into contact with sea water. Several samples of corroded water pipe were exhibited. He also made mention of the electrolytic work done by Dr. Samuel Sheldon of Brooklyn. In the discussion of this paper Carl Hering proved that the voltmeter method was not satisfactory for determining the magnitude of the current carried by a pipe. He suggested employing, in addition to the voltmeter, an ammeter, shunting the voltmeter, and of employing the formula

$I = \frac{e i'}{e - e'}$, where I = the current carried by the pipe, i = the current indicated on the ammeter, e = the voltage when the ammeter was not in circuit, and e′ = the voltage where the ammeter was in the circuit.

The meeting for the day was then adjourned.

Thursday Evening's Banquet.

A subscription banquet was held by the society on Thursday evening in the Banquet Hall of the German Liederkranz, 111 to 119 East Fifty-eighth Street. There were present 100 members and guests, including about 25 ladies. The decorations were elaborate. The letters A. E. S. composed of red, white and blue globes, were suspended facing the dais. A feature of the evening was the musical programme, arranged for the intermission of the courses. Professor C. A. Doremus presided as toastmaster. Professor Richards responded to the first toast and congratulated the members upon the success which had so far attended their meeting. Dr. Walther Nernst of Germany, the celebrated inventor of the Nernst lamp, was the second speaker. His introductory remarks were in English, but he concluded his speech in German. He particularly complimented Professor Willard Gibbs for his pioneer work in the field of electrochemistry. Dr. Nernst expressed a desire that the German Chemical Society and her sister fraternity, the American Electrochemical Society, would be able to become affiliated some time in the future. C. F. Scott, president of the American Institute of Electrical Engineers, then spoke of the time when the American Electrochemical Society broke away from the Institute and formed a society of its own. He remarked that when this occurred the Institute thought it was a bad thing for it to do, but that now the Institute was convinced that it was a good thing, as the American Electrochemical Society had accomplished such remarkable results in so short a time. President Scott thought it would be a good thing if the American Institute of Electrical Engineers was the hub around which all the other electrical societies would revolve.

Friday's Proceedings.

The society was called to order at 9:30 a. m., followed by the reading of a paper entitled "Notes on the Composition of Electroplating Solutions," by Dr. N. S. Keith. In the discussion which ensued, S. E. Gitly stated that electrotypers had a proneness for adhering to the time-honored formulæ in the preparation of solutions; and that numerous causes of complaint were really due to the use of improperly compounded solutions. By changing the solution this difficulty could often be obviated. C. O. Mailloux remarked that electrotypers almost looked with reverence upon the old 8° Beaume solution, and it was only by extreme coaxing that they could be induced to use solutions of different concentration and different specific gravity. Mr. Hering said that a new method of agitating solutions had been recently carried out in England. The solution was first injected through a pipe and then squirted with great velocity against the cathode.

The next paper read was "Modern Electrolytic Copper Refining," by Titus Ulke. In the absence of Mr. Ulke, his paper was read by President Richards. Mr. Ulke pleads for more good fellowship and good will among electrochemists, as free interchange of ideas is necessary to accelerate the growth of electrochemical industries. Frequent reference was made throughout the paper to the author's work on copper refining, just issued from the press. Heating the electrolyte 50 to 60° C. is advantageous, as it lowers the specific resistance of the electrolyte and increases the tensile strength of the deposited copper. Nearly all improvements in electrolytic copper refining are of American origin. The introduction of electrode traveling cranes has greatly decreased the time for refining.

The present production of electrolytic copper is 322,000 tons per annum, valued at $96,000,000. The world's production is 883 tons per diem. Cost of production is from $3 to $18.

President Richards then read a communication from Mr. Frenzals of Denver, Colo., in which he offered a prize of $250 for a method of treating rare minerals. He is particularly interested in vanadium, tungsten, uranium and palladium. Only members of the society are entitled to compete.

Dr. Walther Nernst, professor of physical chemistry at the University of Gottingen, Germany, then addressed the society on "New Apparatus for Determining the Vapor Densities of Gases at High Temperatures." This paper was followed by "Notes on Electrical Endosmose," by Dr. W. D. Bancroft. Endosmose or cataphoresis accounts for the transmission of current through the diaphragm. By varying the concentration of the solution, it is possible to obtain both a positive and negative endosmose.

Dr. Louis A. Parsons then gave an abstract of his paper on "Ions and Electrons." This paper was followed by that of Carl Hering, on "Uniformity in Electrochemical Equivalents." In the discussion of this paper Dr. Bancroft maintained that voltameters greatly influenced the result of ionic charge. The value of 96,600 coulombs is approximate and really accurate enough for industrial use. If, however, the value 96,540 is used the result will be more accurate and hence should be employed in physicochemical measurements. Mr. Hering said that, after all, the value of the legal ohm, 1.118, instead of 1.1176, makes no real difference to the industrial electrochemist, as the error introduced is quite negligible. Upon the conclusion of the discussion Dr. Bancroft gave a brief abstract of his paper on the "Electromotive Force of Alloys."

Election of Officers.

The report of the tellers showed that the membership had grown to about 425. The officers of the present year were re-elected, viz.: President, Dr. Joseph W. Richards; first vice-president, Dr. W. D. Bancroft; second vice-president, Dr. C. A. Doremus; third vice-president, Dr. W. R. Whitney; managers, Colonel Samuel Reber, Dr. S. P. Sadtler and C. O. Mailloux; treasurer, Dr. Pedro G. Salom; secretary, Charles J. Reed, 929 Chestnut Street, Philadelphia.

For president Dr. Richards received 160 votes and A. H. Cowles of Cleveland received 109 votes.

Electrochemical Data.

The programme of the morning was concluded by the reading of a very long paper on "The Electrolytic Production of Metallic Compounds," by Professors C. F. Burgess and Carl Hambuechen. As a preface to this excellent paper the authors pointed out the unreliability of technical information relating to electrochemistry and the number of papers in the transactions of scientific bodies which are the product of over-enthusiastic persons. They recommend the sifting out of all this matter for the guidance of workers in this field. Freak patents and inventions are too often misleading to young workers in the field.

Excursions.

The excursion committee, of which Dr. F. G. Wiechmann was chairman, arranged an elaborate programme for Friday and Saturday afternoons. The excursion consisted of three parties on Friday afternoon, each numbering about 40 persons. Party A visited the plants of the Willyoung & Gibson Company and the Crocker-Wheeler Company. Party B "took in" the works of the Sawyer-Man Electric Company and of Eimer & Amend, and then visited the Cooper Union laboratories. Party C went to the plant of the United States Electro-galvanizing Company at the Brooklyn Navy Yard and later inspected the chemical and physical laboratories in the navy yard.

Joint Meeting with the Institute.

A special meeting of the American Institute of Electrical Engineers was held on Friday evening, April 17th, in the Assembly Hall of the New York City College. The American Electrochemical Society was present as the guest of the American Institute of Electrical Engineers. There were present about 500 members and guests of both societies. A very interesting paper was presented by William J. Hammer, on the subject, "Radium and the Treatment of Disease by the Ultra-violet Light." The paper was abstracted by Mr. Hammer, who illustrated his remarks by lantern slides and a series of beautiful experiments with radium and other fluorescent substances. Some of the experiments were so striking that one was reminded very much of the spectacular demonstrations of Tesla. One of Mr. Hammer's experiments consisted in discharging a small cannon by interposing a hand in the path of light rays falling upon a selenium cell. He facetiously suggested as a practical application of this experiment, that if the government would only place selenium cells along the coast in connection with its forts, that when the enemy would come along the shore plying its searchlights upon the fort the latter would automatically fire the guns. He spoke of the remarkable properties of radium, and mentioned many cases in which patents suffering from lupus vulgaris or consumption of the skin, were completely cured by the application of ultra-violet light. Mr. Hammer also shaded the selenium cell with his hand from rays of light and succeeded in starting a five-horsepower motor in operation. The motor was belted to a dynamo which generated sufficient electromotive force to illuminate a bank of lamps. All of these experiments were brought about by the well-known

fact that selenium changes its resistance to a marked degree when acted upon by light. The change in the current strength of the cell actuated a telegraph relay, which in turn operated the main circuit, to which the various appliances were connected.

SATURDAY MORNING SESSION.

A paper entitled "Electro-deposition of Metals Upon a Rotating Cathode," by J. G. Zimmerman, which was left over from Friday's session, was read in the absence of its author by Professor Burgess. On depositing nickel some peculiar results had been noticed. With ordinary stationary cathodes about six amperes per square foot is sufficient; and to insure uniform deposition should not be greatly exceeded. By employing rotating cathodes the author found that a current density of 3,000 amperes could be safely used, and that the deposit besides being made at a quicker rate was smoother and much more uniform. His conclusion is that frictional rather than centrifugal action accounts for the uniformity. This is in exact contrariety with the views of Cowper-Coles, who, in his recent paper before the British Institution of Electrical Engineers, claims that centrifugal action alone accounts for the observations made. In the discussion Carl Hering said that practically the same result would be obtained by a rapid circulation of the liquid, and that it is, moreover, a much simpler mechanical method. Either a thorough agitation of the liquid, or by injecting it under pressure against the cathode are far simpler than any rotating-cathode method. Dr. Bancroft maintained that the most important feature, after all, is the renewal of the electrolyte at the cathode as quickly as possible. The mean velocity is not important, but the velocity of the ions in immediate contact with the cathode most directly concerns the nature of the deposit. With 300 amperes per square foot, fairly good results can be obtained. S. E. Gitly stated that it was feasible to deposit a one-half gram of metal (copper) in 15 minutes with a current density of 12 amperes per square foot. Very rapid circulation always produces best deposits.

A. B. Marvin then presented his paper on "Electrolytic Conduction Without Electrodes." His experiments were conducted in the laboratory of applied electrochemistry of the University of Wisconsin. The apparatus employed consisted of a transformer with a primary of 23 turns of copper wire and a secondary of one turn of electrolyte contained in a thin wooden trough. The transformer core was of the shell type, the inner tongue being 6 by 18.5 centimeters and the outer 5.3 by 3 centimeters. The trough was built up of dry pines, the parts being wedged together to avoid the use of nails which might accidentally come in contact with the electrolyte. The extremities of the trough were run out beyond the sphere of magnetic leakage from the transformer and connected by a glass tube which passed out through the two branches of the wooden trough, and also, with a snug fit, through a test coil built up like an ordinary Gramme ring. The core of the ring consisted of iron wire shellacked before winding, and over this core was wound 700 turns of No. 30 insulated copper wire, which, in turn, was connected to a telephone receiver. With this apparatus it was found that an alternating impulse impressed on the copper winding of the transformer would induce an impulse in the electrolytic secondary, and if an electrolyte is capable of transmitting a current under such circumstances, the current which would be caused to flow through the glass tube would throw out lines of force which, by cutting back and forth through the inner halves of the 700 turns of copper wire would cause a humming in the telephone receiver.

In the discussion which followed W. L. Smith remarked that it is entirely possible that the noise induced in the telephone was of electrostatic rather than of electrolytic origin. President Richards maintained that the title of the paper was wrong; that it should be "Metallic Conduction Without Electrodes," and that the conduction was not electrolytic but a conduction by metals whose resistance is known. Assuming this to be the case, the electrolyte may conduct electricity without decomposition as a conductor of the first class. Mr. Hering differed from the president's views, and stated that the conduction in this case is exactly of the same nature as though electrodes were included in the circuit; and that nothing metallic is included. Dr. Carhart took the stand that if the electrolytic dissociation theory is correct it is ionic conduction which accounts for the observed phenomena.

A paper on "Potentials of Zinc in Aqueous Solution," by H. E. Patten and W. R. Mott, was read by the latter. The authors state that the predominating influence rests entirely with that metal which is highest in the electrochemical series. The single potential of zinc in various solutions varies from +1 to —1. The potential is greatly affected by oxidizing agents, such as $KMnO_4$ or $KMnO_2$. In general all oxidizing agents tend to lower it. Numerous curves were exhibited, showing the potential of zinc immersed in mixed solutions such as $MgSO_4$ and $ZnSO_4$, $ZnSO_4$ and $CdSO_4$, $ZnSO_4$ and K_2SO_4. In a compound of cadmium and zinc sulphates there is an especially lower decomposition point. In regard to alloys the potential rises abruptly at first then gradually decreases to the end. The electromotive force of all alloys with zinc, with the exception of copper, is about that of zinc alone.

Woolsey McA. Johnson then presented his paper on the "Electrolytic Deposition of Nickel." He begins his paper by stating that the employment of a solution of about 43 degrees C. is inadvisable. The hot electrolyte accelerates turbidity of the solution. About five to 10 times as much energy is required to deposit nickel as copper because of their widely different positions in the electrochemical series. Nickel has to be deposited from a highly alkaline solution, whereas copper can be readily deposited from a dilute acid solution. Nickel electrolysis is not a reversible process, like copper electrolysis. Mr. Johnson advocates the use of a "matte," or rough surface, as nickel will stick to a corrugated surface best of all. In the discussion Professor Burgess stated that in the deposition of this metal it was highly essential to insure the absence of all insoluble substance floating around in the electrolyte. The solution must be perfectly clear.

The papers of the session were concluded by a brief description by Barry McNutt of a laboratory electric furnace. This was an experimental furnace of the Siemens type. Electrodes consisted of carbon rods in graphite crucibles. The furnace was devised for series working, and to accomplish this the base was made by taking arc-light carbons and putting them in the form of bundles held together by cylindrical metal. Connection of all in series was by means of crushed carbon which was pressed down in the shallow retaining cup. The furnaces were designed for 150 amperes at 40 volts and the current adjusted by cutting in parallel resistance and varying the current by 25-ampere steps. A large photograph of the furnace was exhibited.

Several papers on the programme were read by title only as the authors of some were not present. The last feature of the morning's programme was a fine exhibit of new electrochemical apparatus by A. Eimer of the New York firm of Eimer & Amend.

MORE EXCURSIONS.

On Saturday afternoon, April 18th, two excursion parties were arranged. Party A visited three large electric power houses and Party B inspected the rapid-transit subway. They afterward united and went through the buildings and laboratories of Columbia University.

CONCLUDING SESSION.

The convention came to an end on Saturday evening with a German-American smoker. The evening opened with a presidential address by President Richards, during which he spoke of the great opportunities for growth of the society. Prof. C. A. Doremus mentioned the convention which is to be held in Germany in June, during which an effort will be made to standardize the electrochemical units. The feature of the evening was a demonstration of the Hewitt mercury-vapor rectifier by P. Thomas. The actinic properties of the Cooper-Hewitt mercury lamp were dwelt upon by Dr. Max Von Recklinghausen. He showed by photographs that it was equivalent to about one-half that of bright sunlight on a June day.

The great success of the meeting was due in a large measure to the local secretary, Alois von Isakovics. A.

Chicago Electrical Association.

The regular meeting of the Chicago Electrical Association was held at its rooms in the Monadnock Block on the evening of April 17th, with Vice-president Junkersfeld in the chair. H. B. Gear of the overhead department of the Chicago Edison and Commonwealth Electric Companies read an interesting and instructive paper on the subject "Overhead Distributing System of the Commonwealth Electric Company." His paper was illustrated by about 20 stereopticon views, principally of diagrams and maps and original curves which he had worked out. There was an attendance of about 50 members and visitors, and the paper was briefly discussed by H. Almert, P. Junkersfeld and Thomas G. Grier. Mr. Gear's paper will be given in a future issue of the Western Electrician. The next meeting of the association will be at the Albion Cafe in the Pullman Building, on May 1st, when H. P. Clausen will give an address on "Recent Developments in Party-line Telephony."

Washington Chapter of the Institute.

The Washington, D. C., chapter of the American Institute of Electrical Engineers was organized at the Columbian University on April 9th. Dr. Frank A. Wolff, professor of physics and electrical engineering, Columbian University, was elected chairman, and Philander Betts, electrical engineer of the Potomac Electric Power Company, was elected secretary of the chapter. An executive committee consisting of Col. Samuel Reber, W. H. Tapley and E. E. Clement was chosen. The papers on high-tension transmission subjects, which were presented at the March New York meeting, were given in abstract by some of the members, and a discussion followed.

On May 4th the Cairo Electric Light and Power Company and the Egypt Electric Company, both of Cairo, Ill., will surrender their charters and be merged into the Cairo Electric and Traction Company. Light, power and street-car service will be furnished by the new company, and the railway system will be extended to Mound City and Villa Ridge, Ill.

WORLD'S FAIR NOTES.

Prof. W. E. Goldsborough, chief of the department of electricity, was in Chicago a few days ago. While in this city Professor Goldsborough met representatives of nearly all of the telephone manufacturing companies, and it is understood that nearly 20,000 square feet of exhibit space will be occupied in the Electricity Building by Chicago telephone manufacturers.

The committee on ceremonies has decided to send up on the evening of April 30th during the fireworks celebration a large balloon made of the finest oil silk and filled with hydrogen. To the balloon will be attached a notice stating that the finder will, upon the return of the same to the Exposition company, be presented with a season's pass to the exposition. It is stated that the balloon is capable of traveling a thousand miles under favorable conditions.

The dedication of the St. Louis World's Fair, to take place on April 30th, May 1st and 2d, will probably be the most spectacular event of the year. The programme is very elaborate. On the evenings of April 30th and May 1st magnificent displays of fireworks will be provided under the direction of H. J. Paine. The programme for the fireworks includes over a hundred set pieces, among them being a full scale representation of the cascades, Festival Hall and Terrace of the States. This gigantic production will extend for nearly half a mile on the high ground just south of the Administration Building. A giant United States flag will be suspended from monster balloons half a mile in the air, and upon their ignition, by means of electric wires, smaller flags of other countries will rise, firing salutes while the audience, lead by a chorus of 500 voices, will sing "The Star Spangled Banner."

The minds of many inventors have been busy with plans and suggestions for novel attractions for the St. Louis Exposition which shall eclipse the Eiffel Tower and the Ferris Wheel. One of the many schemes proposed is the Condon spiral elevator, which is to be a steel tower 1,000 feet high, with spiral tracks running around the outside on which cars would travel to the top and then down again. The track would be 11,068 feet in length and would be endless, the cars ascending and descending on distinct tracks. The total number of spiral convolutions would be 20, and the grade at no point would be above 20 per cent. The cars would be suspended from the track and would be hauled by an endless cable, the cars going up balancing those descending. Each car would be built to hold six people, and it is estimated that 8,316 people could be carried at every trip, making it possible to accommodate 110,000 passengers in a day of 16 hours. Platforms would be erected at the top and at different elevations, where the passengers could alight and view the surrounding country. Emergency brakes would be provided and the front car of each train would be in charge of a conductor. It is believed that the structure could be erected at a total cost of $800,000.

The central tower of the Administration Building will be illuminated for the dedication with 6,000 incandescent lamps, the current for which will be taken from the University power plant described in a recent issue of the Western Electrician. The vertical lines of the two hexagonal towers on the front of the tower will be marked out in lines of light, as will also the immense archway beneath, while between the two towers a very large American flag, occupying the entire space, will be suspended. This flag will be composed of lamps installed on the Elblight system, which consists of two cables composed of fine stranded wire, well insulated, lying side by side. The lamp used is provided with two sharp points, which are forced into the cable and form contact by penetrating the wire rope. It is thus possible to put lamps as far apart or close together as desired, as no socket is necessary. In forming the flag a three-eighths-inch steel cable will be stretched between the tops of the towers; the wires of the Elblight system will be hung from this, forming a solid surface the size of the flag. The colored lamps—red, white and blue—will be so inserted as to represent the Stars and Stripes. The flag will be suspended from the steel cable by rings, so that even a slight wind will cause it to sway to and fro, giving it a very natural effect. The flag will be in operation through the entire dedication period.

Proposed Electric Railway for Nicaragua.

The Pittsburg and Boston Capital Nicaragua and Transcontinental Railroad Company is now preparing for an active campaign in Central America. It is the intention of the company to build an electric railway in Nicaragua which may ultimately attain to 500 miles in length. Over it the company hopes to transport the product of coffee plantations, which have been in cultivation for several years. The railroad company is backed by the United States Coffee Company, which has a capital of $15,000,000. The power for the new railway will be derived from water. It will be operated on the third-rail system, and, it is said, will cost $12,000,000.

The Ries Patent Sale.

Elias E. Ries, by his attorneys, has filed exceptions in the United States Circuit Court at Baltimore to the ratification of the sale of the electric patents, with pending applications and incidental rights of action for infringement, belonging to the late firm of Ries & Henderson. The sale was made on March 3d last by George Whitelock and Arthur Steuart, special masters. The purchaser was Arthur G. Thompson of New York, who acquired the property for $60,000.

The sale was the result of the litigation begun against Mr. Ries by Albert H. Henderson, his partner, on April 28, 1896.

The patents referred to were issued between the years 1886 and 1899, inclusive, to the firm of Ries & Henderson as the assignee of the well-known inventor, Elias E. Ries, now of 116 Nassau Street, New York city, but formerly a resident of Baltimore, Md. The property included in the sale embraced 47 United States letters patent relating to various important electrical inventions, as well as a large number of similar applications, many of which have found their way into general use, and in respect to most of which Mr. Ries is the recognized pioneer in the arts to which they pertain. An account of the sale was given in the Western Electrician of March 21st. Among the various groups into which these patents were divided are patents relating to electric welding and tempering, electric riveting, electric soldering, electric heating, electric generation and transmission, electric traction, conduits for electric and cable railways, and patents on various electric-railway systems, including those covering modern methods of operating railway cars or trains by means of high-tension transmission currents and transformer sub-stations.

One of the most important of these last-named patents, No. 622,865 of April 11, 1899, was issued to Mr. Ries upon an application filed by him in 1887, after successive and strongly-contested interference proceedings, extending over a period of more than 12 years, in which his claim to priority of invention, as shown by the official records, was finally sustained. This patent, which Mr. Ries continued to prosecute, among others, after the dissolution of the partnership, and which has until 1916 to run, contains 16 claims that are alleged to be of such broad scope as to cover the entire modern electric-railway industry. Among Mr. Ries' opponents in these interferences were such prominent inventors as Chas. J. Van Depoele, George Westinghouse, George Wilhelm von Siemens, Rudolph M. Hunter, Chas. S. Bradley and others.

In his bill of exceptions Mr. Ries alleges that his alternating-current or converter electric-railway patents, included among those sold, are fundamental and controlling; that since the date of the partnership dissolution the art has developed, and that within the last two or three years the inventions covered by these patents have been and are now being extensively used by all the larger electric-railway companies in this country, in violation of the rights of the late co-partners and of his individual interest in the patents, and that the right to recovery for past infringement, which was included in the sale, aside from the present and future value of the patents themselves, was worth much more than the total price bid for the entire property.

In support of this statement, Mr. Ries' petition for a resale of the patents contains a list of electric-railway companies now in operation and under construction in New York city alone, which are alleged to have adopted or are about to adopt the system of electrical transmission, conversion and distribution originally invented and patented by him, and which is said to be vital and essential to their successful operation. Included in this list are the Metropolitan Street Railway Company, the Manhattan (Elevated) Railway Company, the New York Rapid Transit (Subway) Company, the New York City Interurban Railway Company, the Interborough Railway Company, the Brooklyn Rapid Transit Company, the Staten Island Electric Railroad Company and the electrical equipment of the various projected tunnels and terminals of the Pennsylvania, Long Island and New York Central Railroads, all of which, it is affirmed, already involve a capital investment of over $200,000,000 in Greater New York alone, a large part of which has been invested within the comparatively short time that has elapsed since the merits of this system for heavy or long-distance transportation work have been demonstrated.

Mr. Ries further avers, in his petition to the court praying for the setting aside of the sale, that the one-half interest in the patents held by his late associate had been privately acquired without the knowledge of the petitioner long prior to the sale by certain persons in whose interests the entire title to the patents were actually purchased at the public sale of the partnership property held pursuant to the decree of the court; that the sale was not, as a matter of fact, held at the place set forth in the advertisement of sale, but in a different place; that the sale was made without sufficient opportunity to enable the public to investigate the large number of patents and applications involved and to attend the sale for the purpose of bidding thereat, and that the petitioner's original motion for an extension of time of the sale so as to afford him an opportunity to protect his interests was denied.

Notwithstanding the opposition of the attorneys representing the purchaser, Judge Morris considered the exceptions of Mr. Ries well taken, and refused the ratification of the sale pending a further hearing, which will shortly take place upon the questions involved. Mr. Ries seems to feel confident of obtaining an order directing the special masters to resell the property as provided for by the decree, but under conditions which will be calculated to bring a price more nearly in accordance with what he holds to be the true value of the property, which, it is said to be Mr. Ries' intention, with certain aid that has been promised him, to acquire in his own interest.

Railroad Repair-shop Design and Equipment.[1]

By George A. Damon.

It is with the idea that more unfavorable comment will be passed upon a proposed plant than upon one which has already been built that has encouraged the writer to present the following description of a complete repair shop which as yet exists only on paper. A large part of the matter was contained in a report which was intended to be only of a preliminary nature. The example may, therefore, be considered as both hypothetical and actual, and should serve the purpose of focusing the discussion upon a shop of this particular size, leaving larger problems for future consideration.

There are now being operated upon this line 116 locomotives, the largest of which weigh 100 tons, and are 53 feet six inches long over tender. As the service is severe each engine should pass through the shop at least once a year. With a modern shop the average length of time for overhauling should not be over four weeks. Allowing 13 engines per pit per year it will require nine pits for regular repairs. Provision for growth and accidents will make 11 stalls for the erecting shop advisable, and space equivalent to five stalls should be allowed for the boiler and tank shop.

The power house is to be a practically fireproof building with a dividing fire wall separating the engine and boiler rooms. Floors will be of concrete construction. All foundations for machinery, as well as the footings in this building and all other structures, are to be of concrete. The engine-room floor may be above grade to provide a high basement for the piping and steam auxiliaries. The central location of the power plant will allow it to contain not only the heating, lighting, power, compressed-air and water equipment, but also pumps for oil to the boiler and blacksmith shop, and hot-water pumps for the roundhouse and main shops. Ample provision should be made in the building to take care of at least 50 per cent. additional equipment without adding to the building proper. A chimney seven feet in diameter and 150 feet high is to be built of brick on a substantial concrete foundation, and will be connected to the boilers by means of an underground brick flue passage.

An 80-ton crane, capable of standing 25 per cent. overload occasionally, is needed above the transverse pits in the main shop. A 10-ton electric crane should be provided to serve the heavy tools in the machine shop. A 10-ton hand crane should be installed over the equipment in the power-plant engine room. An electric messenger telpher could be installed to advantage between the scrap bins, casting shed, repair tracks, wheel house, roundhouse and blacksmith shop. Air hoists, or the recently developed electric hoist, are provided over all heavy tools not served by an electric crane. Jib cranes are to be used in the blacksmith shop.

The turntable is to be of 200 tons' capacity, and of the deck pattern, carried on a central pivot supported by a heavy isolated concrete foundation. An electric motor operated from a cab set over the motor carriage will turn the table completely around in 30 seconds in an economical manner.

The transfer table is intended to serve both the engine and coach departments, and, therefore, will be of 120 tons' capacity and 75 feet long. It is to be fitted with a motor capacity of 40 horsepower, and will be equipped with a winding attachment with a cable which will reach anything within 250 feet of the sides.

In the present state of the art the 250-volt direct-current system is better adapted for all-around railroad-shop purposes than the alternating-current system. For use on cranes, on the transfer table, and on individual machine tools, the variable-speed, direct-current motor is best suited. The alternating-current induction motor has the advantage of having no commutator or brushes, and will, therefore, require less attention, but this advantage will not justify the extra first cost involved in its installation under existing commercial conditions, in a plant of this size.

As a general rule all machines requiring over three or four horsepower should be equipped with separate motors. Smaller machines can be arranged in groups, each driven by line shafting operated by a motor of a uniform 10-horsepower size. To provide for the speed control of about a dozen tools in the erecting shop a balancer set will be installed delivering either three or four voltages to the variable-speed motors.

The lighting should be on the three-wire system with a compensator at the power plant and all incandescent lamps for local illumination and the enclosed-arc lamps for general illumination about the shops and grounds should be operated at 110 volts. Plug outlets of a specially heavy design will be distributed liberally, and the use of torches in the buildings should be entirely discontinued.

The wiring may be carried from the switchboard to the buildings in tunnels or conduits. All branch wiring for power about the shops will be protected by iron-pipe conduit, which can also be used liberally to protect the lighting wires. Considerable care will be taken in planning the wiring system to provide for extensions and additions, and to avoid the cobweb appearance presented by some of the recently built shops.

The cranes and transfer table will be on a separate circuit provided with an ammeter on the switchboard to indicate at once the location of excessive loads. The transfer-table wiring is to be on the side of the runways and not overhead.

A telephone system, with an instrument on every foreman's desk, and in the office of every department, will be installed complete with a central board.

A fire-alarm system and a watchman's clock system will also be desirable.

About 40 stations of an annunciator system can be installed to advantage in connection with the tool room in the main shop, and thus make it possible to deliver the tools to the mechanics by messenger. Under this system all tools are repaired and ground in the tool room.

The adoption of one central power plant needs no argument, but the selection of its equipment, both as to type and capacity, should be given careful consideration.

[1] Abstract of paper read before the Western Railway Club in Chicago on April 21, 1903. Mr. Damon is a well-known Chicago engineer.

A "Wireless" Newspaper.

Two issues of The Wireless, the first daily newspaper in the world relying for its regular outside press report on space telegraphy, have been received by the Western Electrician. As heretofore stated, The Wireless is published at Avalon, Santa Catalina Island, 33 miles from Los Angeles, Cal., by the Los Angeles Times. The first issue, dated March 25th, is in the shape of a three-column folio, the exact size of the pages being 11 by eight inches. Later the size of the type page was increased to four columns. The system of space telegraphy employed in transmitting the news is owned by the Pacific Wireless Telegraph Company, of which Gen. A. L. New of Denver, Colo., is president. The apparatus used is said to be entirely different from that employed by Marconi, and the practicability of the system has been demonstrated by actual use. The manager of The Wireless at Avalon is S. J. Mathes, one of the founders of the Los Angeles Times.

Santa Catalina Island lies in the Pacific Ocean off the coast of southern California, and is a well-known resort for pleasure seekers. Los Angeles is a few miles inland on the mainland. A summary of the Times' news is telegraphed every morning by the ordinary method to a wireless station on the coast, whence it is transmitted through the ether to the island. The Avalon editor adds his local items and gets the paper out early in the forenoon. As the island has no cable connection with the mainland, the wireless system is particularly valuable.

Chicago Street-railway Situation.

The attention of all the street-railway interests in Chicago is at present centered on Springfield where the house of the state Legislature is considering municipal-ownership legislation. The Mueller bill was passed some days ago by the Senate and a House committee has now reported a substitute bill to which many objections are raised, both by the local city officials and the street-railway companies. The committee bill gives the city authority to build, buy and operate street railroads, but does not, like the Mueller bill, empower the city to acquire necessary property and real estate by condemnation. It does not, like the Mueller bill, give the city a power of regulation as regards street-railroad companies it does not now have. The Chicago City Council has unanimously adopted a resolution condemning the committee bill and petitioning the Legislature to substitute the Mueller bill as amended. A representative delegations of citizens has gone to Springfield to urge the passage of satisfactory measures. R. R. Govin and Joseph S. Auerbach of New York have arrived in the city to take up the negotiations with the city authorities in the interests of the Union Traction Company.

At the first meeting of the new Chicago City Council on April 20th, the new list of committees was announced. The committee on local transportation retains Alderman Frank Bennett as chairman and all the old members, with one exception, Alderman Honore Palmer taking the place of Alderman Connery.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

It is stated that a large amount of stock in the Twin City Telephone Company (Independent) of Minneapolis and St. Paul, has been transferred to Pittsburg capitalists. Whether it is a controlling interest, is unknown. The deal has been on for some days, but no details can be secured. It is declared not to be an absorption by the Northwestern Company (Bell), as the franchise in both cities prohibits the transfer to a rival company without the consent of the councils. Officials of the company deny that there has been any transfer of unusual size in the company's stock, or that the control of the company will be changed.

August Monson, the owner of the telephone system at Motley, Minn., has devised a new automatic switchboard which is claimed to be an improvement on present boards and can be installed much cheaper. It will not, however, allow more than one conversation through the board, at a time, for when two receivers are down, all other instruments on the board are cut out.

The La Crosse (Wis.) Telephone Company will place its wires on Main Street in conduits.

A local exchange is projected for Litchville, N. D., by Mr. Beeman, the owner of the exchange at Valley City, N. D. A line between Valley City and Litchville is also planned.

The council of Duluth, Minn., will examine the books of the Citizens' Telephone Company, which recently asked permission to increase its charges. It claims to be doing business on a basis of $44,988 income per year, while the maintenance, operating, contingent and deferred amount to $57,884 per year.

C. F. Barto, a former lineman of the Iowa Telephone Company, at Sioux City, Iowa, has secured a verdict against the company of $4,237 damages for personal injuries.

The City Telephone Company of Tabor, Iowa, has voted to increase the capital stock from $22,000 to $50,000. The new issue of stock is to be sold to stockholders at 50 cents on the dollar.

The Madelia Telephone Company has been formed at Madelia, Minn., with a capital of $10,000, of which $3,500 is paid up. An effort will be made to buy the local exchange of the Fairmont Telephone Company, and if it fails, a new system will be installed. R.

Indiana Telephone Items.

The American Telephone and Telegraph Company has asked for a long-distance franchise in Logansport. The Home Telephone Company is opposing the grant until the ordinance more fully and explicitly sets out what the proposed long-distance service is. The franchise asked by the American company might be construed into meaning a local plant, and the Home company is anxious to maintain a monopoly.

An up-to-date telephone system has been put in operation at Manilla, Ind., by the Central Union Telephone Company. The exchange is connected with the exchange at Shelbyville, and the subscribers have free use of this connection and service as well as at Ray's Crossing, Blue Ridge and Homer and a 15-cent toll rate to Indianapolis. The rate for the Manilla subscribers is $1 a month.

The United Telephone Company has decided to equip its main leads from its office or exchange in Bluffton with cables, and as soon as new poles can be placed the work of stringing the cables will begin.

The incorporation of new telephone companies continues. Last week's Indiana list follows. The name and address of the company, amount of capital stock, territory to be served and name of one director are given.

Veedersburg Telephone Company, Veedersburg; $25,000; Veedersburg and in Fountain, Park and Clay Counties; John L. Osborn.

Roam Telephone Company, Roam; $15,000; Roam and in Wabash and Miami Counties; G. T. Grimes, Pettysville.

Art Telephone Company, Saline City; $7,000; Saline City and in Clay County; Alba Long.

Prairie Creek Mutual Telephone Company, Middletown; $10,000; Middletown and in Vigo County; Vincent Yeager.

Brownsburg Telephone Company, Brownsburg; $6,000; Brownsburg and in Hendricks Boone and Marion Counties; J. S. Tharp.

Co-operative Telephone Company, Portland; $10,000; Jay, Delaware, Madison, Randolph, Blackford, Wells and Adams Counties; D. M. Baker, Portland.

Rural Telephone Company, Inglesfield; $1,000; Inglesfield and vicinity; Joseph Burnston.

Rockfield Telephone Company, Rockfield; $3,000; Rockfield and in Carroll County; F. M. Tyrael. F.

On the Pacific Slope.

The Calispell Valley Telephone Company has filed articles of incorporation at Newport, Wash. The capital stock is $50,000. A. G. Stephens is one of the incorporators.

Seattle, Wash., will soon be connected by telephone with the west side of Puget Sound. The Peninsula Telephone Company, with headquarters at Bremerton, Wash., has arranged to join its system with the Sunset Telephone Company's lines. This entails a submarine cable three miles long, which will be laid at once.

The International Telephone Company of America, with headquarters at Washington, D. C., is about to make application to the City Council of Spokane, Wash., for a franchise to operate in that city for a period of 25 years. The company agrees to put in 5,000 telephones during the first 18 months of the franchise, if granted, work to begin within six months after its acceptance by the city. A charge of two cents per call of five minutes or less will be made, it is said. The matter is being worked up by Charles H. Mattiam.

A new modern switchboard of the central-energy pattern, to accommodate 1,500 subscribers, is about to be installed at Victoria, B. C. W. H. Kent, general superintendent of the New Westminster and Burrard Inlet Telephone Company, has ordered the board made in Montreal, Canada. P.

Ohio Telephone Notes.

The Sunday Creek Valley Telephone Company, Gloucester, with a capital stock of $50,000, has been incorporated. G. E. Turner, A. F. Turner, A. B. Allen, G. W. Rose and others are interested in the company.

The Adena Telephone Company, Adena, recently incorporated, with a capital stock of $5,000, will build a line connecting Smithfield, Hopedale, Harrisville and Unionvale in Jefferson and Harrison Counties. J. W. R. Smith, William H. Thompson and others are interested.

Officers of the Home Telephone Company (Independent) of Hamilton are reported to have stated that they have arranged with the Fitzsimmons Telephone Company of Cincinnati to enter that city. The plan is to have an exchange in Cincinnati, and it is supposed that the Fitzsimmons company will build it. The Home has been granted the right to construct lines on two different pikes in Hamilton County.

The Williams Electric Telephone Company of Cleveland has been incorporated for the purpose of manufacturing telephone apparatus. The capital stock is $10,000. P. E. Hintz, L. B. Spanner, E. P. Kern, C. M. White and H. H. Hammond are the incorporators.

The wreck train on the Wheeling and Lake Erie railroad at Massillon has been equipped with telephone apparatus as an experiment. It is very much the same as an ordinary telephone and is provided with a coil and a long pole with a hook to hook over the telegraph wires. When connection is thus made, bells ring in every office on the line which signals telegraph operators to cut out. When the pole is removed the bells again signal the operators that the line is open. So far the experiment has proved satisfactory. O. M. C.

Bell Telephone Output.

The American Telephone and Telegraph Company reports its output of instruments for the month and quarter ended March 31st, with comparisons, as follows:

	1903.	1902.	1901.	1900.
March:				
Gross output	84,280	96,557	76,751	65,878
Returned	38,172	42,847	37,517	20,664
Net output	46,108	53,710	39,234	45,214
January 1 to March 31:				
Gross output	305,961	279,553	216,109	183,003
Returned	116,646	114,498	89,427	63,004
Net output	189,315	165,055	126,682	119,959
Outstanding March 31	3,339,635	2,691,065	2,079,498	1,700,464

Michigan Telephone Company's Affairs.

The Union Trust Company of Detroit, Mich., as receiver for the Michigan Telephone Company, has filed a petition in the United States Circuit Court asking for authority to issue $50,000 in receiver's certificates payable in three months, bearing six per cent. interest. The proposed certificates are to be a first lien upon the company's property, the proceeds to be used to connect the different parts of the system, now done by the Detroit Telephone Company's apparatus, which is not under control of the receiver. A proposition to lease the Detroit Telephone apparatus is said to have fallen through.

TELEPHONE MEN.

Mark Baugher has become manager of the local exchange at Farmington, Iowa.

A. L. Hutchinson of Weyauwega, one of the well-known Independent telephone men of Wisconsin, was in Chicago last week.

Ex-Governor W. Murray Crane, of Dalton, Mass., has been elected a member of the executive committee of the American Telephone and Telegraph Company.

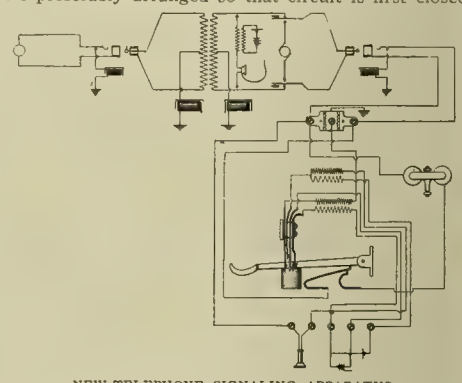
L. J. Palmer, who has been with the Iron Range Telephone Company at Crookston, Minn., has been placed in charge of the company's office at Cass Lake, Minn.

Frederick P. Fish of Boston, president of the American Telephone and Telegraph Company, made a flying visit to Detroit, Mich., last week to consult with Secretary Hance of the Union Trust Company, receiver of the Michigan Telephone Company.

John P. Downs, assistant chief engineer in the experimental works of the Bell Telephone Company at Boston, was married a few days ago at Cleveland to Miss Etta Murphy. He was formerly with the North Electric Company and is a native of Cleveland.

New Telephone Signaling Apparatus

An invention which provides means for sending a signaling current from the subscriber's station of a telephone system to the exchange without the employment of a magneto generator has recently been patented by Francis W. Dunbar and William W. Dean of Chicago, their patent being assigned to the Kellogg Switchboard and Supply Company. The inventors employ a large induction coil, preferably operated by the subscriber in removing his telephone receiver from the switch-hook upon which it normally rests. In practice the switch-hook is associated with a suitable spring, which serves when the weight of the telephone receiver is lifted from the hook to raise the hook, thereby actuating the contacts which control the circuit through the primary of an induction coil. This induces a current in the secondary of the induction coil, which passes to the central station to actuate the individual annunciator located thereat. The contacts actuated by the switch-hook are preferably arranged so that circuit is first closed



NEW TELEPHONE SIGNALING APPARATUS.

through the primary of the induction coil, the current continuing to flow for a considerable period to magnetize thoroughly the iron in the core and coils, at the end of which time the circuit is opened to produce thereby in the induction coil a decided inductive effect, thus inducing a current of substantial value, which will pass to the central station. In order that the current may thus flow for the desired period of time, there is associated with the switch-hook a retarding device, such as a dash pot, which limits the movement of the switch-hook, as the same is impelled by the spring. The circuit through the primary of the induction coil may thus be maintained closed for a sufficient length of time to magnetize thoroughly the core and coils before the circuit is opened by the further movement of the switch-hook. The accompanying drawing is a diagrammatic view illustrating two telephone lines and connecting apparatus at the central station, one of the lines being illustrated as equipped in accordance with the invention.

Toll-line Combination in Indiana.

The Allied Independent Toll Company, composed of representatives of Independent telephone companies of northern Indiana and eastern Illinois, was organized at Logansport last week. Twenty representatives were present at the meeting, and letters of indorsement from eight companies read. Walter J. Uhl of Logansport, was chosen president, and Henry A. Barnhart of Rochester, secretary, of the new company. These two men, with three committees appointed, will have full charge of the perfection of the organization. Another meeting will be held May 11th, at which time the committees will report and incorporation papers will be prepared for filing. For the present the company will serve as a sort of clearing house for the business of the individual exchanges, and a committee was appointed to have charge of the business. Later, when the company is incorporated, the offices will be centrally located and men engaged to attend to the company's business. Three cable lines, running out of Logansport to South Bend, Wabash and Remington, will likely be the first built by the company, as these were discussed at length. The following-named telephone men were present at the meeting: A. Halleck, Rensselaer; J. F. Bruner, Remington; T. E. Hanway, Monticello; C. A. Jay and Steve Tuder, Kokomo; J. E. Yarling and W. A. Huff, Peru; R. C. Stephenson and Henry Barnhart, Rochester; Theodore Thorward, South Bend; O. P. Freyberg, Lafayette; O. Rex, North Manchester; Walter Uhl, G. W. Powell, M. A. Jorden, G. W. Seybould, M. B. Lairy, J. F. Digan, Joseph Reitemeier and S. D. Brant, Logansport; D. C. Harter, North Manchester, and others.

GENERAL TELEPHONE NEWS.

The Colorado Telephone Company has asked for a franchise at Rico, Colo.

The Marissa (Ill.) Telephone Company has increased its capital from $5,000 to $10,000.

The Marion (N. C.) Telephone Company has let a contract for a long-distance line to Rutherfordton, N. C.

The Teachey Bell Telephone Company of Teachey, Duplin County, N. C., has been chartered with a capital of $5,000.

The Northeastern Telephone Company has commenced work on an extensive new telephone system at Portland, Maine. The work is in charge of Lewis A. Goudy.

The headquarters of the Stephenson County Telephone Company have been changed from Chicago to Freeport, Ill., and the board of directors increased from three to seven.

The Utah Telephone Company will enter the Montana field and work will be commenced at Great Falls, Helena and Missoula during the present year. R. B. Jones is the managing director.

The Macon Telephone Company of Lenawee County, Mich., capitalized at $30,000, and the Litchfield (Mich.) Farmers' Mutual Telephone Company, capital $2,000, have recently been incorporated.

The Rapids and Western Telephone Company has been formed to take over the business of the Western Telephone Company at Rapids, Wis., Rockland and Cato. The new company will make extensive repairs.

D. Johnston and Seth Hartley are the prime movers of the new telephone company at San Bernardino, Cal. A meeting was held a few days ago for the purpose of discussing plans for incorporation. Material for the new system has already been ordered.

A stone and brick one-story building 66 by 47 feet, is to be built at Field's Corner, Dorchester District, Boston, and will be occupied by the New England Telegraph and Telephone Company. This company will hold its annual meeting in New York on May 4th.

The Montana Telephone Company has been incorporated at Helena, Mont., by C. H. Crake, J. C. McCuay, F. D. Kingsbury and C. R. Sceffin, with a capital stock of $2,400. A line will be built between Collins and Cutbank. The headquarters of the company will be at Choteau.

Twenty-five new suits were brought in the justice courts on April 18th against the Chicago Telephone Company by subscribers seeking to recover money alleged to have been paid to the company in excess of the amount permitted by the city ordinances. It is stated that hundreds of similar actions will be commenced before May 1st.

Mayor Harrison, at a recent meeting of the Chicago City Council, vetoed the ordinance, previously passed, which granted a franchise to the Woodlawn Park Telephone Company. The veto was made on the ground that two companies were already operating in the district, and that the Illinois Telephone and Telegraph Company had also a right to the territory. The ordinance was referred to the committee on streets and alleys south.

The International Railway Company of Buffalo, N. Y., operating 400 miles of lines and reaching Niagara Falls, Lewiston, Lockport and Queenston, has contracted with the Bell Telephone Company to install an extensive system of telephones and signals on all its city and suburban lines. Combination receiver and transmitter instruments will be used and they will be placed in iron boxes every mile on the city lines and from two to three miles apart on the suburban roads. The telephones will be used by the motormen and conductors in cases of accidents or delays, and the dispatcher can signal the motormen by means of an electric signaling apparatus at each station, when he desires to instruct them.

MANUFACTURERS AND DEALERS.

The telephone department of the Electric Appliance Company, Chicago, has more than doubled its capacity in floor space, machinery and employes. The steady increase in the demand for Eaco line of telephones and switchboards has made this necessary. The company has many new circulars describing its telephone specialties which will be sent upon request.

The Faller Automatic Telephone Exchange Company, manufacturer of the Faller mechanical operator, has leased the handsome new factory building at 772 to 776 Twelfth Avenue, foot of Fifty-fifth Street, New York city. The building has six floors, with light on all sides, and will accommodate about 1,000 hands. The Faller company has taken it on a 10-year lease, with an option to purchase.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., and Chicago, reports that it has begun the erection of a second factory in Rochester, which will be engaged in the manufacture of telephones. The plans call for a factory having 200,000 feet of floor space and capable of turning out 2,000 telephones a day. The company also reports having just secured a contract from the Home Telephone Company of Kansas City, Mo., for 6,500 central-energy telephones.

International Desk Telephone.

A portable telephone, as a rule, having more hard usage and careless handling than any other instrument in a telephone system, is most subject to get out of order. The International desk telephone illustrated in Fig. 1 was designed by the International Telephone Manufacturing Company of Chicago, with a view of securing the most neat-appearing, convenient, reliable and durable instrument of the kind that could be produced, regardless of the cost of manufacture.

The pedestal is an artistically designed stand of heavily nickel-plated cast brass. It is hollow, to allow the transmitter cords to pass through it. The standard and bottom are clamped firmly together with a heavy binding nut in the base. All exposed

FIG. 1. INTERNATIONAL DESK TELEPHONE.

parts of the instrument are strong, smooth and solid and are made of nickel-plated brass.

The entire switch, shown in Fig. 2, in the desk set is built in the spring post or head of the pedestal. The spring post can be readily removed from the pedestal and all parts conveniently inspected. The switch and restoring springs are mounted on hard-rubber blocks, supported by the spring post, and are completely enclosed with a dustproof cover.

The contact springs are all long and made from the best german silver, and are provided with platinum contacts. The hook is provided with an insulated pin near its base, to which the restoring spring is connected. This insulated pin is provided at both ends with platinum contacts, which make and break the connection when the hook is raised and lowered. This construction permits the platinum contacts to make a clean, positive sliding connection and requires but a very small movement of the springs.

The hook-restoring spring is so designed that it has three inches of heavy spring german silver for a restorer, making the switch very active and durable. The springs are firmly clamped with heavy, specially stamped nuts, fastened with machine binding screws passing through the rubber block from the opposite side, as may be seen in the cross-section of the upper rubber block in the cut. All binding screws are threaded into metal, leaving none depending on threaded rubber.

The hook takes its bearing in the spring post on special steel screws, which extend into the post and form a bearing fully three-sixteenths of an inch in length. The back of the hook, where the steel bearing screws enter, is slotted and is firmly clamped

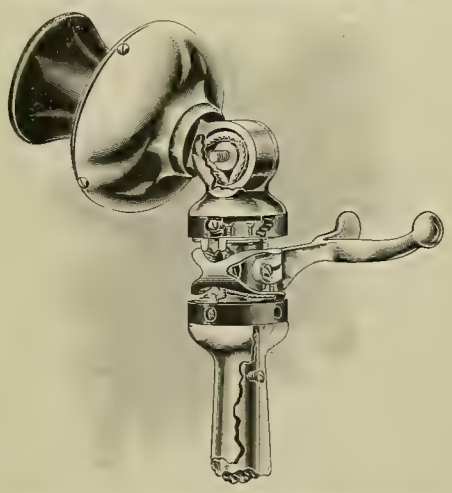


FIG. 2. INTERNATIONAL DESK TELEPHONE.—TRANSMITTER.

to the screws to prevent any possibility of the bearing working out or becoming loosened. The hook stops directly on a heavy brass screw that is shouldered against the brass spring post, to make an absolute and positive stop, and avoid any liability of weakening or breaking the lower contact spring.

The movable head or lug is provided with a concealed stop at the joint of the pedestal and transmitter. All springs and connecting wires are entirely enclosed and perfectly insulated, leaving no exposed metal parts to form a part of the circuit at any time.

The transmitter lug is cored out, as shown in Fig. 2, to leave ample space for the two cords leading directly from the front and back electrodes to the termials in the base. This construction leaves no sharp corners and fully protects the conductors.

Emergency Service of Street-railway Companies.

Probably no other man leads a life that can be compared so nearly with that of a fireman as the member of a street-railway wrecking crew in a large city, and the work must be done with almost as much skill and certainty, with quite as much haste as that of the hook and ladder truck or the fire engine.

The Metropolitan street railway of New York city has seven stations where the relief wagons, which are properly called "red devils," are kept. Whenever a pedestrian is unfortunate enough to be run over by a car or caught underneath, or in case of any other accident which delays traffic, the nearest station is notified and in a few minutes the red wagon goes clanging, bounding over the pavement, swings in sight and draws up by the side of the scene of trouble.

In most cities, where overhead trolley wires are used, two styles of wagon are necessary, one a low truck designed for the removal of obstructions from the tracks and the other a tower wagon with its crew for the splicing of a broken trolley wire. The former is easily recognized by its fifth wheel, which is carried ready for adjustment to any vehicle which stands upon a track immovable because one of its own wheels has been crushed down.

The crews average six men and four horses in two shifts, each wagon having about 50 miles of track to look after. The men sit in constant readiness to go out to the relief of a car, and when a message is received each one leaps up to perform his special part in a rapid preparation to depart. The day is supposed to be divided into two laps of 12 hours each, but the men always agree among themselves for the night squad to stay on longer, because they receive by no means so many calls as the day squad.

Often when a conductor calls up a station he finds the wagon already gone to the scene of some other accident; in such a case he has to keep ringing up other crews, even though he has to summon a wagon from miles away.

There are various systems of alarm; some companies have private telephones and some use the public telephone. The Chicago Union Traction Company has an alarm-box system which has proven very satisfactory on its North Side cable lines. When a car gets in trouble the gripman of a train has only to jump off the car, run an average of 200 feet forward or back of his train, lift an oval iron-trap from the center of an iron manhole cover, take a small key from his pocket, insert it in a little iron-bound box in one side of the cable conduit, and make one turn of the key. Within 15 seconds the cable is still. So also is every car on the loop's circuit, and so also is every piece of machinery in the nearest power plant of the Union Traction Company.

Under the paving between the double tracks of the cable lines are strings of gaspipe housing the wires of the cable-alarm system. In the center of each track, north of south, there is a big manhole cover placed just over the cable pulleys which operate to hold up the cable at each stretch of 31 feet, and in the north track, at every third street crossing, is one of these manholes, numbered, with a small oval trap which may be lifted with ease for the insertion of a cable-alarm key. These numbered manholes mark the alarm stations connected by electric wires with the power house of the company at Division Street.

The action of a key in one of these boxes rings a gong in the power house with which the particular cable is connected. The gong is close to the engineer of the plant, and as the gong strikes the number of the box is shown upon a board at one side. One full turn of the key in a box is an arbitrary notification to the engineer to stop the cable in a moment; two turns is the signal to slow up, a term which means reducing speed to one-third the regular rate; three turns is a call for an emergency wagon, and four turns is a call used only after the last car is in the barns at 1:30 o'clock in the morning, and when the cable inspection gang has struck a portion of the rope which needs repairing.

Ten emergency stations are maintained by the Chicago Union Traction Company. They are of great value in those sudden emergencies when the power driving the cable must be shut off in a moment.

Scandinavian Technical Congress.

A Scandinavian Congress of Technical and Sanitary Science is to be held in Copenhagen, Denmark, on June 24th to 27th. Among the subjects to be discussed are ways and bridges, railways, mechanical industries, naval construction, electro-technology, heating and ventilation, chemical industries, mining, control of food stuffs, health of towns, hospitals, schools and factories, military and field-hospital hygiene. Applications for membership in the congress may be addressed to the Dansk Ingeniorforening, Amaliegade, 38, Copenhagen K., Denmark. The membership fee has been fixed at 20 crowns ($5.40).

The City Council of Chicago Heights, Ill., has granted a 20-year franchise to the Chicago Heights Street Car Company, to construct and operate a street-car system in that city. Interurban privileges were also granted.

The Emanations of Radium.[1]

By Sir William Crookes, F. R. S.

A solution of almost pure radium nitrate, which [illegible] used for spectrographic work, was evaporated to dryness in a dish, and the crystalline residue examined in a dark room. It was feebly luminous. A screen of platinocyanide of barium brought near the residue glowed with a green light, the intensity varying with the distance separating them. The phosphorescence disappeared as soon as the screen was removed from the influence of the radium. A screen of Sidot's hexagonal blende (zinc sulphide), said to be useful for detecting polonium radiations, was almost as luminous as the platinocyanide screen in presence of radium, but there was more residual phosphorescence, lasting from a few minutes to half an hour or more, according to the strength and duration of the initial excitement.

The persistence of radio-activity on glass vessels which have contained radium is remarkable. Filters, beakers and dishes used in the laboratory for operations with radium, after having been washed in the usual way, remain radio-active, a piece of blende screen held inside the beaker or other vessel immediately glowing with the presence of radium. The blende screen is sensitive to mechanical shocks. A tap with the tip of a penknife will produce a sudden spark of light, and a scratch with the blade will show itself as an evanescent luminous line. A diamond crystal brought near the radium nitrate glowed with a pale bluish-green light, as it would in a "radiant-matter" tube under the influence of cathodic bombardment. On removing the diamond from the radium it ceased to glow, but when laid on the sensitive screen it produced phosphorescence beneath, which lasted some minutes.

During these manipulations the diamond accidentally touched the radium nitrate in the dish, and thus a few imperceptible grains of the radium salt got on to the zinc-sulphide screen. The surface was immediately dotted about with brilliant specks of green light, some being one millimeter or more across, although the inducing particles were too small to be detected on the white screen when examined by daylight.

In a dark room, under a microscope, with a two-thirds-inch objective, each luminous spot is seen to have a dull center surrounded by a luminous halo extending for some distance around. The dark center itself appears to shoot out light at intervals in different directions. Outside the halo the dark surface of the screen scintillates with sparks of light. No two flashes succeed one another on the same spot but are scattered over the surface, coming and going instantaneously, no movement of translation being seen. The scintillations are somewhat better seen with a pocket lens magnifying about 20 diameters. They are less visible on the barium platinocyanide than on the zinc-sulphide screen. A powerful electromagnet has no apparent effect on the scintillations, which appear quite unaffected when the current is made or broken, the screen being close to the poles, and arranged axially or equatorially.

A solid piece of radium nitrate is slowly brought near the screen. The general phosphorescence of the screen, as visible to the naked eye, varies according to the distance of the radium from it. On now examining the surface with the pocket lens, the radium being far off and the screen faintly luminous, the scintillating spots are sparsely scattered over the surface. On bringing the radium nearer the screen the scintillations become more numerous and brighter, until, when close together, the flashes follow each other so quickly that the surface looks like a turbulent, luminous sea. When the scintillating points are few there is no residual phosphorescence to be seen, and the sparks succeeding each other, appear like stars on a black sky. When, however, the bombardment exceeds a certain intensity, the residual phosphorescent glow spreads over the screen, without, however, interfering with the scintillations.

If the end of a platinum wire which has been dipped in a solution of radium nitrate and dried is brought near the screen, the scintillations become very numerous and energetic, and cease immediately the wire is removed. If, however, the end of the wire touches the screen, a luminous spot is produced which then becomes a center of activity, and the screen remains alive with scintillations in the neighborhood of the spot for many weeks afterward. "Polonium," basic nitrate, produces a similar effect on the screen, but the scintillations are not so numerous.

Microscopic glass, very thin aluminum foil, and thin mica do not stop the general luminosity of the screen from the X-rays, but arrest the scintillations. I could detect no variations in the scintillations when a rapid blast of air was blown between the screen and the radium salt. A beam of X-rays from an active tube was passed through a hole in a lead plate on to a blende screen. A luminous spot was produced on the screen, but I could detect no scintillations, only a smooth, uniform phosphorescence. A piece of radium salt brought near gave the scintillations as usual, superposed on the fainter phosphorescence caused by the X-rays, and they were not interfered with in any degree by the presence of X-rays falling on the same spot.

During these experiments the fingers soon become soiled with radium, and produce phosphorescence when brought near the screen. On turning the lens to the, apparently, uniformly lighted edge of the screen close to the finger, the scintillations are seen to be closer and more numerous; what to the naked eye appears like a uniform "milky way," under the lens is a multitude of stellar points, flashing over the whole surface. A clean finger does not show any effect, but a touch with a soiled finger is sufficient to confer on it the property. Washing the fingers stops their action.

It was of interest to see if rarefying the air would have any effect on the scintillation. A blende screen was fixed near a flat glass window in a vacuum tube, and a piece of radium salt was attached to an iron rocker, so that the movement of an outside magnet would either bring the radium opposite the screen or draw it away altogether. A microscope gave a good image of the surface of the screen, and in a dark room the scintillations were well seen. No particular difference was observed in a high vacuum—indeed, if anything, the sparks appeared a trifle brighter and sharper in air than in vacuo. A duplicate apparatus in air was put close to the one in the vacuum tube, so that the eye could pass rapidly from one to the other, and it was so adjusted that the scintillations were about equal when each was in air. The vacuum apparatus was now exhausted to a very high point, and the appearance on each screen was noticed. Here, again, I thought the sparks in the vacuum were not quite so bright as in air, and on breaking the capillary tube of the pump and observing as the air entered, the same impression was left on my mind; but the differences, if any, are very minute, and are scarcely greater, than might arise from errors of observation.

It is difficult to form an estimate of the number of flashes of light per second. But with the radium at about five centimeters off the screen they are barely detectable, not being more than one or two per second. As the distance of the radium diminishes the flashes become more frequent, until at one centimeter or two centimeters they are too numerous to count.

On bringing alternately a Sidot's blende screen and one of barium platinocyanide face downward near a dish of "polonium" sub-nitrate, each became luminous, the blende screen being very little brighter of the two. On testing the two screens over a crucible containing dry radium nitrate, both glowed; in this case the blende screen being much the brighter.

Examined with a lens, the light of the blende screen was seen to consist of a mass of scintillations, while that of the platinocyanide screen was a uniform glow, on which the scintillations were much less apparent.

The screens were now turned face upward, so that emanations from the active bodies would have to pass through the thickness of card before reaching the sensitive surface. Placed over the "polonium" neither screen showed any light. Over the radium the platinocyanide screen showed a very luminous disk, corresponding with the opening of the crucible, but the blende disk remained quite dark.

It therefore appears that practically the whole of the luminosity on the blende screen, whether due to radium or "polonium," is occasioned by emanations which will not penetrate card. These are the emanations which cause the scintillations, and the reason why they are distinct on the blende and feeble on the platinocyanide screen, is that with the latter the sparks are seen on a luminous ground of general phosphorescence which renders the eye less able to see the scintillations.

Considering how cross-grained the structure of matter must be to particles forming the emanations from radium, I cannot imagine that their relative penetrative powers depend on difference of size. I attribute the arrest of the scintillating particles to their electrical character, and to the ready way in which they are attracted by the coarser atoms or molecules of matter. I have shown that radium emanations cohere to almost everything with which they come in contact. Bismuth, lead, platinum, thorium, uranium, elements of high atomic weight and density, possess this attraction in a high degree, and only lose the emanations very slowly, giving rise to what is known as "induced radio-activity." The emanations so absorbed from radium by bismuth, platinum, and probably other bodies, retain the property of producing scintillations on a blende screen, and are non-penetrating.

It seems probable that in these phenomena we are actually witnessing the bombardment of the screen by the electrons hurled off by radium with a velocity of the order of that of light, each scintillation rendering visible the impact of an electron on the screen. Although, at present, I have not been able to form even a rough approximation to the number of electrons hitting the screen in a given time, it is evident that this is not of an order of magnitude inconceivably great. Each electron is rendered apparent only by the enormous extent of lateral disturbance, produced by its impact on the sensitive surface, just as individual drops of rain falling on a still pool are not seen as such, but by reason of the splash they make on impact, and the ripples and waves they produce in ever-widening circles.

1. Paper read before the Royal Society, London, March 19, 1903.

General Electric Type-H Transformers.

The shell type of transformer was manufactured by the General Electric Company for eight years, from 1888 until 1896, at which time the many advantages afforded by the core type with reference to safety, durability and economy were recognized. The type-H transformer was then placed on the market (being the first core type of transformer to appear in this country), and has during the last seven years become recognized as a standard of excellence in transformer design. During this period continuous improvements have been made in all the features that go to make up a good transformer. Some of these are enumerated below.

The great reductions made in losses during the last three years are noticeable. On the various sizes the average percentage reduction in core loss is 11.7 per cent. and in regulation is eight per cent. Since transformers are usually energized 24 hours a day, low core loss is of great importance in its effect on the all-day efficiency. Minimum core loss is one of the leading features of type-H transformers, the core loss being as low as is consistent with proper insulation, low temperature and good regulation.

It is essential that the regulation of a transformer be as low as is consistent with good characteristics in other respects, as it admits of the use of high-efficiency lamps, insures low cost for lamp renewals and makes possible a small variation in voltage between the peak and light loads on the station and consequent uniform light throughout the 24 hours.

Fig. 1. Section of Transformer.

Fig. 2. Mica Insulation Shield.

Fig. 3. Showing Spaces for Circulation of Oil.

GENERAL ELECTRIC TYPE-H TRANSFORMERS.

Low uniform temperature is of importance in preserving the insulation and preventing deterioration of the iron, which results in increase in core loss, commonly known as aging. The American Institute standard of 50° C. as the ultimate temperature rise for electrical apparatus has been adopted, as this is regarded by the most eminent engineers as a good safe figure. The ultimate temperature rise of type-H transformers will not exceed this amount, and because of the details of construction, the temperatures are uniform throughout. Every part of every coil has practically the same facility for passing off its heat. The construction of one of the transformers is shown in Fig. 1.

Aging has been reduced to a minimum by the use of a specially treated sheet steel and by processes of manufacture which have been developed in the course of 15 years' experience. Among the aids in regulating the properties of steel may be mentioned the microscopic examination of samples of steel. This method of investigation requires very skillful experts and a high grade of technical knowledge; but no expense has been spared to secure the best results. The effect of this work is shown by the result of a test which was made on 43 type-H transformers taken indiscriminately from the lines of central stations. These were returned to the factory and were very carefully retested to show the amount of aging during their periods of operation. These transformers had been in service on an average for 2½ years and showed the small average of 3.1 per cent.

Every transformer before shipment receives very careful tests as to its characteristics. An accurate record is kept of all these tests, so that at any time they can be readily compared with the result of subsequent tests. Careful attention is also paid to the insulation. The method of manufacture of the various insulations used and methods of inspection em-

ployed, combined with the low uniform temperature maintained, have met with such success that during the last three years less than one-third of one per cent. of the total capacity of transformers sold have burned out from all causes, including lightning and overload. The percentage of burnouts due to lightning alone is two-tenths of one per cent. In this connection, particular attention is called to the mica insulation shield shown in the accompanying illustration (Fig. 2) which is placed between the primary and secondary coils and renders a cross between primary and secondary practically impossible, thus giving security to the customer.

The value of oil as a cooling and insulating medium has long been recognized, but this value is greatly reduced unless oil of the best properties, electrically, is used. Although the oil used in type-H transformers, which is made especially for the purpose, has very high insulating qualities and is remarkable for its non-absorbent properties, it is subjected to very rigid inspection as to its characteristics, for the presence of moisture, and unless it passes this test satisfactorily, is rejected. The result is oil which gives the best results both as to cooling and insulation. Fig. 3 shows clearly spaces which are left for the circulation of oil in sizes of transformers constructed with cruciform cores.

Type-H transformers are made in 16 sizes, from 600-watt to 50,000-watt, inclusive, and in two lines which for convenience are termed the high and low-frequency lines. Both of these lines of transformers have the well-known characteristics of the type-H design, and it is stated that both will give perfectly satisfactory operation on either 60 or 125 cycles. The distinctive difference between the two lines of transformers from an operating standpoint is in their data, the high-frequency transformers being slightly less efficient than the low-frequency, and having a correspondingly lower cost. For 60-cycle operation the high-frequency line may be used when extremely low efficiency is not of great importance. The transformers made for three-wire service have the winding so distributed that the voltage on the two sides of a three-wire system will not differ more than the regulation drop of the transformer, even with one-half the rated capacity of the transformers, all on one side; with ordinary distribution of load the voltage will be practically equal on the two sides.

National Association of Manufacturers.

The eighth annual convention of the National Association of Manufacturers was held in New Orleans last week, the opening session taking place on April 14th. James W. Porch, vice-president for Louisiana, called the convention to order. Mayor Paul Capdevielle and Governor W. W. Heard made speeches of welcome and President David M. Parry of Indianapolis responded in eloquent terms. The reading of the president's annual report was dispensed with, as it had been printed. Marshall Cushing of New York, secretary of the association, reported a membership of 2,025, an increase of 100 per cent. during the year. During the opening and the succeeding days of the convention several comprehensive and valuable papers were read and the discussions were specially spirited. The keynote of the convention was the labor question, and the desire was strong toward uniting employers of every character in organizing effective opposition to trades unionism. The convention was very largely attended and the delegates were royally entertained.

Central-station House Organs.

The house-organ idea is spreading among the larger central-station companies. At least three of such companies now distribute regular publications. The Edison Electric Illuminating Company of Brooklyn issues the Brooklyn Edison, the New York Edison Company its Bulletin, and now the Chicago Edison and Commonwealth Electric Companies of Chicago present the Electric City. These little papers appear monthly, and their idea is to educate possible consumers in the uses and advantages of electric current. They are sent free to many users of light and power who may be interested. All are attractively printed and illustrated.

British Pacific-cable Deficit.

It appears that the new British Pacific cable has thus far not been a paying investment, for, according to the estimates made by the cable board, there will be a loss on the working of the cable of $460,000 for the year ending March 31, 1904. This will throw a responsibility of $153,500 on to New South Wales, Victoria and Queensland. The contributors to the Pacific cable and their proportions are: Great Britain, five-eighteenths; Canada, five-eighteenths; New Zealand, two-eighteenths; Victoria, two-eighteenths; New South Wales, two-eighteenths; Queensland, two-eighteenths.

It is reported that the Ravenswood extension plans of the Northwestern Elevated Railroad Company of Chicago are progressing satisfactorily and that an announcement of an official character may be expected soon. The new line will run about 2½ miles into a territory that has been looked over carefully and judged to offer a good field for an elevated line.

CORRESPONDENCE.

London Letter.

London, England, April 11.—The extension of the London United Tramways Company, which was merely chronicled last week, comprises some seven miles of route. Some particulars of the power-house equipment of this tramway company were given in this journal some time ago, and it need only be stated here that an additional sub-station has been constructed, for the purposes of this extension, which is fed from the power house at Cheswick by the agency of three-phase, triple-core cables at 5,000 volts on each phase. At the sub-station the pressure is reduced to 450 volts. Adjoining the sub-station is a car shed with sufficient capacity for 150 cars. It may also be stated, in connection with the main power house at Cheswick, that a new 1,000-kilowatt generating set was added, consisting of an Allis engine, directly coupled to a British Thomson-Houston three-phase generator, working at a pressure of 5,000 volts. The luncheon which was given at the inauguration of this extension and the speeches which followed it, served admirably to emphasize the controlling power which the Yerkes group of financiers is gradually acquiring in London: Speyer Brothers were represented, and the confidence with which through communication was prophesied between the tramways and the District Company's railway lines, when they are "electrified," gives one a suspicion that the American interest in the tramway company is one more than that of a mere shareholder. At the same time, however one may view the prospect of the creation of a monopoly such as this may eventually be, it is a satisfaction that as far as it can the government is exercising a wise judgment in refusing to allow all control of the statutory companies in which Mr. Yerkes is interested to be taken away from it. On the other hand, monopoly or no monopoly, the only way that any one will get the traffic in London is by cheap fares, so that the public has little to fear.

What is stated to be the largest single-cylinder gas engine made in this country has just been turned out at Salford. The machine has a capacity of 700 horsepower on a continuous load and was constructed for direct connection to a 500-kilowatt direct-current dynamo. This latter has 12 poles, the total weight of the armature being 15 tons. The set has been ordered for work in a large electrolytic works, and therefore absolutely constant running is of paramount importance. Although this plant is far in advance of what has yet been attempted in the way of gas-driven dynamos in Great Britain, I understand that a 1,000-horsepower gas engine, to be directly coupled to a 700-kilowatt dynamo, is under course of construction at the same works.

The expenditure up to date upon the British post-office telephone system amounts to over $5,000,000, although a considerable part of this sum has not yet been brought into use, being for plant and stores not yet purchased, but provided for. Seven exchanges are now in operation, 8,749 instruments having been fitted in connection therewith. It is also stated that four other important exchanges will be opened this year, and that from 150 to 200 new lines are being brought into use every week.

In connection with the purchase of the portion of the undertaking of the Metropolitan Electric Supply Company in the parish of St. Marylebone (London) by the borough council, which has been mentioned more than once here, another difficulty has now arisen as a result of the application to the London County Council for a loan to complete the transaction as ordered by the umpire in the arbitration. The London County Council has expressed the opinion that it can neither lend the necessary money, nor even give its consent to the borrowing of the money through other channels, as the Marylebone borough council has, as yet, no rights to carry on an electric-lighting undertaking. If this actually be the case, an appeal will have to be made to Parliament to adjust matters.

The municipal telephone system at Hull is being proceeded with and a large number of tenders have been let.

The complete system of tramways in Manchester is now worked electrically, the last route having been converted and cars were running a few days ago. There are now 140 miles of track and 400 cars in constant use. At Leeds, too, where the tramways are now wholly electrical, an increase of over $200,000 has taken place during the last year.

W.

New York Notes.

New York, April 18.—The threatened strike by the employes of the Manhattan Elevated Railroad for a nine-hour work day and certain other concessions has been averted for a time at least. At the close of a meeting of the executive committee of the men, which was held after the employes had voted as to whether a strike should be ordered to enforce the demands for a shorter working day, it was announced that President Mahon of the International Association of Street Railway Employes had secured a reopening of the negotiations with the company which were interrupted on Wednesday by the refusal of the board of directors to consider the men's demands. It was announced yesterday by President Pepper of the local organization that the men were willing to submit the entire contention to the International president and a local committee. President Mahon succeeded yesterday in opening negotiations with the company, which will continue to-day with the hope of securing a satisfactory settlement. Pending these negotiations the present relations will continue, and as soon as the committee has reported, a general meeting of the body will be called.

The new corporation, of which previous mention has been made, under which all the New Jersey electric traction companies operating in Hudson, Essex, Bergen and Passaic Counties are merged is capitalized at $25,000,000, and controls 450 miles of track. It is generally understood that the new company will make traffic arrangements whereby access to Manhattan will be secured through one of the proposed Hudson River tunnels. Another of the plans of the company is to acquire control of all the gas, electric-light and power companies of the state. The title of the company is the United New Jersey Railways Company.

All the members of the citizens' delegation are using their persuasive power to have the cities committee of the Legislature report favorably upon the municipal electric-light bill introduced by Senator Elsberg for Commissioner Monroe. In the event that the committee fails to act favorably upon the bill, Senator Elsberg will move to have it discharged from further consideration of the measure. Two members on the committee who were interviewed on the subject said they thought that the sentiment of the committee was antagonistic to the measure, and they doubted very much whether it would be reported.

The report of Special Counsel Philbin, engaged by stockholders of the Metropolitan Street Railway Company, and the testimony being developed in the libel suit of William N. Amory against H. H. Vreeland, president of the company, go to show that the reports of the company reveal discrepancies of the most glaring sort. On the other hand President Vreeland assures the stockholders that their company has an abundant surplus, that there has been no misappropriation of the funds, no marking up of its assets, no concealment of its liabilities, and no higher expense of construction than the urgency of the work justified. It is expected that the report of the district attorney on the charges preferred, unless something happens to change the color of the report, as it was originally outlined, will prove to be a distinct blow for the enemies of the Metropolitan. The experts employed by Mr. Jerome have made preliminary reports to him declaring that the deductions of Philbin and William N. Amory were based upon a misunderstanding of the figures taken from the books and the reports of the Metropolitan Company. The charges of discrepancies have been met with explanations which have satisfied the district attorney, and he has formed the conclusion that there is no ground upon which to base official action by him against any of those concerned in the management of the Metropolitan.

The Electric and Gas Securities Company was incorporated on April 15th with a capital of $200,000. The company's headquarters are at Yonkers and the directors are E. W. Wheelock, W. C. Dodge and P. F. W. Ruther, all of New York.

The secret survey which engineers and surveyors have been making in the northern part of Westchester, Putham and Dutchess Counties, and in Hudson, Chatham, Albany, and other cities, are being made, it is said, for a company which proposes to build a third-rail electric railroad between Boston, Albany and New York.

O.

New England News.

Boston, April 18.—The name of the Union River Light, Gas and Power Company, incorporated in Maine, has been changed to the Bar Harbor Union River Power Company.

Homer M. Daggett, Jr., of Attleboro, Mass., has been appointed receiver for the Eastern Electric Cable Company by Judge Colt of the United States Circuit Court. This was the outcome of a bill of complaint filed by Henry A. Clark, to whom the company owes $17,000, and who is indorser on obligations amounting to $13,000. It is stated that the company's indebtedness amounts to $100,000.

The Connecticut Senate has passed a resolution authorizing an increase of capital stock by the Branford Lighting and Water Company. The company's stock was $100,000 and the resolution authorizes an increase of $500,000, the company to be empowered to issue bonds amounting to $500,000.

The Connecticut Senate has also passed resolutions granting a charter to the Groton and Stonington Street Railway Company, which proposes to build an electric railway between Groton, Conn., and the Rhode Island state line in Stonington. The road will run through a well-populated country near the shore of Long Island Sound. The company's capital is $600,000. The company can make traffic contracts with any street-railway company in Connecticut or owning roads running between Westerly and Watch Hill, R. I., but it cannot carry freight.

The Whitlow Corporation of New Bedford, Mass., has been incorporated. It has a capital of $5,000, and will deal in electrical and mechanical apparatus and construct and install electrical and me-

[illegible] and supplies. Samuel Whitlow is [illegible] N. Swift is treasurer.

The Greene Electric Light, Power and Manufacturing Company of Ashburnham, Mass., has been incorporated. It has a capital of $10,000. Charles H. Greene is president and Alonzo A. Carr is treasurer.

The Bryant Electric Company, of Bridgeport, Conn., has awarded the contract for building two additional factory buildings, each measuring 60 by [illegible] and three stories high.

The Stafford Springs (Conn.) Street Railway Company is seeking legislative authority to increase its capital from $700,000 to $1,500,000 and to condemn private land. It will build an electric railway between Rockville, Conn., and the Massachusetts state line in Stafford, being a portion of the contemplated through line between Worcester, Mass., and Hartford, Conn. It will carry no freight.

The West End Street Railway Company has voted to add 9,085 shares to its capital stock, the par value to be $50 per share. This will increase the common stock from 181,700 shares of the par value of $9,085,000, to 190,785 shares of the par value of $9,539,250. This stock will be offered to the stockholders at 90, in the proportion of one share of new for each 20 shares of old stock. The proceeds will be used in paying for permanent additions, alterations and improvements to the company's property, made by the Boston Elevated Railway Company.

The A. E. Holaday Company of Fair Haven, Conn., manufacturer of electrical supplies, is preparing to increase its plant by the erection of a building three stories high and measuring 50 by 100 feet.

The Pittsfield (Mass.) Spark Coil Company has been incorporated. It has a capital of $20,000 and will make, sell and deal in electric machines and appliances and storage batteries. Michael Casey is president and William P. Wood, treasurer.

The directors of the Edison Electric Illuminating Company of Boston have called a special meeting of the stockholders, to be held April 23d, at which they will vote on the proposition to authorize the directors to petition the Massachusetts gas and electric-light commissioners for authority to issue 20,000 shares of stock, the proceeds to be used in the acquisition of suburban electric companies.

B.

Southern Developments.

Charlotte, N. C., April 18.—The Birmingham (Ala.) Railway, Light and Power Company has decided to increase the capital stock to $6,000,000, this being a net increase of $1,000,000. The increase was deemed advisable on account of the large amount of new work in progress. The company will also erect a gas plant in Bessemer, Ala.

The largest spring in the world, at Mammoth Springs, Ark., one mile across the Missouri line, will be utilized at once as a natural power plant for operating various mills.

A recommendation will go to the City Council of Atlanta, suggesting that the municipal lighting contract be given to the Georgia Railway and Electric Company for a period of five years. The company agreed to furnish lights at the rate of $75 per arc equivalent per annum.

The city of Greenville, S. C., has granted a 50-year franchise to the Greenville and Anderson electric railway, proposing to connect the above-named cities by trolley. Dr. J. E. Coughlin of Indianapolis, Ind., is interested.

The Memphis (Tenn.) Street Railway Company will make extensions and improvements to its lines involving an expenditure of about $175,000.

The Knoxville (Tenn.) Power Company has filed an amendment to its charter increasing the capital to $10,000. Charles H. Treat is among the incorporators.

The committee on subscriptions for extending the street railway from Rome, Ga., to Lindale, has raised $5,000, northern capitalists having agreed to invest $125,000 in the local electric street railway if the city of Rome would give a bonus of $15,000.

Preliminary surveys are being made on the proposed trolley line from Augusta, Ga., to Columbia, S. C., by Artie Legan, James G. Guignard and others. In the meantime the Columbia City Council has voted down a motion to extend the time for filing the required bond by the company.

The H. B. Dysart Water and Electric Company, having been granted a franchise at Marion, N. C., to build an electric-light plant, will begin work at once.

L.

West Virginia and Kentucky.

Lexington, Ky., April 18.—The Reliance Improvement Company of Wheeling, W. Va., has been incorporated with a capital stock of $25,000. Among the other purposes named in the papers is that of constructing electric-light plants and electric railways. William Koehnline, Joseph Kaiser and others of Bridgeport, Ohio, are interested in the company.

The City Council of Somerset, Ky., sold a franchise to operate an electric line to the highest bidder a few days ago, with the result that Attorney Farreel and Judge Faulkner of Lexington secured it. They were acting for a company which will build a line from Somerset to Monticello to connect with the boat lines on the Cumberland River.

Harry Spinks is making a hard fight to secure an entrance to Cincinnati for his road, which is to connect Newport, Covington and Dayton, Ky., but Attorney Matthew Harold, who is looking after the interests of what is known as the Green Line, says that his road has an exclusive contract with the Cincinnati Traction Company to reach Fountain Square over the Walnut Street line, and that it also has an exclusive right over the Louisville and Nashville railway bridge.

The counties of Marion and Monongalia, W. Va., have granted franchises to the Fairmont, Morgantown and Cheat River Railway Company, to build a trolley line connecting Fairmont, Morgantown and the Cheat River Valley and forming a junction with the Pittsburg, McKeesport, Connellsville and Uniontown line. The road will cost something like $500,000, and it is said that Senator Stephen B. Elkins will furnish most of the money.

Work will be begun at once on the proposed electric line from Somerset, Ky., to Monticello, in the same state. It will be built first to the Pulaski oil fields and then extended on later. The line will be about 35 miles in length. W. A. Gunn of Lexington is the chief engineer.

C.

From the Buckeye State.

Cleveland, O., April 18.—The Youngstown and Ohio River Railway and Light Company was formally organized at a meeting held in Cleveland this week. The officers are as follows: President, T. W. Hill, president of the Cleveland National Bank; vice-president, Will Christy, of the Cleveland Construction Company; secretary, Max P. Goodman. The Cleveland Construction Company will build the road, and Will Christy, member of both companies, states that the route is one of the best in the state. Work will be begun within a short time. The capital stock of the company is to be increased to $1,500,000 within the next few days.

Former Governor Asa S. Bushnell of Springfield and his associates have purchased a majority of the stock of the Springfield and Xenia Traction Company, which for some time has been in the hands of the Mandelbaum-Pomeroy syndicate, and the control of the road has been turned over to him. The new officers of the company are as follows: President, J. J. Fisher; vice-president, J. E. Bushnell, son of the former governor; secretary and treasurer, H. C. Diamond.

The commissioners of Union County have granted a 20-year franchise to the Toledo, Columbus, Springfield and Cincinnati Electric Railway Company to build a line through the county.

The Elyria, LaGrange and Southern Traction Company of Elyria has been incorporated for the purpose of building and operating an electric road through Carlisle and LaGrange Townships, Lorain County. The capital stock is $10,000 and F. H. Foster, J. M. Starr, H. J. Eady and others are interested.

The Columbus, Marysville and Bellefontaine Railway Company has been incorporated, with a capital stock of $25,000, to build an electric line connecting the places indicated. W. H. Luchtenberg, the Columbus railway contractor, L. J. Guthke, M. B. Earnhart and some others are interested.

The Youngstown Light, Heat and Fuel Company of Youngstown has been incorporated, with a capital stock of $25,000, by C. H. Struble, H. D. Pritchard, R. F. Fitzgerald, A. L. Rowland and J. T. Harrington.

A. E. Appleyard & Co. have opened offices at 301 Citizens' Building, Cleveland, with F. Irving Dow as manager.

It is reported that the Cincinnati Interurban Company will spend about $3,000,000 in building lines to connect the various depots of that city. There has been some opposition to the enterprise, but that has been very largely overcome.

The Rapid Railway Company of Cincinnati is now operating cars between that city and Rossmoyne, a distance of 14 miles.

E. E. Galbreath of Cincinnati and other capitalists of that city will shortly commence the construction of an electric line from Ripley to Sardinia. It will be about 24 miles in length and will cross the Cincinnati, Georgetown and Portsmouth at Georgetown. This will open up a portion of country which has neither steam nor electric roads.

O. M. C.

Michigan.

Detroit, Mich., April 20.—J. H. Logan of Fenton is trying to interest capitalists in a plan to establish an automobile line between Flint and Long Lake, to forestall the proposed electric line between these points.

The Chippewa Electric Company of Sault Ste. Marie has been incorporated with a capital of $5,000.

The new casino at the terminus of the Bay City electric lines on Saginaw Bay will seat 3,600 persons, which is considerably more than the one destroyed by lightning at Wenona Beach.

The first electric car was run between Jackson and Battle Creek on Monday, April 13th, on the Jackson and Battle Creek Traction Company's line. The car, containing President Spitzer, Vice-president Potter, Secretary Foot, and delegations from Marshall and Albion Common Councils, was brought from Jackson to Marshall by a dummy engine, the third-rail system not having been entirely installed, but between Marshall and Battle Creek the car was propelled by the completed electric system.

A West Bay City company is considering the establishment of an automobile line between the two sides of the city which is divided by the Saginaw River. This line would be run in opposition to the street-car lines, which operate over but one bridge.

It is understood that the management of the Indiana Railway Company (electric) has tried to purchase the old roadbed of the Michigan Central for the new road between Niles and Buchanan, the roadbed affording a much easier grade.

The new municipal electric-lighting plant at Trenton is completed. It has been installed at a cost of about $14,000, although the estimate was but $7,500. There are about 30 street lights installed.

The freight sheds and car barns of the Detroit United Railway at Pontiac were completely destroyed by fire last week. The fire is supposed to have started from a car standing in the barns. Considerable freight was destroyed, but the loss will not exceed $15,000. The power house was saved.

The Detroit United Railway is planning to install a number of limited cars on the Flint division by June 1st. It is hoped to make the run from Detroit to Flint in two hours and 35 minutes. The Flint division, as well as the Port Huron division, will have the tracks thoroughly overhauled and reballasted before the summer travel begins.

C. G. W.

Information from Indiana.

Indianapolis, April 20.—The Evansville Street Railway Company has accepted the proposition of the Evansville and Henderson Interurban Company to pay the company a three-cent fare for each through passenger without transfers.

Franchises were granted on the 14th inst. to the Union Traction Company to pass through Valparaiso and Hobart with its Logansport-Hammond line. Representatives of the company have asked for franchises in Hammond and Winamac. The councilmen of both cities say that the franchises will be granted.

The City Council of South Bend voted a franchise to the Chicago and Indiana Air Line Electric Railway Company on the 13th inst., without compensation. The mayor vetoed the franchise. The proposed route is from Chicago to South Bend, via Michigan City, with branches to the southern Michigan summer resorts. There are seven companies seeking franchise rights to run west of South Bend and two, the Indiana and the Air Line companies, have already begun operations. The latter announces that it will proceed with its South Bend-Michigan City line, regardless of any action on the part of rivals.

Local traffic of the steam railroads centering in the city of Richmond has been reduced to almost nothing by the service of the interurban lines.

The Jones-Hogue Company of Indianapolis was incorporated last week with $10,000 capital stock. The company proposes to do electrical and mechanical engineering and construction work of railways, heat, light and power plants. The incorporators are H. W. Jones of Cleveland, George A. Hogue, L. L. Green and E. E. Elliott of Indianapolis. One of the main purposes of the company, it is understood, will be to bid on the next lighting contract in Indianapolis, now held by the Indianapolis Light and Power Company. For the present the company intends to limit itself largely to interurban-road construction. Mr. Jones is president, and Mr. Elliott secretary.

The General Construction Company of Fort Wayne has incorporated with $50,000 capital stock. The directors are George W. Beers, S. M. Foster, Charles McCulloch, Samuel S. Fisher and others. The company proposes to take contracts for constructing electrical plants and systems, including telephone and interurban systems.

The Converse Electric Light Company of Miami County has incorporated with a view of erecting an electric-light plant in Converse. The capital stock is $15,000. O. P. Sweringen and S. M. White are directors.

A company composed of J. J. Netterville, C. L. Henry, C. W. Haven and I. E. May was organized last week to secure control of the electric-light and water plants now owned by the city of Anderson. The new company will enlarge the plants and install new machinery.

F.

Northwestern Notations.

Minneapolis, April 18.—The Faribault Gas and Electric Company of Faribault, Minn., has been incorporated with $250,000 capital stock. The bulk of the stock is owned by New Yorkers.

The application of the electric-light company and the street-car company at Great Falls, Mont., for an extension of franchise will be submitted to popular vote. The entire expense of the special election will be borne by the grantees of the franchise.

The motion of the council of Mitchell, S. D., for no annulment of the franchise of the electric-light company has been defeated. The company moved in the matter and improved its service, however. The company will make further improvements to the plant, putting it on a modern basis.

Business men of Muscatine, Iowa, contemplate forming a company to put in an electric-light plant. The plan of the promoters is to sell the plant to the city.

The Northwestern Electric Company of Fargo, N. D., has been granted a franchise for an electric-light plant for Cooperstown, N. D.

The Wisconsin River Railway and Power Company has been granted a franchise through Stevens Point, Wis., for an electric railroad.

A proposition has been made to purchase the Electric Light Company property at Kaukauna, Wis., and make improvements thereon. The sale will be conditional on the city eliminating the requirement of an underground system of wires and the privilege of adopting the Edison system.

The Ottumwa Telephone Company of Ottumwa, Iowa, has expended over $73,000 in reconstructing the system and expects to spend about $10,000 in completing the work.

The franchise for the Independent exchange of Sioux City, Iowa, now before the City Council, has been amended to require a two per cent. gross earnings tax and to require the company to make connections with all companies entering the city.

The Duluth-Superior Traction Company announces that it will proceed to place its wires in Duluth underground before the end of the year, as required by the recent ordinance of the City Council. The other electric companies have announced their willingness to proceed with the removal of their wires, but waited on the traction company. This assures the early removal of the wires.

Charles F. Nolte, George Nolte and W. J. Malloy have applied to the county commissioners for an electric-railway franchise from Whatcom, Wash., to Marietta, Ferndale, Birch Bay and Blaine, returning via Lynden. R.

Among the Rockies.

Salt Lake City, Utah, April 16.—Electrical construction has been rather extensive throughout the western states during the past few weeks. Particular activity has been shown in the promotion of suburban street-railway systems.

It seems probable that Cheyenne will have an up-to-date electric street-car service in the near future, and improvements and extensions which will aggregate a cost of approximately $100,000 will be made shortly at Great Falls, Mont., where the Daly and Ryan electrical interests have been consolidated.

A decree has been entered by the district court at Salt Lake which orders the sale of the interest of the Salt Lake Water and Electrical Power Company to satisfy judgments amounting to approximately $500,000.

Considerable activity has developed at Twin Falls, Idaho, where the Twin Falls Land and Water Company is preparing to install a large power plant. Several gangs of men are already at work, and it is expected that the machinery will be ready for operation early in May.

The Mitchell-Gleason Company has forfeited a guarantee of $1,000 providing for certain railway extension in New Mexico during a limited period. It was held that the company had failed to comply with the terms of the franchise. G.

Butte, Mont., April 16.—At a meeting of the stockholders of the East Pacific Mine, held at Helena, Mont., last week, it was decided to install an electric concentrator at the mine with a capacity of from 50 to 75 tons a day. The concentrator, together with an electric hoist and compressor, will be operated by power generated at Winston, six miles away. The power plant is to be of the most modern construction and work will commence at once.

Alexander Freeman and other Bozeman (Mont.) men have circulated a petition to the county commissioners asking a franchise for an electric-lighting plant for the town of Belgrade. The work is to be commenced within 60 days after the franchise is granted. H.

On the Pacific Slope.

San Francisco, April 15.—The Board of Public Works of San Francisco has appointed J. C. Stut to act as consulting engineer to prepare plans for operating the Geary Street railway as a trolley system, using power purchased from other companies. The question of the city acquiring the road may again be submitted to the vote of the people.

A special election has been called for April 25th at Great Falls, Mont., to vote on the question of granting a franchise to John D. Ryan and associates for the construction of an electric-light and power plant and also street-railway franchises in Great Falls.

The Washoe Power and Development Company has been incorporated at Reno, Nev., to furnish light and power and to establish a pumping plant. The directors of the new concern are N. J. Evans, H. C. Cutting and others.

Arrangements are now being made by the City Council of Stockton, Cal., to submit a proposition to the people to bond the city for $160,000 for the purpose of erecting a municipal lighting plant in accordance with the plans submitted by Professor C. L. Cory of the University of California, as previously mentioned in the Western Electrician.

The Van Duzen Electric Power Company of Eureka, Cal., has completed the survey for the power system to Eureka and the Eel River Valley. Arrangements will be made for a plant of 2,000 horsepower, which will be established at once on the Van Duzen. Five other plants will be erected, aggregating a total of 10,000 horsepower.

Charles W. Clark, F. J. Carolan and Henry P. Bowie of San Mateo, Cal., are said to be behind the scheme to construct an electric line to run from San Mateo to Burlingame and Halfmoon Bay. Bids will be received on June 1st for the sale of the franchise.

The comparative statement of the gross earnings of the United Railroads of San Francisco, the company owning all the electric and cable roads in the city with the exception of three cable lines, for the month of February is as follows: February, 1903, $445,162; February, 1902, $391,869. The earnings for February, 1903, show an increase of 13.50 per cent. over the same month last year. The total earnings from March 20, 1902, to February, 28, 1903, amounted to $5,352,042.

A company is being formed at Shelton, Wash., to consolidate the electric-lighting business, steam-laundry, ice plant and cold-storage interests with the steam-heating business. New machinery will be added to the steam laundry and the capacity of the electric plant will be doubled. Further information may be secured by addressing W. H. Kneeland.

Z. A. Johnson has selected a definite location for the site of his electric power plant on Lolo Creek, near Nez Perce, Idaho, and has awarded the contract for the construction of the dam and power house to Joseph Christie. It is expected to develop 250 to 350 horsepower. The power will be transmitted over a copper line 12 miles long.

H. E. Huntington has made an application for a franchise for a double-track trolley from Riverside to Corona, in southern California.

The Reward Gold Mining Company has started up its new electric equipment at Reward, Inyo County, Cal. A 20-stamp mill is operated by a Westinghouse electric plant, driven by a Leffel turbine wheel under a head of 25 feet of water. A 120-kilowatt, three-phase, 2,000-volt generator transmits current three-quarters of a mile to the mill, where a 50-horsepower induction motor operates the stamps and concentrators. A 50-horsepower motor drives an air compressor and a 15-horsepower motor the ore crusher. The milling plant was installed by the Union Iron Works of San Francisco. A.

Seattle, Wash., April 15.—John D. Ryan has asked the City Council of Butte, Mont., for a franchise to erect and operate an electric power plant in that city.

The Melrose Tramway Company of Melrose, Mont., has filed articles of incorporation for the purpose of erecting and operating an electric railway extending from North Melrose to the Clearwater River. W. G. Watson is interested.

The City Council of Tacoma, Wash., passed the ordinance imposing a two per cent. tax upon the earnings of the Tacoma Railway and Power Company.

The Grays Harbor Light and Power Company, through John C. Hogan, has accepted an ordinance to build a railway into the city of Hoquiam, Wash.

The Inter Mountain Electrical Company has filed articles of incorporation at Salt Lake City, Utah, for the purpose of constructing and repairing electrical machinery and apparatus. It is capitalized for $50,000, and its incorporators are S. F. Fenton, L. H. Farnsworth, G. E. Fenton, E. A. Tripp and E. A. Kraft.

For the first time in several months Puyallup, Wash., was lighted by electricity a few days ago. The current was furnished by the Tacoma Railway and Power Company, which company will continue lighting the town under the name of the Puyallup Electric Company.

The State Board of Building Commissioners of Oregon has made a contract with the Salem Light, Power and Traction Company for the lighting of the various state institutions for another year, under the same terms that governed the 10 years' contract which has just expired. The cost to the state for this service is a trifle more than $1,000 a month. It is the purpose of the state to own a plant eventually.

The Sprague Light Company of Lincoln County, Wash., has filed articles of incorporation, with capital stock of $6,000. Geo. E. Smith and others are the incorporators. P.

PERSONAL.

Mr. A. B. Fink, secretary and manager of the Diamond Meter Company of Peoria, was a Chicago visitor last week.

It is announced that George W. Lloyd has been appointed assistant superintendent of the Western Union Telegraph Company, with headquarters at Minneapolis.

Emil G. Schmidt of Sandusky, Ohio, has been appointed general manager of the railway, lighting and heating plants at Springfield, Ill., which have recently been merged into one company.

D. B. Dean of the J. G. Brill Company was in Chicago last week. Mr. Dean, who is now a resident of Cleveland, was until a few years ago a well-known electrical and street-railway salesman of Chicago.

F. D. Ward, general master mechanic of the Lake Street Elevated Railway Company of Chicago, has gone to London, England, where he will be engaged in a similar capacity with Charles T. Yerkes' underground-railway interests.

Garry Meeker, formerly of Columbus, Ohio, is interested in building an electric line from Beaumont, Texas, to the Sour Lake oil district. He was in Columbus last week and, it is said, financed his company. The line will be 19 miles in length. Mr. Meeker now resides at Houston, Texas.

The mayor of Detroit, Mich., has appointed Henry P. Hetherington as commissioner of the city's municipal electric-lighting plant. He succeeds J. E. Davis for a term of five years. Mr. Hetherington is managing editor of the Detroit Journal and one of the best-known newspaper men of the city.

L. G. White has been appointed assistant general superintendent of the Columbus street railway, Columbus, Ohio. He was formerly connected with the Columbus Edison Electric Company. He is succeeded there by Sheldon Roberts. Sullivan Hopkins is general superintendent of the railway.

At the annual meeting of the stockholders of the American Marconi Wireless Telegraph Company, held in New York, on April 20th, Samuel Insull of Chicago and J. W. Griggs were re-elected directors. John B. Oppe, manager of the Canadian Marconi Company, was elected to succeed J. D. Kelley as a director.

W. B. Tarkington, for many years superintendent of the Council Bluffs, Iowa, division of the consolidated Omaha and Council Bluffs Street Railway Company, has resigned his position to become general manager of the Detroit, Monroe and Toledo Short Line Electric Railway Company. His headquarters will be at Detroit.

Friends of George P. Barton, the well-known patent lawyer of Chicago, will rejoice with him that the fears recently entertained for the life of his son, Lester C. Barton, should turn out to be unfounded. Young Mr. Barton is a student at Yale, and it was apprehended that he had been drowned in a sailing expedition on Long Island Sound.

George H. Day has resigned the presidency of the Electric Vehicle Company of Hartford, Conn., to become general manager of the Association of Licensed Automobile Manufacturers, a new combination of leading factories. Ex-Governor M. G. Bulkeley of Hartford, vice-president of the Electric Vehicle Company, succeeds Mr. Day.

It is said that John C. Weaver, one of the division superintendents of the Cincinnati Traction Company, who has been with the Cincinnati Street Railway Company for more than 30 years, will retire in a short time, and that Robert E. Lee will succeed him. The company makes a practice of pensioning those who retire because of old age and who have been in the service for many years.

Alfred Jackson, electrician in the fire-alarm repair department of the city of Chicago, died at the West Side Hospital on April 16th. Mr. Jackson was born in Kansas and was 22 years of age. He came to Chicago three years ago, during which time he had been in the employment of the city. He was a well-known member of the International Association of Electrical Workers, of which his brother William, also employed by the city as an electrician, is grand president.

John Hoyt Lillie, who took the first census of Chicago preparatory to its incorporation, died at his home in Los Angeles, Cal., on April 1st. Mr. Lillie was 90 years of age. In 1850 he was granted a patent on an electric motor. In the same year he produced an electric light by the use of fine platinum wire and predicted the time when electricity would be largely used for lighting. His electric motor was sold to P. T. Barnum and attracted much attention, but was not seriously considered for industrial use.

Dr. Harold Pender, formerly an instructor of physics at Syracuse University, Syracuse, N. Y., after many experiments, is said to have confirmed the existence of the magnetic effect of electric convection. Faraday propounded the theory and Rowland demonstrated it to be true in 1876. Dr. Pender has been experimenting on the convection of electric charges for some time, and now announces that his efforts have been unexpectedly successful. Of late he has been working in Paris in conjunction with Messrs. Poincare and Cremien, two eminent physicists.

Lieutenant B. R. T. Collins, chief engineer of the Harrison Street station of the Chicago Edison Company, has accepted a position with Stone & Webster of Boston and left for the East this week. Mr. Collins had been with the company for several years and is an engineer of excellent capacity, well liked by his associates. He is a graduate of the Massachusetts Institute of Technology, and served as a lieutenant in the navy during the Spanish-American war. On the evening of Tuesday, April 21st, Mr. Collins was tendered a complimentary banquet by the engineering and office staff of the company.

Owing to a disagreement with Mayor McNamee, Charles F. Hopewell has resigned the superintendency of wires and lamps in Cambridge, Mass., after serving seven years. Mr. Hopewell asserts that the mayor ordered a cut in the salaries in the wires and lamps department and then stated that Mr. Hopewell was responsible for the reduction. Timothy C. O'Hearn has been appointed city electrician in that city. Mr. O'Hearn is a graduate of the Cambridge Manual Training School, also of the

Institute of Technology, in which latter educational institution he has been an instructor since graduating.

James D. Hawks of Detroit, Mich., president of the Detroit and Mackinac Railroad, has been the leading figure in bringing about the formation of the Detroit Edison Company, capitalized at $6,000,000, which has purchased the stock of the Edison Illuminating Company of Detroit, and is now engaged in constructing a lighting and power plant of large proportions for that city. Mr. Hawks stands high in his profession as an engineer and has built many steam railroads. He is at present interested in several electric-railway enterprises, including the Detroit-Jackson, the Grand Rapids-Muskegon and the Jackson-Grand Rapids lines.

ELECTRIC LIGHTING.

Fayette, Iowa, is to have a municipal lighting plant. At a special election it was voted to purchase the electric-light plant for $4,000.

The Memphis (Tenn.) Consolidated Gas and Electric Light Company has announced its intention of extending its conduit system at an expense of $93,000.

The City Council of South Stillwater, Minn., has voted to bond the town for $23,000, to erect an electric-lighting plant and install a system of water works.

From January 1st to April 18th the Chicago Edison Company added an equivalent of 60,000 16-candlepower lamps to its connected load and the Commonwealth Electric Company 40,000. The total connected load is now about 1,200,000 lamps' equivalent for the Edison company and 500,000 for the Commonwealth company.

The electric-lighting and hot-water heating plant of the Evanston Yaryan Company of Evanston, Ill., which has been in the hands of a receiver for some time, was sold at a foreclosure sale last week. Lyman A. Walton, vice-president of the Equitable Trust Company, representing the bondholders, bid in the property for $219,295. The plant which originally cost over $300,000 has been in operation for about two years, but did not prove a paying enterprise.

ELECTRIC RAILWAYS.

Electricity has displaced the last of the 5,200 horses which once worked on the Manchester (England) tramways.

The Westchester Traction Company of Ossining, N. Y., intends to construct an extension to Port Chester, N. Y. The company has been authorized to increase its capital from $300,000 to $1,500,000.

The Havana street railways have begun collecting five-cent fares in American money, in accordance with the concession granted by the military government. The fares had hitherto been paid in five centavos, Spanish coin.

The Mobile Light and Railway Company has completed an electric road from Mobile to Whistler, Ala. The residents of the two towns and those along the line are delighted with the new advantages the road brings to them.

A company represented by J. H. McDonald was recently granted a franchise by the City Council of Oakland, Cal., to construct and operate an extensive electric street railway in that city. It is stated that work will be begun at once.

A comparative statement of the earnings of the Aurora, Elgin and Southern Traction Company, operating between Elgin and Yorkville, Ill., shows the gross earnings for the month of March of the present year to be $32,824 as against $30,535 for the same month last year. The operating expenses for March, 1903, were $19,973, which includes an accident amounting to two per cent. of the gross receipts. Deducting $10,632, the amount of taxes, bond interest, etc., from the net earnings for the month, gives a balance available for dividends of $2,217, an increase of $583 over March, 1902. The net income available for dividends for the three months ended March 31, 1903, is $4,009, compared with $3,236 for the corresponding period last year.

AUTOMOBILES.

Final arrangements for the international automobile race across Ireland will be made on April 25th, on which date trial races to select the positions of the starters will be held. According to present arrangements, S. F. Edge of England, as holder of the cup, will start first with his green Napier racer. He will be followed at intervals of two minutes by 11 other contestants, representing Great Britain, France, Germany and the United States.

The fifth National German Automobile Exposition held at Berlin came to a close on April 14th. It was in all respects the most interesting, popular and successful exhibition of the kind ever held in Germany. The exhibits numbered 115, practically all German. It not being an international display, only two American machines were exhibited—the Oldsmobile and the Locomobile of America; these were shown by German firms. Nine-tenths of the vehicles exhibited had hydrocarbon motors. The leading manufacturers discussed the organizing of a syndicate to promote their interests in regard to foreign trade, and it is probable that a representative display will be made by them next year at St. Louis.

SOCIETIES AND SCHOOLS.

L. F. Mahler, district manager of the Curtiss-Crippen Engineering Company in Chicago, gave an interesting talk on the DeLaval steam turbine before the members of Engineers' Council No. 191 of the Royal League at Masonic Temple, Chicago, last Monday evening. Mr. Mahler gave about 150 stereopticon illustrations of the company's factories, the turbine wheel and accessories. Some valuable facts of interest to engineers were brought out by the discussions, which followed some of the speaker's remarks and illustrations.

The April meeting of the Engineers' Society of Western Pennsylvania was held at Pittsburg on April 21st. The discussion was on the paper, "Commercial Gases for Power Purposes," read by Alexander M. Gow. It was announced that at the last previous meeting 64 new members were elected. The meeting was preceded by a reception and dinner at the Union Restaurant, at which informal toasts were the feature. An interesting programme is being arranged for the May meeting, when the subject for discussion will be "Modern Material of Construction." Four or five papers have been prepared for this meeting.

About 100 junior students of engineering of Purdue University, Lafayette, Ind., made the annual trip of inspection to Chicago last week. They were in charge of W. F. M. Goss, dean of the schools of engineering. The students of electrical engineering visited the Chicago Telephone Company's main exchange, plants of the Chicago Edison Company, the works of the Western Electric Company, the Commonwealth power plant and the power plants of the Union Loop and Chicago City Railway Company. The civil-engineering and mechanical-engineering classes visited other places of interest. On one evening the students attended receptions given by the students of the Chicago and the Northwestern universities.

PUBLICATIONS.

The H. O. S. Engineering Company of 277 Broadway, New York city, has issued a price list of its all-copper panelboards.

The Buffalo Forge Company of Buffalo, N. Y., is distributing an artistic mailing card which illustrates and sets forth the advantages of the Buffalo disk wheels for ventilating and cooling purposes.

The Warren Ball Bearing Fixture Company of 377 Broadway, New York, issues a new catalogue descriptive of its Fergusson ball-bearing adjustable fixtures. Portable, desk and piano-lamp fixtures in various styles are illustrated, and also showcase lights, adjustable telephones, mirrors, etc.

Luther L. Miller, a well-known patent attorney of Chicago, has published two booklets entitled, respectively, "The Law of Trade Marks of the United States and the Principal Countries" and "Trade Marks: A Book for Advertisers." Each of the books is comprehensive and contains much information on the subject of trademarks which should be of importance to advertisers and manufacturers. The booklets are published primarily for Mr. Miller's clients, but he will be glad to send them to friends of the Western Electrician on request.

SPACE TELEGRAPHY.

Dr. Lee DeForest is in Seattle, Wash., looking over the ground with a view to making arrangements for the establishment of a space-telegraph system between Seattle and Asiatic Russia. It is proposed to establish the first station at Cape Flattery and from there the line of communication proposed will be via Dutch Harbor, Petropaulavsk on the Peninsula of Kamchatka, to Yokohama, with stations at each of those points. The system might also be extended to Hong Kong with a branch to Manila. A branch could also be built from Dutch Harbor to Nome, Alaska. The system, if constructed, will be installed by the DeForest Wireless Telegraph Company of New York city.

MISCELLANEOUS.

What is said to be the largest electrical pumping plant in the world is that at Utah Lake, Utah. It raises 65,000,000 gallons of water a day for irrigating the Great Salt Lake Valley.

Leading German surgeons and authorities on cancer, such as Leyden, Rosenbaum and Israel, discredit the recent report of the British cancer commission that the virulent disease can be cured through high-frequency electric treatment. Experiments with electricity have been made by leading German authorities for 10 years, and according to such an authority as Professor von Bergman have been abandoned as impracticable.

By a method that requires no cutting, S. Mayon has a device for removing from the stomach metallic objects that may be attracted by a magnet. A small electromagnet is arranged to slide in a tube similar to that of a stomach pump, and the apparatus is passed into the stomach through the mouth, when the magnet draws the foreign body into the tube. By lighting up the stomach with X-rays, the operator is able to bring the magnet into contact with the metal at the point most suitable to enter the tube.

The British legation in Mexico reports that the use of electricity not only for lighting but also for industrial purposes is becoming more general, and several companies have been formed for the purpose of making use of the larger waterfalls throughout the country for the generation of electricity, the machinery being imported chiefly from the United States. The electric-light company of the City of Mexico has been unable to supply the demand for electricity for lighting purposes, and the extension of the electric-railway lines about the City of Mexico has greatly increased the use of electricity.

TRADE NEWS.

The capital of the American Electric Fuse Company, Chicago, has been increased from $25,000 to $100,000.

Scharf Bros., electrical engineers and contractors, announce that they have removed their offices to 474 Columbus Avenue, New York city.

On May 1st the New York offices of the engineering firm of Ford, Bacon & Davis will be removed to the Blair & Co. Building at 24 Broad Street.

The Brode Electric Company, jobber and dealer in electrical supplies, has been incorporated and has moved into its new store at 306 South Los Angeles Street, Los Angeles, Cal., to accommodate its increasing stock of supplies.

Roth Bros. & Co. announce that they will move to their new location, and will occupy the entire building at 27 and 29 South Clinton Street, Chicago, May 1st, and will continue, as heretofore, to make dynamos and motors. All their machinery will be individually electrically driven.

Consul Marshall Halstead of Birmingham, says that a manufacturer of anchors wishes to be put into communication with the makers of large steel castings and forgings. The Englishman wishes to hear from manufacturers who are able to take orders for and make early deliveries.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 25th, for the installation of a conduit and electric-wiring system for the United States postoffice at Lockport, N. Y., in accordance with the drawings and specifications, copies of which may be obtained at the supervising architect's office or at the office of the superintendent of construction, at Lockport, N. Y.

The Holcomb-Lobb Company of Chicago states that its reason for disposing of its cedar business to the William Mueller Company was to allow it to extend and enlarge its oak-tie business, in which it will continue. In the past the Holcomb-Lobb Company has dealt extensively in standard oak track ties, besides sawed switch and bridge ties. The company states that the demand for oak ties is greater than ever, and it is finding it difficult to keep up with its orders.

The largest of the four shops of Pawling & Harnischfeger, crane manufacturers at Milwaukee, Wis., was damaged by fire on April 15th, the loss being estimated at upwards of $100,000. The burned shop was largely used for erecting purposes and the loss falls principally on some cranes which were nearly completed. The firm states that its business will not be hindered, and that it will proceed with its work as before, the other buildings of the plant being large enough to handle the orders.

It is reported that the St. Louis Car Company has purchased the entire plant of the Laclede Car Company of St. Louis, and that improvements will be made to an extent that the capacity of the combined plants will be equal to an outfit valued at $5,000,000 per annum. There are at present 1,627 cars in course of construction at the former plant. Of this number 1,397 are for electric-railway companies in the United States and 230 are for foreign countries. There are a number of cars being built for the Fonda, Johnstown and Gloversville Railway Company of New York, which, it is said, will be the largest electric cars ever built.

A new line of alternating-current induction long-scale voltmeters and ammeters is being put out by the Westinghouse Electric and Manufacturing Company of Pittsburg. These instruments are closely allied to the company's integrating wattmeter. The scales begin at zero, and the divisions are absolutely proportioned and uniform above 20 per cent. of the full capacity, with a length and openness said to be obtained in no other type. The dial is made of translucent material, illumined from the rear. An electromagnet is used to produce a shifting magnetic field, in the air gap of which is an aluminum disk in which currents are induced by the field, resulting in the disk's movement. This motion being opposed by a spring, the amount of deflection is shown by a pointer mounted on the shaft of the disk. The instruments are said to be absolutely un-

affected by external fields, are totally dead-beat, and are compensated for changes in temperature and frequency. The moving elements being very light in weight, the bearings perfect, jewels finely ground and the shaft carefully hardened and polished, render friction a negligible quantity. The parts are interchangeable and the cases dustproof and of neat appearance.

Probably the largest contract for electrical generators ever placed for use west of the Rocky Mountains has been awarded by Stone & Webster of Boston, managers of electric-power, traction and lighting plants along Puget Sound, to the General Electric Company. The order is for six machines, two to be furnished to the Tacoma Industrial Company for use in their development of the White River and four to the Pierce County Improvement Company for the work of developing the Puyallup River, including the flow from the Mount Ranier glaciers. The generators will be three-phase, 60-cycle, of 3,500-kilowatt capacity each, at 2,300 volts and 225 revolutions. Deliveries will commence next September.

BUSINESS.

The Central Electric Company of Chicago reports that so far this spring it has received more orders for Stombaugh guy anchors than ever before. It attributes this to the fact that the Stombaugh is easier to install, is cheaper, will stand a greater strain, and will give more satisfaction in general, than any other guy anchor on the market.

The Electric Storage Battery Company, of Philadelphia, manufacturer of the Chloride accumulator, has in process of installation two batteries contracted for by the United Traction Company of Albany, each having a capacity of 700 kilowatts. These will be located at Albany and Troy respectively, and will be operated in connection with specially wound boosters for regulating fluctuations. The Cleveland, Painesville and Eastern Railway Company is to install, about June 1st, a battery having a capacity of 460 kilowatts. This battery is to be operated in connection with a motor-driven differential booster, and the installation is designed to relieve the station of fluctuations, to care for peaks and allow the station to be operated with fewer generators than are now in service.

J. F. Butterfield, electrical engineer and contractor, 113 Adams Street, Chicago, recently secured three important contracts in Indiana, one for the installation of 80,000 feet of cable for the Logansport Home Telephone Company, Logansport, Ind.; one for 100,000 feet of cable for the United Telephone Company at Hartford City, Marion, Montpelier and Bluffton, Ind., and the third for 30,000 feet of cable for the South Bend Home Telephone Company, South Bend, Ind.

The Page & Hill Company of Minneapolis, wholesaler of white-cedar poles and posts, is one of the latest concerns to engage in the pole business, having recently absorbed the white-cedar business of the Menz-Hill Lumber Company. The new company has fine stocks in its yards on the Chicago and Northwestern railway in Wisconsin and on the Great Northern line in Minnesota. The company is in a position to fill orders promptly and asserts that it will deal only in the choicest grades.

At the last meeting of the board of directors of the Allis-Chalmers Company, held in New York, on April 15th, the regular quarterly dividend of 1¾ per cent. was declared on the preferred stock. The volume of business on the books of the company at present far exceeds that of any time since the organization of the company, notwithstanding the fact that the output of the plants has been increased to a large extent. The company says it can see no abatement of prosperity in its various branches of manufacture. There seems to be an unlimited demand for all kinds of high-grade machinery, which is certainly a good indication that prosperity is enjoyed in all lines of manufacture.

The Western Electric Company of Chicago has let contracts to the amount of $1,057,000 and work has begun upon some of the buildings which are to be erected at the site of the company's new plant at Hawthorne, Ill. The work already contracted for will include a power house, 265 by 173 feet, with a chimney 250 feet high; a machine shop, 821 by 150 feet; a foundry, 176 by 402 feet; an office building, 54 by 160 feet; a pattern-storage building, 54 by 220 feet; a water tower, 47 by 47 feet and 180 feet high, and a cable plant, 550 by 250 feet. The Western Electric Company is calling attention to its line of switchboards for both direct and alternating-current work for all voltages. The company carries in stock a large quantity of switches, circuit-breakers, instruments, marble, etc., so that it is able to make prompt deliveries, especially when boards composed of some of its numerous standard panels for generators and feeders are wanted. The company also makes special announcement of its line of over 50 styles of standard street hoods for incandescent and arc lighting.

March engine sales of the Allis-Chalmers Company of Chicago included the following: Oliver Iron Mining Company, Duluth, Minn., one 16 by 36 1890 Reynolds Corliss; Charles L. Vickers, Houston, Texas, one 18 by 36 Reynolds Corliss; Milwaukee Chair Company, Milwaukee, Wis., one 20 by 42 Reynolds Corliss; South Side Elevated Railway Company, Chicago, one 34 and 70 by 54 horizontal cross-compound; Washburn-Crosby Company, Minneapolis, Minn., one 26 and 58 by 60 cross-compound condensing; Illinois Steel Company, Chicago, two 46 and 86 by 84 and 84 by 60 vertical steeple cross-compound blowing engines; International Traction Company of New Jersey, Jersey City, N. J., two 34 and 68 by 48 cross-compound condensing; Schmeichel & Lange, Sutley, S. D., one 10 by 30 girder frame; Hunter Milling Company, Wellington, Kan., one 12 by 42 jet condenser; Lyon Cypress Lumber Company, Chicago, one 26 by 48; Griffin Wheel Company, Chicago, one 18 by 48 engine, with compressor attachment; Wild Goose Mining and Trading Company, Alaska, spare parts for Riedler pumping engine; Charles Butters & Co., Ltd., Mexico, one right-hand Corliss engine, 14 by 42; two horizontal tubular boilers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 14, 1903.

725,027. Portable Gas or Electric Light. Joseph E. Bohner, New York, N. Y. Application filed May 28, 1902.

An improved portable lighting stand is described.

725,044. Insulator. Charles Claydon, Searcy, Texas. Application filed September 19, 1902.

The insulator consists of a block of insulating material having a wire-supporting groove in the surface thereof, and a wire loop partially embedded in the block with the side members thereof spaced apart and emerging from the block on opposite sides of and at points remote from the groove. (See cut on next page.)

725,061. Cigar Lighter. James J. Fleming, Elk Garden, W. Va. Application filed May 27, 1902.

The device has a wick in the body to be ignited, a battery and a spark coil in the lid and contacts carried by the body and lid respectively and in circuit with the battery and spark-coil, the contacts being disposed for engagement and subsequent disengagement when the lid is moved to open position.

725,067. Storage Battery. William Gardiner, Chicago, Ill., and James R. Macmillan, Menomonie, Wis., assignors to the Northwestern Storage Battery Company. Application filed January 31, 1902.

In the cell are an inner tubular electrode containing active material in a finely comminuted form, washers of insulating material on the electrode acting as separators, a fabric lining in each of the tubular electrodes and a complemental electrode also in tubular form within which the last-named electrode fits.

725,079. Electric Car. Gardner C. Hawkins, Boston, Mass. Application filed September 25, 1901.

One claim reads: In an electric car, a settling chamber, a heater, and a delivery conduit to deliver the heated air from the heater into the car, the conduit being located in the settling chamber.

725,091. Alternating-current Apparatus. John F. Kelly and Cummings C. Chesney, Pittsfield, Mass., assignors to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed July 28, 1900.

Combined with two symmetrical generator circuits having electromotive forces of different phase are similar means connected to the coils for producing resultant electromotive forces, each displaced in opposite directions by an angle of 15 degrees from the electromotive forces of the generator circuits.

725,092. Alternating-current Apparatus. John F. Kelly and Cummings C. Chesney, Pittsfield, Mass., assignors to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed November 10, 1900.

Two main induced generator circuits having electromotive forces displaced by 90 degrees are combined with two auxiliary induced circuits acting respectively, one with each of the main induced circuits to produce electromotive forces of other phase displacement.

725,116. Safety Gear and Signal System for Railways. Jesse J. Moore, St. Louis, Mo. Application filed May 12, 1902.

Two crossing railway tracks are combined with a series of blocks of electric conductors, each of which is divided into two parts insulated from each other, and each of which parts is connected to one pole of an electric battery or generator, and means for grounding one pole of a battery to an adjacent block where one track is given the right-of-way.

725,132. Safety Device for Elevators. Edward H. Price, Sioux City, Iowa. Application filed April 16, 1902.

Circuit-controlling devices are arranged to operate a lock only when the elevator has stopped opposite the door.

725,133. Electric Incandescent-lamp Socket. Guy H. Proctor, Somerville, Mass., assignor to the New England Electric Manufacturing Company, Boston, Mass. Application filed February 3, 1902.

The socket has a snap-circuit-controlling device.

725,140. Device for Maintaining Constant Speed in Electric Motors. John G. Roberts, Detroit, Mich., assignor to Harry J. Fox, trustee, Detroit, Mich. Application filed January 2, 1902.

A direct-current electric motor has a short-circuit connecting opposite points of one of its windings, and a timed circuit controller in the short-circuit to keep the motor at uniform speed. (See cut on next page.)

725,192. Die for Forming Battery Plates. Arsène d'Arsonval, Paris, and Georges Vaugeois, Billancourt, France. Application filed June 4, 1901.

The die has a pair of screws with means for holding them in proximity to each other.

725,195. Circuit-closing Device. Henry P. Ball, New York, N. Y., assignor to the General Incandescent Arc Light Company, New York, N. Y. Application filed January 29, 1902.

A circuit-maker comprises a solenoidal magnet, an armature therefor, a bridge-piece carried by the armature, terminal contacts adapted to coact with the bridge-piece, and means for adjusting the position of the armature and terminal contacts relative to the magnet.

725,196. Rheostat. Joseph P. Ball, Frankford, Pa. Application filed April 7, 1902.

The rheostat comprises a plate of insulating material provided with a series of radially arranged slots, a resistance located in the slots, and independent means for holding the resistance in the slots.

725,208. Electrolytic Coating Apparatus. Heinrich W. Bötz, Ludwigshafen-on-the-Rhine, Germany, assignor to the firm of Columbus Electricitäts-Gesellschaft mit Beschränkter Haftung, Ludwigshafen-on-the-Rhine, Bavaria, Germany. Application filed August 6, 1902.

In an electrolytical apparatus for coating sheet metal are a fixed anode, an horizontal support at the foot thereof, a movable anode guided in vertical position, and a carriage supporting the movable anode.

725,214. Telegraph Instrument. Carey E. Bunker, Oregon, Mo. Application filed May 23, 1901.

A telegraph system is described which comprises a normally closed main line including a key and a relay. The key is constructed to automatically and normally hold the main line closed and to open the line when depressed. The relay is provided with a circuit-closing front stop normally engaged by the relay armature. The arrangement of the sounding stops is such as to permit the louder reading sound of the lever on the de-energizing of the sounder magnets.

725,215. Telegraph Key. Carey E. Bunker, Oregon, Mo. Application filed August 31, 1901.

The self-closing key described has two contacts normally holding the line closed and movable on the depression of the key to break contact successively without breaking the circuit until both are separated.

725,218. Storage Battery. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed August 13, 1902.

The tank is provided with a bottom, side walls, and end walls which extend upwardly above the tops of the side walls. Battery plates are arranged in the tank and are provided with necks which project laterally over the side walls. A cover for the tank is supported bythe end walls.

725,221. Electric Switch. Troy Cope, New Waterford, Ohio. Application filed May 6, 1902.

A pair of magnets provided with end extensions are combined with a slidable armature, the body portion of which is arranged between the extensions and has its ends bent outwardly across the ends of the magnets, an arm secured to one end of the armature and having its outer end pivotally connected to the switch tongue, and means for completing the circuits through the magnets for operating the switch tongue.

725,224. Induction Motor. Abe L. Cushman, Concord, N. H., assignor of one-half to Benjamin A. Kimball, Concord, N. H. Application filed July 8, 1902.

The motor combines a secondary winding made up of elements of low specific resistance, means for forming a closed induced circuit from a part only of the elements so as to reduce the current induced in the secondary at starting, and means for bringing into action additional elements as the motor speeds up.

725,225. Induction Motor. Abe L. Cushman, Concord, N. H., assignor of one-half to Benjamin A. Kimball, Concord, N. H. Application filed October 13, 1902.

This patent is similar to the one above.

725,239. Brush Holder for Dynamos. Eugène Gaud, Asnières, France. Application filed August 6, 1901.

A spring is arranged perpendicularly to the commutator of the machine and connects the end of the arm of a collar with the end of the upright arm of a yoke-lever. A flexible conducting plate connects the collar with the yoke-lever, a carbon presser is pivoted by one end of the yoke-lever, and a spring connects the upright arm of the yoke-lever to the carbon presser.

725,244. Telephone-call Register. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed September 17, 1898.

Gearing between the arbor and the actuating means of the register dials is adapted to move the actuating means at a speed greater than the speed of the arbor, whereby a buzzing signal is secured, and a gong is adapted to be sounded by the movement of the arbor and gearing after the buzzing signal has been sounded.

725,259. Automatic Cut-out. Isidor Kitsee, Philadelphia, Pa. Application filed May 20, 1897. Renewed May 15, 1902.

In the cut-out are an electromagnetic device having its coils connected in multiple arc and its core connected in series with the circuit, and a movable member adapted to coact with the core for closing the circuit therethrough.

725,331. X-ray Tubes. Theodor Friedlander, Chicago, Ill., assignor to R. Friedlander & Co.. Application filed June 23, 1902.

The main X-ray tube has an auxiliary tube with an anode terminal adapted to absorb the gaseous atmosphere of the main tube.

725,334. Thermostat. Henry W. Germiner, New Boston, Ohio, assignor of one-half to James

[illegible] New Boston, Ohio. Application filed [illegible] 5, 1902.

An improved thermostat is described.

725,345. Paper-making Machine. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to Charles L. Hamilton, Philadelphia, Pa. Application filed July 19, 1902.

The method of removing particles of fiber from a paper machine screen is described. It consists in making the screen the cathode of an electrolytic cell and carrying successively successive parts of the screen through the electrolyte of the cell.

725,355. Resistance Coil. Edwin F. Northrop, Philadelphia, Pa., assignor to Morris E. Leeds & Co., Philadelphia, Pa. Application filed February 4, 1903.

Combined with a bobbin having a metal core are supporting terminals formed upon one end of the core, and an electrical conductor wound on the core and electrically connected to the supporting terminals.

725,386. Bellows Motor Controller. Frank E. Whitney, Augusta, Ga. Application filed July 29, 1902.

An electric motor for operating the bellows has a variable resistance in the motor circuit, and resistance-varying means controlled by the bellows and operating to decrease the resistance in circuit upon an increase in the working capacity of the bellows.

725,402. Pneumatic Signal. Joseph H. Brady, Kansas City, Mo. Application filed April 8, 1902.

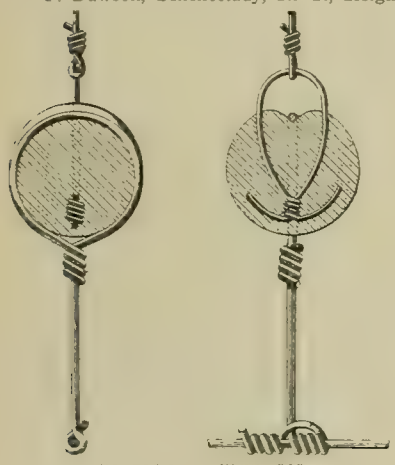
A motor and speed-changing mechanism are arranged for operating the lever in power connection with the shaft.

725,415. Device for Varying the Number of Poles in Alternate-current Motors. Robert Dahlander and Karl A. Lindström, Westeras, Sweden, assignors to the General Electric Company, Schenectady, N. Y. Application filed April 9, 1897.

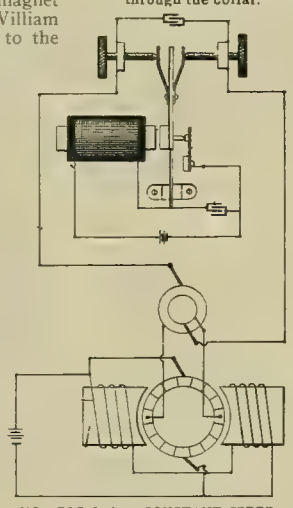
The three-phase motor described has drum windings comprising a separate winding for each phase, each of the separate windings comprising two sections, means for connecting the windings to a three-phase source and to each other in such a manner as to produce a field having a certain number of poles and means for changing the connections so as to reverse the direction of the current flow in one of the sections of each winding, thereby producing a field having half or double the number of poles.

725,416. Device for Shifting the Field-magnet Frames of Dynamo-electric Machines. William F. Dawson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 28, 1901.

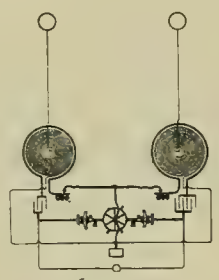
Combined with the magnet frame of a dynamo-electric machine are grooved bed-plates under the feet of the frame, roller carriages in the grooves, and means for transferring the weight of the frame from the bed-plates to the carriages.



NO. 725,044. INSULATOR.



NO. 725,140. CONSTANT-SPEED MOTOR CONTROL.



NO. 725,605.—SIGNALING SYSTEM.

725,436. Trolley-wire Clamp. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 28, 1902.

Combined with a supporting member provided with an eye or slot are arc-shaped clamping members provided with gripping jaws passing through the eye or slot, and means for forcing the gripping jaws together.

725,442. Globe Holder for Arc Lamps. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 7, 1899.

The holder comprises an air-tight support for the bottom of the globe, a clamping device and an adjusting device for bodily shifting it toward or from the axis of the globe.

725,444. Electric Time Switch. Eli Hemphill, Avalon, Pa., assignor of one-third to William Jones, Bellevue, Pa. Application filed July 15, 1902.

The switch has means whereby it may be thrown to a closed position, means for automatically locking the same in the position, means for releasing the switch from its locked position to open the same, and means for locking the switch in its open position.

725,450. Air Compressor and Heater. Charles R. Keller, Dayton, O. Application filed February 9, 1901.

An electrical heating apparatus for heating air under compression for motive power comprises a cylinder, two perforated disks arranged on the interior of the cylinder adjacent to the ends thereof, caps inclosing the ends of the cylinder and providing chambers between the perforated disks and the caps, a series of solid electrical conductors arranged between the disks and serving to heat air introduced to the chamber between the disks, an air-inlet pipe through which air is inducted under compression at one end of the cylinder, and an air-outlet pipe at the opposite end of the cylinder through which heated air is discharged.

725,454. Alternating-current Motor System. Sigvald Krohn, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 20, 1901.

One claim reads: The combination of an induction motor having two windings of respectively different numbers of turns, a resistance for each winding, and means for utilizing either winding as an inducing member and the other winding as the induced member in connection with the resistance corresponding thereto.

725,456. Electromagnetically Operated Steering Check. Hermann Lemp, Lynn, Mass., assignor to Elihu Thomson, Swampscott, Mass. Application filed June 5, 1902.

One claim reads: In combination, a cylinder containing a body of fluid, a piston, a lever for moving the piston, a valve for controlling the movements of the piston, an electromagnet for controlling the valve, and a contact carried by the lever for closing the circuit of the magnet.

725,463. System of Distribution. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 30, 1900. Renewed August 4, 1902.

The invention consists of a rotary converter, means for feeding current of a given phase into the armature winding across points separated by half the polar pitch, and means for feeding current of the same phase into the winding across points separated by less than half the polar pitch.

725,476. Telephone System. Thomas Paul, Yorkton, Canada, assignor of one-half to John L. McDougal, Yorkton, Canada. Application filed June 14, 1901.

Metallic connections are controllable at will from the central station for temporarily establishing a talking circuit from the central station to one subscriber's station through the normal contact of a second subscriber's station.

725,485. Trolley Wheel. Ernest C. Rolfe, Belleville, Ill. Application filed July 8, 1902.

An improved trolley wheel is described.

725,523. Electric Arc Lamp. Harlan P. Wellman, Ashland, Ky. Application filed December 3, 1902.

Combined with a magnet coil having a central opening are a magnetic collar within such opening, an armature extended through but not engaging with such collar, a clutch actuated by such armature, and non-magnetic means for limiting and guiding the latter in its movements through the collar.

725,548. Process of Extracting Copper from Carbonate and Oxide Ores. Henry R. Ellis, Salt Lake City, Utah. Application filed October 7, 1902.

The process includes subjecting the charged solution to electrolytic action.

725,552. Doorway. Amos F. Gerald, Fairfield, Me. Application filed June 3, 1902.

A doorway of a cabinet with outwardly operated doors hinged upon opposite ends of the cabinet has a pivoted treadle secured to the floor of the casing, and an electrically operated mechanism set in operation by the treadle to open one door and close the other alternately.

725,556. Electric Igniter for Explosive Engines. George A. Goodson, Minneapolis, Minn. Application filed March 17, 1902.

An electric generator having a rotary member is combined with an engine-driven impelling device moving the member in a constant direction, and means for giving the device a speed independent of the engine's speed.

725,558. Electrically Driven Centrifugal Blast Fan. Hermann K. Grüll, Vienna, Austria-Hungary. Application filed January 28, 1902.

The arms of the fan and the field magnet of the motor are carried by an annular mounting plate.

725,571. Stop Mechanism for Machinery. Tom J. Landrum and Leon J. Bamberger, Louisville, Ky., and David C. Wright, New Albany, Ind. Application filed February 18, 1901.

The mechanism comprises a magnet, switchboard and clock mechanism in circuit with a battery, contact points on the face of the clock connected to the switchboard, and a spring portion at the outer end of the hour-hand of the clock adapted to pass over the contact points.

725,592. Art of Telegraphy. Henry A. Rowland, Baltimore, Md., assignor to the Rowland Telegraphic Company, Baltimore, Md. Application filed November 23, 1897.

The system consists in impressing upon a line an electromotive force of a periodically varying character, having alternate impulses of opposite polarity, suppressing a number of impulses for each character or signal, and adjusting the times of the commencement of the suppression of the impulses, with reference to the difference in phase between the impressed electromotive force and resultant current, so that the times shall coincide with the times of zero current.

725,596. Alternating-current Motor. Adolph W. Schramm, Philadelphia, Pa., assignor to the Electro Dental Manufacturing Company, Philadelphia, Pa. Application filed January 9, 1903.

Combined with an electric motor having field windings, an armature with a commutator and brushes are an inductance coil having a constant number of its convolutions connected with the field-windings and means for connecting the brushes at will to different ones of the convolutions of the coil.

725,598. Electric Circuit-closing Mechanism for Keyed Musical Instruments. Ernest M. Skinner, Dorchester, Mass. Application filed October 1, 1902.

A contact lever engages two contacts with a rubbing action when the key is depressed.

725,602. Circuit Breaker for Fire-alarm Systems. Daniel T. Spring, Andrew Long and George H. Ebeling, Wheeling, W. Va. Application filed June 23, 1902.

In the mechanism is a train of gearing, including a circuit-breaking wheel, a circuit-breaking lever, an electric contact co-operating with the circuit-breaking lever, an elbow-shaped detent, a restraining arm, and a pull-hook.

725,605. System of Signaling. Nikola Tesla, New York, N. Y. Application filed July 16, 1900.

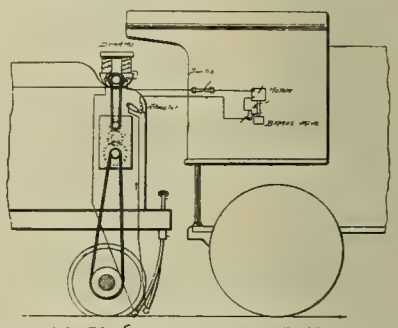
One claim reads: In a system for the transmission of electrical energy, the combination with means for producing two or more distinctive kinds of disturbances or impulses, of receiving circuits, each tuned to respond to the waves or impulses of one kind only, and a receiving device dependent for operation upon the conjoint action of the several receiving circuits. (See cut.)

725,611. Automatic Brake-operating Mechanism. Marion A. Born, Lawrenceville, Ga., assignor of part of his right to Early W. Born, Norcross, Ga., Edward W. Vance, Buford, Ga., Milton Hopkins Loudon, Kansas City, Mo., Daniel McConville, Steubenville, O., and Emma Byles, Washington, D. C. Original application filed March 11, 1902. Divided and this application filed August 28, 1902.

An air-brake operating mechanism for trains running on the same track comprises a controlled source of electrical energy on each train, a continuous conductor, means for energizing a circuit including only a portion of the conductor, a circuit including a rotary motor, an air-brake system, and means actuated by the motor for operating the valve thereof. (See cut.)

725,618. Trolley Head. Samuel Fierbaugh, Huntington, W. Va., assignor of nine-twentieths to L. V. Waugh, Huntington, W. Va. Application filed December 6, 1902.

The device comprises a socket and a trolley-wheel holder having a shank rotatable and vertically shiftable in the socket.



NO. 725,611.—AUTOMATIC BRAKE-OPERATING MACHINE.

725,622. Guard for Third Rails. Charles W. Hornung, Jersey City, N. J., assignor of one-half to Nathaniel H. Sanborn, Jersey City, N. J. Application filed December 22, 1902.

A third or electrically charged rail is combined with a guard in proximity to and made to overhang the rail, the body of the guard having a longitudinal flange substantially centrally of its height, and a support against which the body of the guard fits flatwise, the flange of the body being adapted to fit over the top of the support.

725,634. Art of Wireless or Space Telegraphy. John S. Stone, Cambridge, Mass., assignor to the Stone Telegraph and Telephone Company, Portland, Me. Application filed January 3, 1903.

A method of receiving wireless-telegraph signals consists of employing groups or trains of simple harmonic electromagnetic waves of different frequencies to co-operate in affecting an electric translating device and thereby producing intelligible signals.

725,635. Space Telegraphy. John S. Stone, Boston, Mass., assignor to the Stone Telegraph and Telephone Company, Portland, Me. Application filed March 12, 1903.

The inventor describes an apparatus adapted to transmit a number of overlapping trains of electromagnetic waves, differing from each other in frequency and in order of transmission, in combination with means, at a receiving station, adapted to be actuated only by the co-operation of the energies of the overlapping trains of electromagnetic waves for producing intelligible signals at the receiving station only.

725,636. Space Telegraph. John S. Stone, Boston, Mass., assignor to the Stone Telegraph and Telephone Company, Portland, Me. Application filed March 12, 1903.

At a space-telegraph station are a number of systems each adapted to transmit electromagnetic waves of a different frequency, a number of devices being associated with each system for regulating or controlling the transmission of electromagnetic waves therefrom and each adapted to cause the transmission of a set of trains of electromagnetic waves made up of a number of trains of electromagnetic waves of different frequencies.

725,644. Electric Igniter for Explosive Engines. George A. Goodson, Providence, R. I. Application filed December 26, 1902.

The igniter comprises an electric generator and other elements.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXXII. CHICAGO, MAY 2, 1903 No. 18

An Interesting German Single-phase Light and Power Plant.

By Frank C. Perkins.

A hydro-electric power plant has been installed at Kirchberg, near Burgdorf, Germany, in which single-phase alternating-current machinery has been utilized. The current is transmitted a distance of 800 meters to the works of Käser & Co., where it is utilized for power purposes as well as for lighting the establishment. The current is also transmitted a distance of 1,200 meters, over copper conductors 4.5 millimeters in diameter, to the village of Kirchberg, where it is transformed to a lower pressure for operating arc and incandescent electric lamps, as well as small motors.

In the accompanying group of illustrations, Fig. 2 shows the exterior of the power station, as well as the entrance of the water to the turbine room. The entire plant was equipped by the Oerlikon Company of Zurich, Switzerland, and consists of a single-phase alternator, as well as a polyphase generator, a synchronous motor of 25.3 horsepower at the works above mentioned, and the usual transformer stations for light and power in the village of Kirchberg.

The turbines are of the Girard type, having vertical shafts, and are connected to the generators by gearing and belt transmission. One of the turbines has a capacity of 70 horsepower and the other of 35 horsepower. The larger turbine is utilized for operating a single-phase generator, which supplies a current of 1,100 volts pressure at a frequency of 55 periods per second. One of these machines has a capacity of 22.5 kilowatts, requiring 35 horsepower from the turbine. This machine is of the inductor type, and the exciter is mounted on the same shaft as the alternator, which operates at a speed of 820 revolutions per minute.

The polyphase generator is of the Oerlikon revolving-field type, taking 35 horsepower and supplying a three-phase current of 1,100 volts pressure, the speed being 1,100 revolutions per minute. This three-phase alternator may be run with one phase in parallel with the alternator above described, as a single-phase machine, having a capacity of 35 horsepower. This generator also has its exciting dynamo directly connected outside, on the main bearing of the machine. Fig. 4 is a view of the interior of the power house, showing the single-phase generator in the foreground and the polyphase machine at the left.

The synchronous alternating-current motor at the works above mentioned has an effective output of 25.3 horsepower, and may be operated from the single-phase generator or from the polyphase generator at the power house. In the latter case, one pair of conductors being used, the alternator working as a single-phase generator, the total efficiency of this power transmission including the generator, transmission line and motor, is 72.2 per cent. Fig. 3 shows the motor as installed in the works.

The high-tension primary three-phase transmission line connecting the power house with the village of Kirchberg consists of three copper conductors four millimeters in diameter. There are three transformer sub-stations, one of which is located at the factory and has a capacity of eight kilowatts, while the others are utilized for lighting the village, the pressure of the distribution circuits being 124 volts, the various transformers having a capacity of from four to six kilowatts. One of these transformer stations in Kirchberg is illustrated in Fig. 1.

The three-phase transformer at the works has a capacity of 20 kilowatts and reduces the pressure of the three-phase current to 120 volts. The secondary circuits for light and power in the village are installed on the three-wire system. There are a total of 500 incandescent lamps in service, and on the power distribution there is a number of polyphase motors, including two which are operated from a 20-kilowatt transformer, one of which has a capacity of 11 horsepower and the other six horsepower. These motors are not of the squirrel-cage type, but are provided with slip rings and brushes.

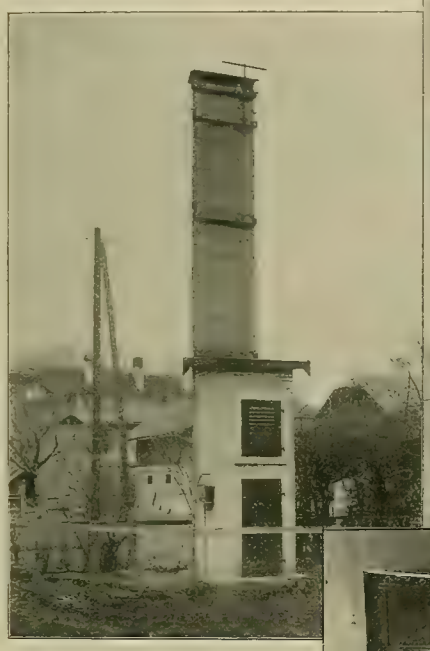


Fig. 1. Transformer Station at Kirchberg.

Fig. 3. Single-phase Motor.

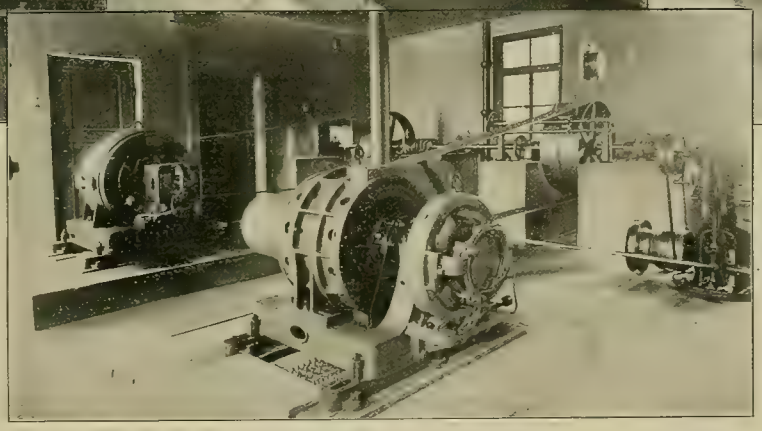


Fig. 2. Power Station at Kirchberg.
Fig. 4. Interior of Power House.

AN INTERESTING GERMAN SINGLE-PHASE LIGHT AND POWER PLANT.

Professor J. W. Esterline and a number of seniors at Purdue University, Lafayette, Ind., are conducting a series of experiments in determining the efficiency and air delivery of the various types of direct and alternating-current fan motors. All the prominent manufacturers of fan motors have sent one or more motors to be used in the experiments.

Plans of the Detroit Edison Company.

Previous mention has been made in the Western Electrician of the large power station which the recently organized Detroit Edison Company is building near Detroit, and some additional information concerning the plans of the company are of interest. The new plant is located on a tract of about 40 acres on the Detroit River, immediately adjoining Fort Wayne on the west and between the fort and the property of the Solvay Process Company. The building will be built of steel and masonry and will be thoroughly fireproof. The plant will have an initial equipment of 20,000 horsepower, and the ultimate capacity of the station will be 75,000 horsepower. It is stated that steam-turbine generating units will be installed in units capable of developing 6,000 to 8,000 horsepower each.

A sidetrack connecting with all the railroad systems has been laid on the property and large docks are about to be built, enabling the largest vessels to load and unload at the company's plant. Work is now progressing at a rapid rate on the concrete foundations of the building, and it is expected to have a part of the plant in operation by October 1st, the whole station to be completed in about a year.

The completion of the new power house will permit of the shutting down of the present four generating stations of the company, that are located in various parts of the residence and business portions of the city. The old stations will be used for supplies and as substations for distributing purposes.

As announced last week, the Detroit Edison Company purposes building on the same property, and immediately joining the generating station, the largest and most economical salt plant in the world. This salt plant will receive its brine from wells reaching to the several large strata of rock salt underlying the property, and will use the exhaust steam from the electric plant in evaporating the brine and depositing the salt. Many new ideas in salt manufacture will be introduced in this plant to the end of producing a finer quality of salt, and of reducing the cost of production, and it is anticipated that the 10,000 barrels of salt which will be produced at this plant every day in the year will be of the highest quality, and yet that the cost of production will be so low as to enable the company always to find a ready market for its entire output.

The company's plans also contemplate the manufacturing of chemical products from salt by the use

[illegible] It is predicted that the [illegible] by products will enable the company to generate electricity at an extremely low cost, and in that event, a decided reduction to its customers, for both light and power, is promised.

The work on the new plant is in charge of Alex Dow, second vice-president of the Detroit Edison Company and manager of the Edison Illuminating Company, which is now controlled by the new company. Westinghouse, Church, Kerr & Co. of New York city are the engineers for the company and H. H. Lane of that firm is supervising the electrical and mechanical equipment.

Overhead Distributing System of the Commonwealth Electric Company.[1]

By H. B. Gear.

The convenience and cleanliness of electric light in the home, its adaptability to purposes of advertising and the applicability of electric motors to all kinds of machinery have rendered the presence of electric current in all parts of our large cities a necessity, where once it was considered a luxury. When these advantages are presented to the public in an aggressive campaign of education, through the medium of modern channels of advertising, the resulting demand upon the central station taxes the resources of the operating engineers, who are entrusted with the management of the generating machinery and necessitates continuous effort on the part of the construction engineers, who must provide the equipment necessary to supply this demand. This has been exemplified in Chicago during recent years in a way which is more or less familiar to you all. In previous papers read before this association the evolution of the general scheme of generating three-phase current for transmission at 9,000 volts to rotary-converter and motor-generator sub-stations has been outlined. The four-wire, three-phase, 60-cycle system has also been described to you, so that we will only briefly outline the salient features of this system.

The problems involved in the distribution of current delivered by steam-driven generators and frequency-changing motor-generators to the overhead system of the Commonwealth Electric Company will occupy our attention at this meeting.

Of the 190 or more square miles, within the corporate limits of the city of Chicago, about 85 may be said to be covered by the lines of the Commonwealth Electric and Chicago Edison Companies. Of these 85 square miles, about 17 are within the area covered by the Chicago Edison Company's franchise. This area is bounded by North Avenue on the north, Ashland Avenue on the west, and Thirty-ninth Street on the south. The portion of this district west of Wells Street and north of Lake Street, together with that portion north of Sixteenth Street and west of Armour Avenue constitutes the

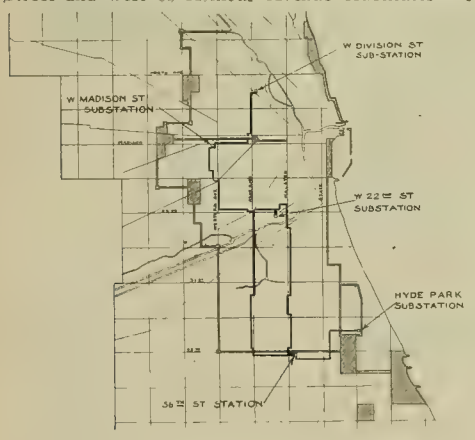


FIG. 2. OVERHEAD SYSTEM OF COMMONWEALTH COMPANY. MAP OF 60-CYCLE FOUR-WIRE TIE LINES.

central district of the Commonwealth Electric Company.

The distribution of current in this portion of the Chicago Edison Company's territory is permitted by means of overhead lines under the Commonwealth Electric Company's franchise. This section of the city is supplied about equally with underground and overhead lines. There are therefore only 8½ square miles of the entire city which are supplied by the underground system. Fig. 1 shows the relative areas covered by overhead and underground construction. The amount of energy distributed from these two systems is, however, approximately in the inverse relation.

During the winter of 1902 and 1903 80 per cent. of the maximum load of the two companies was distributed by the underground system. The remaining 20 per cent., which was delivered by the overhead system, aggregated about 6,000 kilowatts, making the average load density for the overhead system about 78 kilowatts per square mile. The load density for the underground system is about 2,700 kilowatts per square mile.

A load density, such as that of the overhead system obviously involves an alternating system of distribution. With the exception of the portion of the central district which lies adjacent to the underground low-tension distributing system and some 1,600 arc lamps which are carried on series circuits, the current delivered by the overhead system is generated by 60-cycle, four-wire, three-phase dynamos. These machines are wound to deliver 2,300 volts from the neutral point to either phase wire and 4,000 volts between the phase wires. Single-phase lighting feeders are connected from the neutral to either phase wire and are balanced at the station bus-bar. Three-phase motors are operated from four-wire circuits, which also carry single-phase motors in many cases. The power transformers are star-connected, so that standard 2,080-volt lighting transformers are used for both lighting and power services. In cases where the lighting load is not large, one phase of the four-wire circuit is used

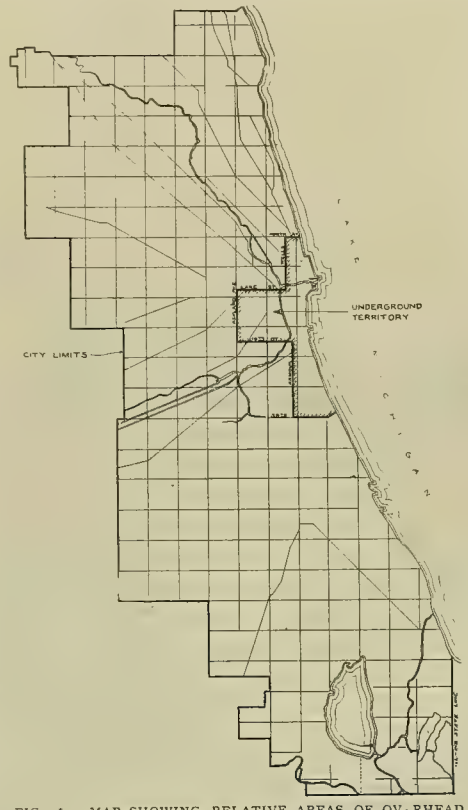


FIG. 1. MAP SHOWING RELATIVE AREAS OF OVERHEAD AND UNDERGROUND SYSTEMS IN CHICAGO.

to carry the lighting load, a regulator being provided in the lighting phase for the purpose of maintaining constant pressure.

The 60-cycle buses of all sub-stations except one are connected by means of four-wire tie lines, so arranged that the load may be transferred from one to the other in case of emergency or during repairs. These tie lines act as power feeders in the territory which they traverse. As the power load does not overlap the lighting load, except for about an hour during the winter months, the presence of this power load on the tie lines does not interfere with their function as tie lines.

The longest of these lines consists of four No. 0 wires (see Fig. 2), connecting the steam station at Fifty-sixth and Wallace Streets with the motor-generator sub-station on West Madison Street, near Rockwell Street. Its length is about eight miles. Another tie line which is now being used as a power circuit from the Fifty-sixth Street station to the territory around Eighteenth Street and Blue Island Avenue will be connected into a new sub-station at Twenty-second and Fisk Streets, thus forming a 60-cycle line between these two stations. The tie line between Fifty-sixth and West Madison Streets will also be tapped at Twenty-second and Ashland and brought into the Twenty-second Street sub-station, so that there will be two lines available for transmission of power from the new plant at Twenty-second and Fisk Streets to Fifty-sixth Street. The sub-stations, one on West Madison, near Rockwell Street, and one on West Division, near Milwaukee Avenue, are similarly connected by means of a tie line of four No. 2 wires, somewhat less than three miles in length.

The light and power distributed in Hyde Park is transmitted to a sub-station at Fiftieth Street and Cottage Grove Avenue by means of a line of eight No. 2 wires, about three miles in length. This being a strictly 60-cycle sub-station, the equipment consists merely of a switchboard with regulators and measuring instruments.

The load of these various stations and sub-stations is distributed from a primary main system by means of about 45 feeders. This number will be increased during the coming year to over 50. The number of feeders running from a station or sub-station varies from six to 12. Six of these feeders are used for the distribution of three-phase power, the remainder being single-phase lighting circuits. The average load at the time of the yearly maximum is about 100 kilowatts on each feeder. The relative locations of the stations and the centers of distribution supplied by these feeders north of Thirty-first Street are shown in Fig. 3.

The general scheme of laying out the lighting circuits consists of a feeder running from the bus-bar directly to the center of distribution, without any taps between. This center is chosen with reference to the load in the vicinity, so that there will be not more than two per cent. drop in any main feeding therefrom.

Primary mains are operated almost entirely on the dead-end system, since interconnection is usually of comparatively little value in improving the regulation and introduces complications for the trouble man. In operating feeders from a three-phase bus it is, of course, impossible to interconnect the primary mains of one feeder with those of another. Fuses are installed on all branches, except on heavily loaded taps, where the blowing of a fuse has been found to interrupt the service seriously, owing to the destruction of the fuse boxes. These branches are therefore provided with fuse boxes, which are connected up with copper wire, the box in this case being used only as a switch for locating trouble.

The problem of primary-main fuse boxes for the control of branches carrying 40 or more kilowatts remains as yet a difficult one.

Lightning arresters are distributed over the primary mains in proportion to the number of transformers to be protected. On feeders and mains they are also located so as to protect the cable where boulevards are crossed underground. Where transformers are comparatively numerous, lightning arresters are located from 1,200 to 1,500 feet apart, as the lines run. Fig. 4 is a map of a circuit supplying a densely loaded territory in Hyde Park of about 400 kilowatts per square mile.

The extension of the system of mains follows the growth of the business quite closely. This necessitates the periodical rearrangement of the feeder system to provide for the changed conditions. The calculations of these feeders has led to a study of economic considerations, which should be kept in mind in the design of feeders of this class. A brief outline of this study may be of interest in this connection.

The annual cost of maintaining single-phase feeders is composed of the two elements which are common to most electrical apparatus, namely: Operating costs and fixed charges. These are related to each other in an inverse manner, so that any cause which results in an increase in the one produces corresponding decrease in the other. There is, therefore,

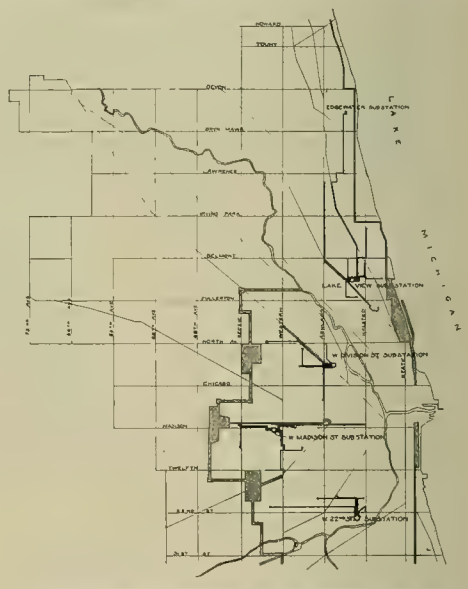


FIG. 3. OVERHEAD SYSTEM OF COMMONWEALTH COMPANY.—MAP OF 60-CYCLE FEEDERS NORTH OF THIRTY-FIRST STREET.

a point at which the sum of these two is a minimum for any given set of conditions. The operating costs of a feeder transmitting electric current consist of the expense of repairs and the value of the energy which is dissipated on the feeder between the station and center of distribution. The repairs are practically independent of the size of the wire used and may therefore be neglected in these calculations. The value of the energy lost on the feeder is, of course, dependent on the cost of energy per kilowatt-hour delivered at the station switchboard. The energy loss on the feeder is dependent upon the average daily load factor of the current transmitted over it. The maximum load and the average daily load factor being assumed, the annual output of the feeder may be readily calculated. Assuming various sizes of wire to be used on this feeder, the value of the kilowatt-hour loss may be determined. This may be reduced to the general form:

Annual value of energy loss equals aR, in which R is the resistance per 1,000 feet of feeder, and a is a constant, which may be determined from the conditions assumed.

The investment in feeder wire is inversely pro-

1. Paper read before the Chicago Electrical Association on April 17, 1903. Mr. Gear has charge of the overhead department of the Chicago Edison and Commonwealth Electric Companies.

portional to the resistance per 1,000 feet; this may be written:

Investment in feeder wire equals $\frac{b}{R}$

In this equation the constant, b, may be readily determined from a table of weights of weather-proof wire, and the assumption of a unit price per pound. The fixed charges may then be assumed as the percentage of this investment.

The investment in station capacity required to supply the feeder loss is a function of the energy loss in kilowatts at the maximum load. It is therefore proportional to the resistance of the feeder per 1,000 feet. This may be written:

Station investment equals cR.

The constant, c, may be determined from the assumed maximum load and the value of station equipment per kilowatt. Fixed charges may then be taken as a percentage of this investment.

Let the fixed charges on line investment be taken at m per cent. and those on station investment at n per cent.

The total annual cost =

$$aR + ncR + \frac{bm}{R}, \text{ or } y = \frac{aR^2 + ncR^2 + bm}{R}$$

Differentiating this equation with respect to R, and reducing, we have $\frac{dy}{dR} = \frac{(a + nc)\,R^2 - bm}{R^2}$

This will be a minimum when $\frac{dy}{dR}$ is zero. Equating this to zero, and solving for R, we have:

$$(a + nc)\,R^2 = bm, \text{ or } R = \sqrt{\frac{bm}{a + nc}}$$

The value of R thus determined will be the resistance of 1,000 feet of feeder which may be operated at a minimum annual cost, under the conditions assumed.

By reference to a table of resistances the size of wire corresponding to the resistance found in the above manner may be ascertained.

The relative rates of variation of the three quantities composing the annual cost are shown in the accompanying curves (Fig. 5). These curves have been calculated for a load of 100 kilowatts transmitted at 2,000 volts from a station in which investment per kilowatt is $150 and energy is delivered to the switchboard at one cent per kilowatt-hour at an average daily load factor of 33 per cent. Copper wire is valued at 15 cents per pound. Fixed charges on the generating equipment are taken at 15 per cent. and on the line investment at 10 per cent. Under these conditions, the resistance of 1,000 feet of feeder, which will produce an annual minimum cost is 0.171 ohm, which corresponds to a size of wire between No. 0 and No. 00. This is illustrated by the curve, which shows that there is a point between No. 0 and No. 00, which is somewhat lower than the value for either of these sizes.

It is of interest to note that the size of wire found by the use of this equation is independent of the distance of transmission, since all the quantities involved vary directly as the length of the feeder. The effect of varying the load carried on the feeder is shown in another set of curves (Fig. 6), from which it is evident that the annual cost and size of wire at the minimum cost vary in direct proportion to the load.

The value of any theoretical calculation, such as the above, to the practical engineer lies chiefly in the fact that the principles underlying the theory are set forth so that in any practical problem the engineer may know whether his work is tending toward the ideal case or away from it. Practical conditions rarely coincide with ideal cases, and the engineer can therefore only approximate his work to the theoretical case as nearly as may be.

If, for instance, the feeders of a steam-driven station are about equally loaded and of about the same length, say, 5,000 feet, the loss at full load would be 2½ per cent., were the feeders calculated as above. The loss on 1,000 feet of No. 0 feeder carrying 100 kilowatts at 2,000 volts is one-half per cent., and since the best economical size varies directly with the load, the loss on any feeder so designed would be at the rate of one-half per cent. per 1,000 feet.

In such a station the bus pressure would be only 2½ per cent. above the feeder-end pressure. Generators are usually designed to deliver about 10 per cent. higher pressure, if necessary, and their armature copper is proportioned accordingly. Hence the copper in feeders might be reduced to 25 per cent. of the theoretical amount, without adding anything to the generating equipment already installed.

Hence, in using the formulæ for such feeders from a station in which the generators are already installed and wound to give a pressure higher than the feeder pressure, the element of fixed charges or generating equipment may be neglected, provided the feeder equipment is so designed that the maximum feeder drop does not exceed the range of pressure of the generator.

In the more usual case, where the feeders vary in length from 1,000 to 15,000 feet, the range of generator pressure must be ample to provide for the average voltage loss on the feeders, feeder regulators being employed to take care of those above or below the average. In this case nothing need be charged against the short feeders for generating equipment until the size of wire is so reduced as to raise their losses above the average.

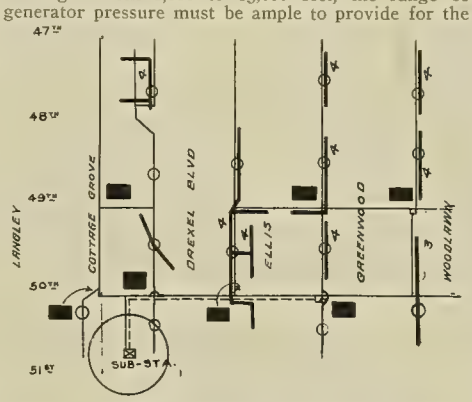


FIG. 4. OVERHEAD SYSTEM OF COMMONWEALTH COMPANY.—MAP OF CIRCUIT SUPPLYING DENSELY LOADED TERRITORY.

In the case of 60-cycle generators driven by 25-cycle motors, however, any increase in pressure on the 60-cycle bus increases the load on the 25-cycle motors, and this in turn must be carried by the armature of the 25-cycle generator, which might otherwise be carrying useful load. It is, therefore, important in these sub-stations that the feeder equipment be calculated in accordance with the foregoing principles.

The 45 feeders supplying the primary main system of the Commonwealth Electric Company vary in length from 2,000 to 17,000 feet, and in size from No. 6 to No. 0. During December, 1902, the single-phase feeders carried loads varying from 75 to 150 kilowatts and the three-phase feeder loads exceeded 200 kilowatts in a few instances. The loss at these loads varied from three per cent. to 10 per cent., the lower losses being on feeders operating from sub-stations.

The transformer, the connecting link between the primary and secondary distributing systems, has been the occasion of much discussion among central-station men during recent years. The adoption of 50-volt lamps in pioneer alternating systems necessitated the installation of separate transformers for each building into which service was introduced. This resulted in the installation of a very excessive amount of transformer capacity in small units. The large all-day losses, which were the inevitable result, eventually attracted the attention of manufacturers to the necessity of a study of these losses. The use of the transformer has, therefore, passed through a career of evolution which is, no doubt, familiar to all. In this evolution a large number of plants have found it advantageous to scrap their entire equipment of line transformers and replace them with modern apparatus. In connection with this work secondary systems have been installed, thus allowing a material decrease in the number of transformers required and an increase in the average capacity per transformer.

Since the formation of the Commonwealth Electric Company in 1898, the distributing systems of the various plants absorbed have successively undergone this process of rehabilitation.

In the district south of Thirty-ninth Street some 850 transformers were replaced by 350, reducing the total capacity by a large percentage, and the constant loss in the cores of these transformers from about 70 kilowatts to 25 kilowatts. A three-wire secondary-distributing system was designed and constructed in the course of this work.

In this connection it might be stated that there has been considerable variance in the practice of the companies throughout the country which are operating overhead alternating systems as regards secondary mains. Some have installed a heavy three-wire network, interconnected throughout with mains varying in size from No. 4 to No. 0000, transformers being installed on the network as demanded by the load. Others have invested in secondary-main capacity less heavily, interconnecting only a few heavy lines along business streets and using isolated transformers for more scattered districts. Still others have lagged behind the march of progress and are adhering more closely to the pioneer method of installing transformers very closely, with only occasional pieces of secondary work.

At the time the secondary system of the Commonwealth Electric Company was being designed this matter was very carefully studied. The revulsion of sentiment against constant iron losses on a large number of transformers resulted in a swing to the other extreme, in the installation of very heavy secondaries supplied by a small number of large transformers in some cases. It was desired, therefore, to ascertain the exact point at which the value of the core losses of transformers is offset by fixed charges on the investment in wire and transformers at different loads. A calculation was accordingly made, in which it was assumed that the load was evenly distributed along a secondary main 10,000 feet in length. This load was varied arbitrarily between five kilowatts per 1,000 feet and 40 kilowatts per 1,000 feet. Transformers were then assumed to be placed along this line in varying number and size, the total capacity remaining constant. The size of wire required to keep the drop within two per cent. was calculated for each set of transformers. From these figures the investment required in transformers and secondary wire is readily ascertained and the value of energy expended in transformer cores computed. Fixed charges and losses for each case assumed, being added, the values found have been plotted so as to show the relation of the annual maintenance cost to the size of wire used and to the distance between transformers. Separate curves were made for various load densities between five and 40 kilowatts per 1,000 feet. The accompanying curves (Fig. 7) were constructed on the above basis, copper wire being figured at 15 cents per pound and transformer values being taken at average values for standard modern makes. The energy is figured at one cent per kilowatt-hour. An analytical determination of the minimum value of annual cost for a given load cannot be made in this calculation, as was done in the case of feeders, since the cost of transformers and their core losses do not vary according to any simple law.

Referring to the curves (Fig. 8), the one representing the calculation for a load density of five kilowatts per 1,000 feet shows that when transformers are placed 1,000 feet apart, No. 8 wire will give two per cent. loss, or, placed 1,250 feet apart, No. 6 wire will give two per cent. loss. The annual cost becomes less as the size of wire diminishes down to No. 8. The calculation in this case was not carried further, since wire smaller than No. 8 is not used practically in such work. On the curve for a load density of 10 kilowatts per 1,000 feet, the minimum annual cost is shown to be secured between No. 4 and No. 6 wire, at 20 kilowatts per 1,000 feet No. 4 wire and at 40 kilowatts the mini-

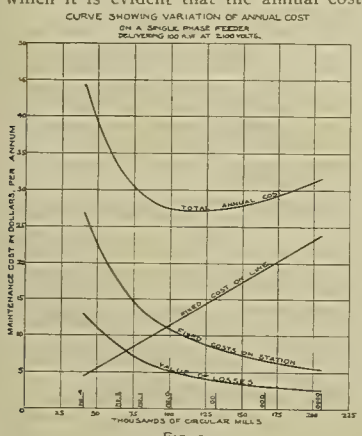


Fig. 5.

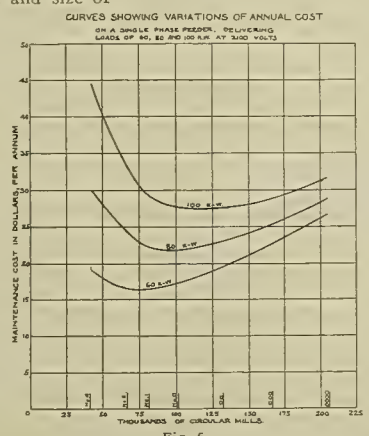


Fig. 6.

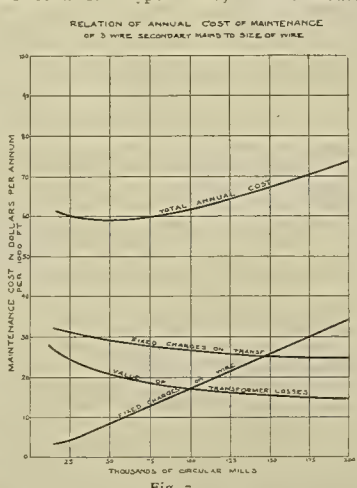


Fig. 7.

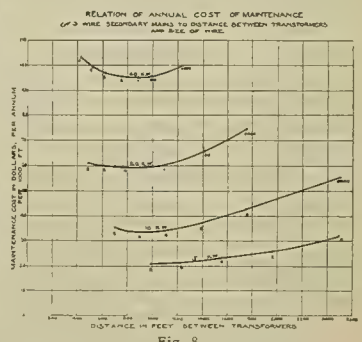


Fig. 8.

OVERHEAD SYSTEM OF COMMONWEALTH ELECTRIC COMPANY. COST CURVES.

mum occurs at about No. 0. Another curve (Fig. 7) shows the way in which the elements composing the total annual cost vary.

The density of the load in apartment-house and residence districts in Chicago varies between five and 20 kilowatts per 1,000 feet. The Commonwealth Electric Company therefore uses No. 6 wire for secondaries in this class of territory for at least 75 per cent. of the business, transformers being located from 1,000 to 1,200 feet apart. In districts where business lighting composes the majority of the load, the load density is somewhat higher, and in a few instances reaches the equivalent of 75 kilowatts per 1,000 feet. In these cases, however, the load is not equally distributed, but consists of a few large blocks of lighting, which are carried from transformers located directly opposite the premises, so that the secondary main is not burdened with this load. Other conditions arise which modify the applicability of this general theory, but as in the case of feeders, these curves pretend only to furnish a basis for the formation of judgment as to the general policy to be pursued in handling this class of work.

Aside from a few pioneer installations made prior to the study of this subject, the secondary distributing system of the Commonwealth Electric Company consists of isolated sections of line, averaging perhaps 800 to 1,000 feet in length. These are supplied in almost all cases by a single transformer, without being interconnected. Where the load density is below 30 kilowatts of distributed load per 1,000 feet, the advantages of interconnection are outweighed by the risk of having the entire system of secondaries shut down by the blowing of a fuse on one transformer. This has often occurred where secondary lines are interconnected without sectional

FIG. 9. OVERHEAD SYSTEM OF COMMONWEALTH ELECTRIC COMPANY.—CABLE POLE.

fuses. Such of the secondary system as was interconnected at the time of its construction in Chicago has been equipped with these sectional fuses placed in the line midway between transformers, so that the blowing of the fuse of one transformer will result in the blowing of the sectional fuses, thus cutting out the section nearest that transformer without blowing the fuses of the other transformers on the system. The location of such sectional fuses, however, requires a close study of the distribution of the load in each instance, and unless the addition of load is very carefully watched from time to time, these fuses may be blown under normal conditions. The system may then operate for a considerable time before it is ascertained that anything has occurred to modify the intended arrangement.

The selection of the transformer equipment to supply an overhead system is of great importance. Inaccurate judgment as to what capacity is requisite may lead to an excessive installation, this increasing both investment and operating expenses unnecessarily.

It is apparent that the lights connected to a transformer in a residence will not require the same capacity per light connected as those in a store or factory. There are five classes of lighting which require separate treatment in the selection of transformers—(a) large residences, (b) apartments and small residences, (c) stores, (d) factories, and (e) churches.

In large residences, that is, those having above 100 lights, the transformer capacity should be such that the heavy loads due to occasional social affairs may be safely carried without providing a capacity greatly in excess of that necessary under average conditions. In case there are several such within a radius of, say, 500 feet, they may be carried by such a capacity as will provide for 75 per cent. of the connected load of the largest house, plus 15 per cent. of the combined load of the remainder. This will give a transformer capacity in excess of the average daily needs, but reasonably safe, since there is little probability that more than one house will be lighted throughout on the same evening, in the same neighborhood.

In small residences and apartment buildings the same general rules apply, except that a ratio of 20 per cent. of the connected load should be used in estimating the capacity required for average conditions.

In store lighting, a knowledge of the locality is of value in the formation of an accurate estimate, but, in general, it is sufficient to provide capacity for 75 per cent. of the connected load. This will give the transformers some overload on Saturday nights and full load on other nights. Store lighting is frequently done by means of arc lamps, and in cases where these are numerous special provision must be made. If the arc lamps form more than a third of the total installation, or if they exceed 10 in number, the requirements of good service will usually necessitate separate transformers for the arc lamps. The power factor of multiple arc lamps being about 70 per cent., the capacity provided must be determined accordingly.

The same general principles govern the selection of transformers for factory lighting, as those above outlined for store lighting, the arc-lamp problem being even more troublesome at times. In this class of lighting, however, we have usually the condition that the transformer capacity is used only during the winter months, and then only 1½ hours per day. This condition allows of more overloading than is permissible in store lighting, where the load is on four to five hours during winter months.

The capacity required for churches varies with the size and character of the installation. Small churches containing less than 300 lights require capacity for almost 80 per cent. of the connected load. Larger churches have the lighting divided among several rooms, and the capacity required for the lighting of the main auditorium is usually sufficient. The light being infrequently used, and when used only for an hour and a half to two hours, the transformer capacity may be selected on the basis of 30 per cent. to 35 per cent. overload. It is often possible to combine the load of a church with residence or business lighting, in which event the fact that the loads do not overlap allows of a considerable reduction in capacity from that which would be required were they not adjacent. In one instance of this sort in Chicago, 45 kilowatts capacity is provided for about 100 kilowatts of combined church and business lighting, without difficulty.

The determination of the proper transformer capacity for motors forms an interesting study in itself. The low power factor of motors when first switched on to the line causes a momentary dip in the pressure on the secondary wiring, which makes the installation of separate transformers for motors imperative, where the character of the lighting is such that flickering is objectionable. This limitation prevents the economizing of transformer capacity in most instances.

The character of the work done by the motor is the chief factor in the determination of requisite transformer capacity. Elevator and similar variable-load motors require less capacity than machine-shop and other comparatively steady-power motors. Where variable-load motors are isolated from other power it is necessary to provide the full capacity, in order to give sufficient voltage to start the motor promptly. When combined with other power they may frequently be figured in at 50 per cent. of their rated capacity, in selecting the transformers.

The power factor of the induction motor being about 89 per cent. in the usual sizes employed in the outlying districts, the motor at full load draws current from the transformer in the ratio of about one apparent kilowatt per horsepower. As the full-load condition is usual in small-power work, the transformer capacity must usually be provided on this basis. With large motors this ratio may be reduced somewhat, especially in cases where the motor is loaded only during a portion of the time. Motor load being usually on at least eight hours per day, it is not safe to take the same risks of overloading which are permissible in the case of lighting transformers.

It is often desired to connect single-phase and three-phase motors to the same set of transformers. The single-phase motors cannot always be easily balanced. The usual method in such cases is to install one transformer larger than the other two, connecting the single-phase power to the larger transformer.

The two-transformer method of supplying three-phase motors has the advantage of reducing the investment by increasing the size of the unit. This is used for installations of less than 15 horsepower where the primary neutral wire is present.

The Wright demand indicator connected in circuit with a transformer has been found to be a valuable aid in getting exact data as to the load being carried in any particular case.

With transformers selected to carry their loads on the principles above outlined, it might seem reasonable to expect that the maximum load on the feeder would approximate the combined transformer capacity of the circuit. Such, however, is not the case. The load on various classes of business does not reach its maximum at the same hour, nor on the same day. It is therefore usual to have a maximum load of 50 per cent. to 65 per cent. of the connected transformer capacity. In widely scattered districts, where small transformers are numerous, the ratio may be as low as 40 per cent.

There are numerous problems of lesser importance, which at times require careful treatment, but a further discussion of them is perhaps beyond the scope of this paper. I may merely mention the equipment of cable poles at points where overhead and underground lines are connected, as indicated in Fig. 9, the framing and supporting of poles carrying the 3,000 pounds weight of a three-phase transformer installation, the arrangement of wires safely on corner poles, where high-tension lines are numerous, the installation of ground connections for lightning arresters and secondary neutrals, and others which are claiming the attention from time to time of those who are responsible for the maintenance and extension of the overhead system of the Commonwealth Electric Company.

Progress in Alternating-current Design.

The trend of invention in any mechanical or electrical line is usually well illustrated by the issues of United States patents as they come out from week to week. Recently there have been patented several inventions pertaining to alternating-current apparatus and they are of sufficient interest to warrant brief descriptions. One of these inventions has for its object the production and regulation of alternating currents of different phase, the currents being due to resultant electromotive forces whose components are of different phase. It is applicable to alternators

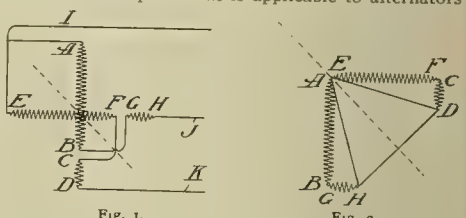


Fig. 1. Fig. 2.

PROGRESS IN ALTERNATING-CURRENT DESIGN.—KELLY-CHESNEY APPARATUS.

and to secondary generators or transformers and has been patented by John F. Kelly and Cummings C. Chesney of Pittsfield, Mass., their patents being assigned to the Stanley Electric Manufacturing Company.

By their invention any induced circuits, such as those of a two-phase alternator or the secondaries of two transformers supplied with two-phase currents, can be combined so as to produce three-phase currents, and the currents produced from the combined electromotive forces can be regulated without disturbing their phase relations. The invention so far as it relates to regulation is applicable to all cases in which currents of one phase are produced by the combination of electromotive forces having other phase relations.

Fig. 1 represents diagrammatically the induced circuits of either an alternator or of two transformers having electromotive forces displaced by 90 degrees. Fig. 2 is a diagram showing the resultant electromotive forces due to a combination of the electromotive forces of Fig. 1. Fig. 3 represents a means of regulation applied to apparatus

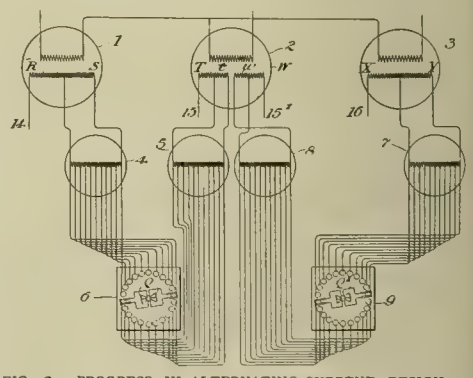


FIG. 3. PROGRESS IN ALTERNATING-CURRENT DESIGN.—KELLY-CHESNEY PHASE-CHANGING APPARATUS.

wherein electromotive forces of three phases are combined to supply two-phase electromotive forces.

Referring to the drawings, (A B) and (C D) represent two induced coils of one phase and (E F) and (G H) the induced coils of a second phase displaced by 90 degrees from that of (A B) and (C D), (A B) being equal to (E F) and (C D) to (G H), all being symmetrically arranged in their time relations. The inventors have discovered that such being the case they can, by making (C D) and (G H) equal to 0.258 of (A B) and (E F) and connecting the inner end of (A B) with the inner end of (G H) and the inner end of (E F) with the inner end of (C D) and the two outer ends of (A B) and (E F) to the main (I) and the outer ends of (G H) and (C D) to mains (J) and (K), obtain three resultant electromotive forces (AH),

(ED), and (DH), Fig. 2, which will result in three-phase currents when the circuits across the mains are completed. In this way apparatus in which the electromotive forces are displaced by 90 degrees can be easily altered to produce three-phase currents and the range and flexibility of a two-phase system extended and increased.

In order to vary or regulate the potential of the currents of different phase in such a system without introducing disturbance and distortion of phase relations, it is necessary to vary proportionally all the component electromotive forces which go to make up the resultant electromotive forces, and part of the invention consists of means for this purpose.

In Fig. 3 (1), (2) and (3) are three transformers whose primaries are supplied with three-phase currents. (R S), (T W) and (X Y) are the three secondaries, having three-phase electromotive forces. The secondary (T W) is divided, so as to consist of two parts (t) (w), each of which is 0.366 of (R S) or (X Y), so that the effective electromotive force of the part (t) is 0.366 of that of (R S) and that of part (w) is 0.366 of (X Y). When this is the case and the parts are arranged as shown, the resultant electromotive forces due to (R S) and (t) and (X Y) and (w) are displaced by 90 degrees. In order that the resultant electromotive forces may be varied without disturbing their phase relations, the effective electromotive forces of the component parts must all be varied, so that the proportion 0.366 shall be maintained. This is done by tapping the main and auxiliary induced circuits and connecting proportional parts thereof—to wit., of (R S) and (t) to two transformers (4) and (5), which are connected to a switchboard (6) and (X Y) and (w)—to other similar transformers and board (7), (8) and (9). Moving the switcharms (Q) (Q') equal distances varies proportionately the effective component electromotive forces which go to make up the resultant electromotive forces, and

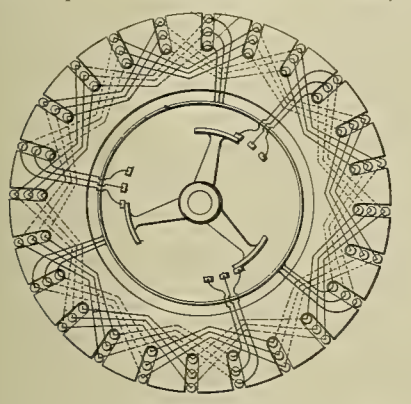


FIG. 4. PROGRESS IN ALTERNATING-CURRENT DESIGN.—CUSHMAN INDUCTION MOTOR.

hence varies the resultant electromotive forces without affecting their phase relations..

An invention of Abe Lincoln Cushman of Concord, N. H., relates to induction motors, and has for its object to secure a good starting torque without the insertion or use of any high specific resistance material in the secondary or induced circuit. This is accomplished by dividing the winding into a number of elements all of low specific-resistance material, such as copper, which may be entirely separate or may be connected star or delta fashion or otherwise, so long as they can be brought into action gradually or successively. When in star connection, as shown in Fig. 4, they are connected into a plurality of star-connected multiple-arc closed circuits when at speed, while when starting there is but a single star-connected winding. This results in a reduction of the current in the induced element at starting and prevents such retardation or lag in the induced current as would prevent a starting torque. Fig. 4 represents a star-winding for an eight-pole induction motor embodying the invention.

When electric railroads are arranged to be supplied with alternating currents of high potential, it is desirable for purposes of safety that current should be supplied at comparatively low potential in the neighborhood of stations and other accessible places. These conditions present some difficulties owing to the fact that the motors which are designed to run normally with high-potential current must, when in the neighborhood of such stations or other accessible places, draw their supply of current from low-potential conductors through step-up transforming devices, which lower the efficiency of operation and necessarily take up valuable space. To avoid the necessity for such transforming devices, Sigvald Krohn of Berlin, Germany, makes use of motors of special construction, the relatively movable members of each of the motors being provided with two windings, respectively, one a high-potential winding and the other a low-potential winding. When the railway vehicle receives current from the low-potential mains, the low-potential winding of the motor or motors is connected, through suitable collecting devices, to the low-potential supply conductors, the high-potential winding of the motor or motors being closed upon a variable resistance, which may be cut in or out to any extent desired or short-circuited in a well-understood manner. On the other hand, when the vehicle receives current from the high-potential mains or supply conductors, the high-potential winding of the motor or

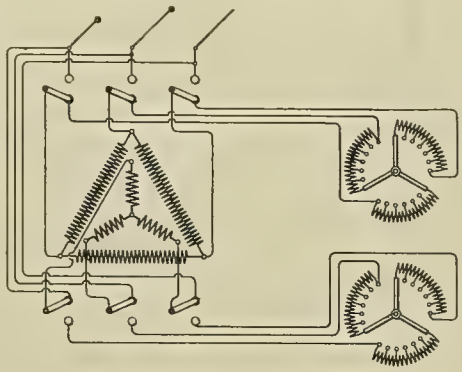


FIG. 5. PROGRESS IN ALTERNATING-CURRENT DESIGN.—KROHN RAILWAY-MOTOR SYSTEM.

motors is connected, through suitable means, to these conductors, the low-potential winding or windings being then closed upon a variable resistance, which, as in the first instance, may be varied or short-circuited as desired. Suitable switching devices perform the operations indicated. Fig. 5 represents an arrangement of motor connections for use with such a system.

Robert Dahlander and Karl Arvid Lindström of Westeras, Sweden, have been granted a patent on a device for varying the number of poles in alternating-current motors. This invention relates to that class of drum windings for alternating-current motors in which the conductors are so arranged and connected that by simply varying the coupling of the same the number of poles, and consequently the speed of rotation of the motor, may be altered. In the winding which they have devised the conductors are so arranged that each two adjacent conductors or groups of conductors of one phase embrace one of the conductors or groups of conductors of each of the other phases. In other words, the winding is so arranged that the conductors or groups of conductors for the several phases follow each other in regular progression around the member on which

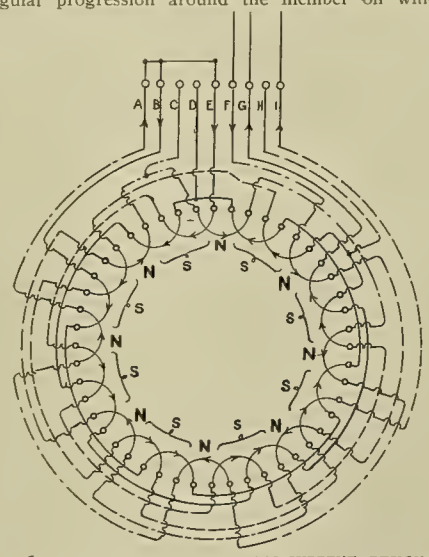


FIG. 6. PROGRESS IN ALTERNATING-CURRENT DESIGN.—DAHLANDER AND LINDSTROM POLE-VARYING DEVICE.

they are wound. The conductors are connected to form separate windings for the several phases, and the winding for each phase is divided into two sections with the terminal connections so arranged that the windings may be connected either in such manner that the current will flow in the same direction through both sections of each winding or in such a manner that the direction of current flow in one of the sections will be reversed.

Fig. 6 represents diagrammatically a drum-winding for a three-phase motor with the windings so connected as to produce a field having 16 poles. With the terminal connections arranged as shown, the windings for the three phases are connected together at one end and at the other end are connected each to one of the three-phase mains, the three middle terminals being left on open circuit. This connection gives 16 poles, as indicated by the letters (N) (S). By making use of the middle terminals it is possible, however, to reverse the direction of current flow in one of the sections of each of the three windings, and with the conductors arranged as shown in the drawings, such a reversal will give a field having only eight poles.

An invention which is particularly useful in connection with single-phase rotary converters is shown in Fig. 7. It has been designed by Alexander D. Lunt of Schenectady, N. Y., with the object of obtaining a point of neutral potential on the alternating-current system, to which may be connected a conductor co-operating with the direct-current mains to produce a multiple-conductor distribution system. Another object of the invention is to reduce the amount of energy lost in the heating of the armature conductors. When the system is operating to convert alternating current into direct current, single-phase current is conveyed into the armature winding (1), along the diameter (2) (5), and also between the taps (3) (4) and (6) (7), represent-

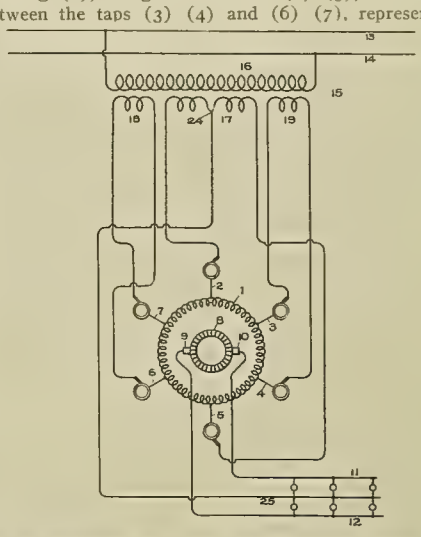


FIG. 7. PROGRESS IN ALTERNATING-CURRENT DESIGN.—LUNT SINGLE-PHASE ROTARY-CONVERTER SYSTEM.

ing, respectively, the ends of chords parallel to the diameter. The supply of current from the companion windings (18) and (19) on the transformer (15) serves to increase the capacity of the converter, and to do this without increasing the heating to such an extent as would be the case if all of the energy were passed into the converter winding solely through the diametrically displaced taps (2) and (5).

Deaf Mutes Go on a Strike.

A strike was ordered at the factory of the Automatic Electric Company of Chicago last week by the machinists, metal polishers, brass and metal workers. With them about 300 deaf-mutes employed as assemblers of the automatic telephone apparatus made by the company were also induced to quit work. The mutes are members of the Telephone and Switchboard Workers' Union, and are said to be the most skillful workers employed by the company. They possess a deftness of touch and quickness of the fingers which peculiarly fit them for this class of work. The mutes were paid the union scale, and many of them were capable of earning more than the average worker. It is said that they had no grievance with the company, but were induced to quit work by those in other departments. The company has closed down the plant for a few days, during which time some alterations will be made and an inventory taken. General Manager A. G. Wheeler anticipates no trouble in bringing about a settlement.

Providence-Worcester Electric Railway.

The Western Rhode Island Railroad Company proposes to establish an electric railway between Providence, R. I., and Worcester, Mass., a distance of 47 miles. One terminus will be at Cowesett Bay, whence passengers and freight can be carried to Hope, R. I., via the Suburban Company's tracks. Roads will be built between Hope and Ashland and North Scituate and East Thompson, the gap to be filled by using the Providence and Danielson tracks. From East Thompson, Conn., to Webster, Mass., a distance of five miles, the cars will be run over the rails of the steam railroad, but by electric power. From Webster to Worcester cars will be run on the tracks of the Worcester and Connecticut Eastern Railway Company. The company will carry coal and is installing four 65-horsepower motors in a locomotive to be used for that purpose. It expects to carry passengers from Providence to Worcester for 50 cents each. George W. Prentice is an incorporator of the company.

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DATES AHEAD.

National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

ILLINOIS, through its Legislature at Springfield, has afforded the country a spectacle of the actual results of a mix-up of the pet "reform" of the municipal-ownership advocates with "practical politics," and the result has been disgraceful. Two bills ostensibly designed to enable the city of Chicago to own and operate its street-railway lines are before the law-making body. One is the Mueller bill, which has already passed the Senate. This is the bill favored by the mayor of Chicago, the local transportation committee of the City Council and such citizens as have gone down to Springfield at the request of the mayor to advocate the passage of a muncipal-ownership enabling act. The other bill is known as the Lindly bill, or the committee bill, from the fact that it was offered by Cicero J. Lindly, chairman of the municipal corporations committee of the House. If it is necessary to give Chicago any municipal-ownership legislation, it is obviously the part of justice to give it that measure for which it asks, if other things are equal. The differences between the bills lie principally in the provisions for financing the purchase of the street-railway systems and in the manner of effecting foreclosure proceedings if the properties should pass into the possession of the owners of the municipal street-railway bonds. The Mueller-bill people insist that their act is drawn so that the securities could be marketed, and that it is a practicable measure, while the other bill is not, being evidently intended, they say, to make municipal ownership impracticable in the very law authorizing it. But this criticism comes with rather poor grace from the delegation of city officials and citizens from Chicago, as almost to a man its members admitted that they did not really favor municipal ownership, but thought that the Legislature should place in their hands an enabling act to be used as a club in making terms with the street-railway companies for franchise extensions. It is a pitiable spectacle and must make the really honest and sincere advocates of municipal ownership—probably there are some such—sick at heart. On all hands, at Springfield, it is admitted that municipal ownership is not really desirable, and that the city should have the reserve power to own and operate the lines merely as a measure of expediency.

But, be the respective merits—or demerits—of the Mueller and Lindly bills whatever they may, the struggle of their respective partisans on the floor of the House in Springfield culminated in a scene of riot calculated to bring the blush of shame to every self-respecting resident of the state. The speaker of the House—a politician named Miller—was in favor of the Lindly bill, which was the child of the political "organization" to which he himself owed his preferment some months previously. He determined on high-handed methods to carry the bill through. Disregarding, therefore, the constitutional right of five members to demand a roll call, and upheld by a small minority of desperate supporters, he declared the bill passed to successive readings and finally adopted. This was done "under the gavel," against the wishes of the majority and amid great excitement, which, toward the close of this extraordinary proceeding, arose to a scene of wild disorder. Exasperated beyond endurance by the speaker's presumption, the majority shouted their denunciations, and from words proceeded to blows, in some instances, in an effort to storm the speaker's platform by getting by the band of "organization" men who guarded it. Finally, the speaker fled from the tumult in terror, after announcing, as was supposed—nothing could be clearly distinguished above the din—the passage of the Lindly bill. Immediately the majority of the house organized by electing a speaker pro tem. and recalled the bill to its second reading, thus nullifying the speaker's unheard-of efforts to carry the bill through. Subsequently, the speaker realized the necessity of some explanation of his conduct, and said, in effect, that his zeal for the Lindly bill was due to the fact that he had heard some allegations that bribery would be resorted to to pass the Mueller bill. At this writing all traction legislation is held in abeyance while a committee is investigating the vague bribery charges—apparently with little success from reports that have been made. And this is the delightful situation—the prelude merely—that has resulted from the attempt to solve street-railway-franchise problems by political methods!

To complicate the Chicago street-railway situation still further, the Chicago Union Traction Company has been thrown into the hands of receivers appointed by the United States Circuit Court. The erstwhile Yerkes companies have come to grief, strangely enough, just at the time when their franchises, or many of them, are about to expire, and when the United States courts may be compelled to order the continuation of operation for the benefit of the creditors. What attitude the federal authorities will take toward the franchise-extension problem is not known; but the receivership will have at least one good effect in that the Chicago City Railway Company, which is comparatively popular with the people and administration of Chicago, will have a chance to make a separate settlement for itself. One outcome of the muddled situation is reasonably certain, and that is that Chicago will not indulge in the luxury of municipal ownership of street-railway lines for at least 20 years and perhaps never. This conclusion is reached quite apart from consideration of the receivership proceedings, which are hardly calculated to advance the hopes of the municipal-ownership advocates.

THAT the fears of foreign countries, particularly Germany, of the American commercial invasion are not groundless is shown by some remarkable figures recently presented by the Bureau of Statistics of the United States Treasury Department. These figures compare production and exportation of manufactures with production and exportation of agricultural products, the purpose being to show the relative growth in each case. The comparison is simply that of the year 1900 with 1870 for the purpose of showing growth, and not a comparison of total exports with total production. Summing up this comparison in a single sentence, it may be said that, contrasting conditions in 1900 with those of 1870, agricultural production has increased 92 per cent., agricultural exportation 132 per cent., production of manufactures 209 per cent., and exportation of manufactures 538 per cent. These figures show very vividly the tremendous growth of the United States as a manufacturing nation and more particularly as an exporter of manufactures. It is no wonder that this development has caused great uneasiness in Europe. In Germany, where the greatest alarm appears to be felt, a determined effort is making to check it by a hostile tariff directed not only at manufactured goods, but, curiously enough, at food products as well. It was formerly said that America might be the granary of Europe if it would leave to the latter the field of manufactures. But Germany is apparently determined that we shall neither sell her manufactures or cheap food for her operatives. We pointed out some time ago that the effect of this new German tariff on the foreign electrical trade of the United States was unfavorable, so far as it went. But the electrical trade between the United States and Germany is not very heavy either way. This country exports about $10,000,000 worth of electrical machinery and apparatus annually, and of this Germany does not take over three per cent. Great Britain and the British colonies are by far our best customers, electrically speaking, accepting something like 75 per cent. of our entire exports in this line. It is evident, therefore, that the loss of the German market will not be very serious to American electrical manufacturers, if, as is likely, the Senate refuses to enter into the reciprocity treaty which Germany is seeking. Nevertheless, the foreign electrical trade of this country is not what it should be, and every effort should be made to extend it. Of course, if it were not for the factories established abroad by American companies, the volume of electrical exports would be much larger, but, even when allowance is made for this condition, we should sell in foreign countries a larger proportion of the electrical products turned out in the United States.

Chicago Street-railway Situation.

Developments in the Chicago traction situation during the last few days have apparently increased the complexity of affairs but may, in the end, help to affect an earlier settlement of the franchise extension questions. On April 22d the Chicago Union Traction Company, the North Chicago Street Railroad Company and the West Chicago Street Railroad Company passed into the hands of receivers, because of default of interest on five notes aggregating $1,154,293. Suits for the collection of the interest were filed in the United States Circuit Court of Appeals by the Guarantee Trust Company of New York, and, the traction companies admitting the default, Judge Peter S. Grosscup at once entered judgment. Demands were then made upon the treasurers of the respective companies, and upon their return unsatisfied receivers were appointed.

The receivers are: In behalf of the trust company, R. R. Govin of New York; for the traction companies, James H. Eckels of Chicago, and as special adviser of the court, Marshall E. Sampsell, clerk of the court. The application for a receivership set forth the facts that notes for $565,089 against the North Chicago Company, for $270,477 against the West Chicago, and for $318,727 against the Union Traction Company were due, and with interest, were unpaid. The insolvency of the three companies was alleged, and it was set forth that the rolling stock of the corporations was heavily mortgaged, and that stocks and other assets of the company could not be reached by a judgment creditor. W. W. Gurley, attorney for the traction companies, filed a plea in each case admitting that the claims of the complainant were proper, and offered no objection to the appointment of the receivers. The bond in each case was fixed at $75,000.

The complainant trust company made the charge in its bills that the "oppressive, illegal and unreasonable attitude" of the city toward the defendant corporation helped to destroy its credit. It is also averred that the city authorities' attitude on the question of the 20-year franchise and their refusal to recognize claims under the so-called 99-year act helped to "impair and destroy the income-producing power" of the street-railway companies.

This receivership is believed to be the beginning of the reorganization of the property, and it is thought the company's status has been improved by the placing of its affairs in charge of a United States court through the receivership. The receivers have met and organized by electing R. R. Govin chairman of the board, James H. Eckels treasurer and M. E. Sampsell secretary. W. W. Gurley was nominated general counsel, and associated with him will be Davies, Stone & Auerbach of New York and William G. Beale of Chicago. John M. Roach will remain as general manager of the Union Traction lines and the general working forces of the companies will probably not be altered.

Later developments of the Union Traction affairs was the petitioning of the Superior Court by two creditors of the company for the appointment of a receiver for the Union Traction Company by a state court, alleging the appointment of receivers by the Federal Court was a trick arranged by the traction company and the Guaranty Trust Company of New York so as to place the property of the company as far as possible out of reach of other creditors.

It is reported that the Chicago City Railway Company is ready to offer the city 7½ per cent. of its gross receipts for an extension of franchise, and it is also believed that this company has severed connection with the Union Traction interests in the matter of extension of municipal privileges. It is likely, therefore, that the Chicago City Company's franchise questions may be taken up by the city and settled while the Union Traction affairs are still pending in court.

Springfield was also a center of great interest during last week, when the House of the state Legislature took up the consideration of the municipal-ownership bills. The Lindly committee bill was put on its second reading, and amendments to it were passed amid wild disorder under Speaker Miller's "gavel rule," that has been such a distinguishing feature of the recent meetings of the House. The speaker was forced to leave the hall, and the majority of the members then elected a temporary speaker, and with more decorum substituted the Mueller bill measure for measure for the Lindly bill after the latter had been recalled. Charges of bribery were afterward made by Speaker Miller, and committees are now investigating the whole matter. Further attempts are to be made by the Chicago citizens' committee and its friends in the Legislature to have the Mueller bill become a law, and it is probable that there will be further interesting developments before the matter is finally settled.

No Municipal Ownership for Detroit.

The attempt to pass a bill in the Michigan Legislature to allow municipal ownership of the street railways in Detroit has been defeated, for the present, at least. The Gruesel municipal-ownership resolution, providing for an amendment to the constitution enabling the Detroit Common Council to arrange for the purchase and operation of street railways in that city, was considered by the House on April 23d and defeated by a vote of 64 to 24.

Arnold Electro-pneumatic Railway System About to Be Demonstrated.

After three or four years of study and experiment, and after encountering and overcoming, apparently, the drawbacks and "bugs" such as are experienced in working out every new invention of importance, Mr. B. J. Arnold, the well-known electrical engineer of Chicago, has satisfied himself, by private tests, that his single-phase electro-pneumatic railway is an assured success in practice. The system is under test and is to be installed on a 20-mile road in Michigan especially built for it, the Lansing, St. Johns and St. Louis Railroad. Owing to the radical departure from former electric-railway practice, only one motor has been made and installed for the Arnold system. But the private tests in Lansing have been so satisfactory that additional equipments have been ordered. A public demonstration of the one equipment now under test will be given in a few days. Mr. Arnold is greatly pleased with the success of the preliminary tests, and naturally so, for if his invention fulfills expectations it will have a revolutionary effect on the application of electricity to long-distance railroading by use of the alternating current.

The railway on which the system is to be installed was completed about a year ago, and at that time its physical features were described in the Western Electrician. It runs northward from Lansing on a private right-of-way through a rich farming district and will ultimately be extended to St. Louis, Mich. In construction, the road closely approximates standard steam-railroad practice, and, as a matter of fact, a freight and passenger traffic has been operated over it by steam, pending the completion of the electrical equipment.

The general features of the Arnold electro-pneumatic system were given to the public in a statement presented by Mr. Arnold before the annual meeting of the American Institute of Electrical Engineers at Great Barrington, Mass., last June. Briefly considered, the invention consists of the use of a single-phase (or, if desired, other alternating-current) motor, operating at constant speed under constant load, the acceleration and retardation of the motor being accomplished by means of compressed air. The single-phase motor with which each car is equipped has both its armature and its field capable of revolution about the common shaft, either separately or together. An engine capable of compressing air is attached to the armature and a similar one to the field, and both are connected to an air-storage reservoir on the car. Each of these engines is also capable of driving, by means of the compressed air, that portion of the motor to which it is connected. Under normal running conditions the field magnet is at rest with respect to the car, and the armature, which is connected to the car wheels, rotates at its constant speed. Slowing down the motor is accomplished by releasing the clutch which holds the field motionless. The field begins to revolve and the field engine starts to compress air. As the speed of the car is decreased the rotation of the field is increased, and when the car is stopped the armature, of course, comes to rest, but its relative speed, with respect to the field, is maintained constant, and the field engine continues to store compressed air in the reservoir.

In starting the car the operations are practically reversed, the field engine being throttled, and, in addition, the armature engine is connected with the air reservoir and aids the armature in coming up to speed. Speeds above normal are secured by actuating the field engine by compressed air, the actual speed of the field being added to the synchronous speed of the motor. In ascending a grade the natural capacity of the motor is increased by the armature engine, and in descending a grade the energy of the motor may be entirely converted into energy of compressed air.

The signal advantages to be derived from such a system may be briefly stated as follows: The motor, operating at constant speed under constant load, will always work at maximum efficiency. The customary variations at the power house will be considerably decreased, as the different motors on the road will always carry the same load. By the use of the alternating-current motors the elaborate and expensive system of rotary-converter sub-stations will be done away with, thus effecting a great saving in installation and maintenance. The energy now wasted in braking and in descending hills will be stored up for future use. Other advantages are the operation in towns and for switching by means of the pneumatic power alone, and the use of a high-tension, single-phase current with a rail return.

The Lansing road uses a 15,000-volt current on the line, and this potential is stepped down on the car to 200 volts, the working voltage of the motors. In passing through large cities the working voltage on the line may be reduced to the working potential of the motor by a stationary transformer, placed at the limits of the city.

Institute Announcements.

The next meeting of the Chicago chapter of the American Institute of Electrical Engineers will be held on May 5th, and it is expected that it will be an exceptionally interesting meeting. The papers presented recently by H. A. Lardner, Phillip Torchio and Peter Junkersfeld at New York on the general subject, "Tendencies of Central-station Development" will be presented in abstract, allowing ample time for a good discussion. B. J. Arnold, L. A. Ferguson, H. M. Brinckerhoff, W. L. Abbott and other equally well-known men have promised to prepare for and take part in the discussion.

The next meeting of the American Institute of Electrical Engineers in New York will be held on May 19th. The annual reports of officers and committees will be presented. B. A. Behrend, chief engineer of the Bullock Electric Manufacturing Company of Cincinnati, will read a paper on "The Experimental Basis for the Theory of the Regulation of Alternators," and "The Weyland Motor" will be described by Professor C. A. Adams, Jr., of Harvard University.

Arrangements for the annuul convention of the Institute in Niagara Falls on June 29th and 30th and July 1st, 2d and 3d are well advanced by the committee on papers, of which Professor Samuel Sheldon of the Brooklyn Polytechnic Institute is chairman. As at former conventions, there will be several groups of papers, and members desiring to contribute or suggest topics for discussion are requested to communicate at once with the chairman of the committee. The following is a partial list of promised papers:

"Energy Transformations in the Synchronous Converter," by W. S. Franklin; "The Storage Battery in Sub-stations," by W. E. Goldsborough and P. E. Fansler; "Commercial Alternator Design," by W. L. Waters; "Central-station Economies," by W. E. Goldsborough and P. E. Fansler; "Engineering English," by T. J. Johnston; "Car Run Tests," by W. E. Goldsborough and P. E. Fansler; "Predetermination in Railway Work," by F. W. Carter; "Electrical Equipment of a Gold Dredge," by Ralph L. Montagu; "Y or Delta Connection of Transformers," by F. O. Blackwell; "The International Electrical Congress of 1904," by Elihu Thomson; "The Legalized Standard of Electromotive Force," by H. S. Carhart; "Symbols and Nomenclature," by Carl Hering; "A Universal Telegraphic Code," by G. O. Squier; "Magnetic Units," by A. E. Kennelly; "The Teaching of Physics to Engineering Students," by W. S. Franklin; "On the Testing of Electrical Apparatus for Dielectric Strength," by P. H. Thomas; "Choice of Frequency for Very Long Lines," by P. M. Lincoln; "Method of Entering Buildings with High-tension Wires," by C. E. Skinner.

A joint meeting with the Society for Promotion of Engineering Education will be held on Friday, July 3d.

The membership of the Institute is growing very rapidly. The catalogue of January 1st showed a total of 1,763 members and associates, of whom 1,506 reside in the United States. New York led with 623 members; Pennsylvania had 173; Massachusetts, 131; Illinois, 99; New Jersey, 67; Ohio, 58; California, 57, and so on down the list. The seven foreign countries leading in membership in the Institute are: United Kingdom, 65; Canada, 47; Mexico, 25; France, 16; Germany, 15; Australia, 12; Japan, 11. Since New Years a large number of associates have been admitted, and the list now contains over 2,200 names.

At a meeting of the board of directors of the Institute on April 24th a communication was received from Mr. C. O. Mailloux, enclosing his check for $1,350, as a further contribution to the library of the American Institute of Electrical Engineers. Of this sum, $1,000 is to be set aside as a fund, the interest of which is to provide for keeping up the sets of transactions which Mr. Mailloux has furnished, and which are subscribed for by the year, and the remainder is to be used in purchasing other sets, binding, etc.

British Engineers in Italy.

About 130 members of the British Institution of Electrical Engineers recently made a visit to Northern Italy, where some of the more important electrical engineering undertakings were inspected. The party was in Italy six days, during which time much knowledge of engineering methods employed in that country was gained. The most general interest was manifested in two electric railways, the Lecco Colico electric railway, with main power house at Varenna, and the Thomson-Houston system supplied with power from the plant at Tornavento. The official programme was concluded on April 9th at Milan, with a banquet given by the Associazione Elettrotecnica Italiana, the sister society of the Institution.

TENDENCIES OF CENTRAL-STATION DEVELOPMENT.

The American Institute of Electrical Engineers held its one hundred and seventy-sixth meeting at its rooms in New York city on Friday evening, April 24th. The general subject of the evening was "Tendencies of Modern Central-station Development" and papers were read by Messrs. Lardner, Torchio and Junkersfeld. In introducing the subject, President Charles F. Scott said:

"The central-station system in itself is typically representative of co-operation and combination in design and construction, in the combustion of coal and the production of steam, the operation of engines and condensers, of dynamos and switches, of indicating instruments and safety devices, of conductors and cables, and the operation of apparatus in substations and on the premises of a thousand customers. Each element is in a measure dependent upon all the others. The reliability of the central station commends in highest terms the ability and success of the modern engineer.

"The following statement has been given me today: 'The Edison system in New York city, as a whole, has never been without current. There have been several accidents, including the fire at the old Pearl Street station in 1890, which have temporarily affected a district, but since 1893 there have been no interruptions of service on the system. On March 31, 1903, the New York Edison Company, on Manhattan Island, was supplying current to 26,000 customers, a total equivalent in 16-candlepower lamps of 2,391,431.'

"The central station will in itself increase its extent and its effectiveness. As electric power distribution in the factory has revolutionized methods and led to increased output and reduced cost of products, so electric power distribution in the city revolutionizes the customs of the people and is a vital factor in advancing civilization."

Following are abstracts of the papers presented and the general discussion which followed:

Economical and Safe Limits in the Size of Central Stations.

BY H. A. LARDNER.

The system of distribution which must be used frequently has a direct bearing on the demand for a large station. Where the distribution pressure is low, as in Edison three-wire, 120-240-volt systems, there are few, if any, cities where a sufficient load can be found for a very large station without exceeding the limited zone of economical distribution at this pressure.

Where this system is in operation, we find that the stations are generally of high first cost and too small to be operated economically. The location is necessarily chosen without regard to the water or coal supply, and the load factor is generally very bad, which adds to the expense of operation. As a temporary expedient, at least, rotary converters, transformers and high-pressure cables have found a place for connecting together the direct-current stations, and thus enabling them to exchange power and considerably improve their load factors.

The next step is to establish a large well-located alternating-current station and feed the rotaries from the machines there installed. This method permits the use of the largest size of generating units, gives their attendant economies, and the demands of the various sections of a city coming at different hours of the day produce a better load factor.

The generating apparatus installed in the distributing or sub-stations, as they may now be called, can be operated if desirable, for one or two watches during the heaviest loads in their particular sections, and the combination undoubtedly results in greater economy. The existence of these sub-stations with generating apparatus, provides a certain amount of reserve or emergency power which can be called upon, and the danger of concentrating all the generating apparatus in one station is in a measure avoided. The fact of their existence also acts as an incentive to keep down the number of new generating stations and to build one alternating station large enough to meet the entire demands of the system, no matter how large that may be.

By the use of a three-wire system and 240-volt lamps, the advantages of 500-volt distribution in copper economy can be obtained, and the zones which can be served from any one station very considerably increased. It is an open question whether with this system of distribution the stations can be made large enough to be built for a fairly low first cost and operated at practically a minimum expense. The alternating-current system of distribution with primary voltage of 2,200 volts and over, has the ability to serve a very extended territory. With this system of distribution, the question of one large station should not be so important, as the load can probably be divided between two or three stations, each large enough to be economical, and by the use of trunk cables they may aid one another in handling the load and add materially to the safety and continuity of the service.

Under proper conditions of design and operation very good comparative results can be secured with compound Corliss condensing-engine units much smaller than those installed in the large stations in New York.

The published guarantees for the steam consumption are as follows, in these stations:

Station.	Pressure.	Vac.	I. H. P.	Steam.
The New York Edison	175	27	5,500	12.5
Manhattan Railway	150	26	8,000	13.0
Metropolitan Street Railway	160		4,500	13.14

That part of the cost of labor for engine operation, which varies with the size, amounts to but a small proportion of the total operating expenses; and although the larger the unit, the smaller the item becomes per horsepower-hour, it is relatively of little importance, except in very small units.

The question of floor space required for reciprocating engines of different sizes demands the largest units practicable.

Economy of operation and in floor space may be made entirely too much of in discussing the advantages of large units, although with similar design and type of machinery, the large units undoubtedly have some advantages, provided the station is large enough to require a sufficient number of units to permit of economical loading.

The following table will give some published data about the engines in the New York Edison, Manhattan Railway and Metropolitan stations:

Engines.	Metropolitan.	Manhattan.	Edison.
Number	11	8	8 installed, 16 ultimate
Horsepower each normal rating	4,500	8,000	5,500
Horsepower each maximum rat'g.	6,600	12,500	8,000
Aggregate rated horsepower	49,500	64,000	88,000
Aggregate maximum horsepower	72,600	100,000	128,000

From the large number of units, we may assume that these are the largest machines the manufacturers cared to produce. Larger engines have been built for use aboard ocean liners, and as conditions are in many ways much more severe aboard ship than on land, it should be possible to have still larger units, if central-station engineers really demanded them.

The steam turbine has now been perfected so that many plants are ordering them, and in a year or so a great many will doubtless be in operation. The turbine presents some characteristics which will, I believe, affect our decision in regard to the arrangement and number of stations for a given system. There is every reason to believe that the use of superheated steam with turbines will be a comparatively simple matter, as the turbines will have no internal rubbing surfaces or cylinder oil. Exhaust steam from turbines being free from oil, may be condensed and returned to the boilers, and this will be an important consideration in many plants now purchasing city water for boiler feed and which find the extraction of oil too difficult and expensive to permit the water being used a second time.

Due to the high speed at which turbines are operated, direct-current machines seem to be ruled out on account of commutator troubles. Perhaps the greatest advantage of the turbine is its economy of floor space. The Curtiss turbine of the General Electric Company is of the vertical-shaft type, and while it requires more head room than the Westinghouse-Parsons horizontal machine, is very economical of floor space. The following table gives the principal dimensions of some of the sizes which are now being built:

Curtiss Turbines and Generators.

Size.	Height.	Diameter.	Floor Space.	R.P.M.
500 k. w.	12' 2"	7' 8"	46.2 sq. ft.	1,800
1,500 k. w.	16' 10"	10'	78.5 sq. ft.	900
3,000 k. w.	22'	14'	154 sq. ft.	600
5,000 k. w.	27'	14' 10"	175 sq. ft.	500

Westinghouse-Parsons Turbines and Generators.

Size.	Height.	Dimensions.	Floor Space.
400 k. w.	7' 6"	19'× 5'	95 sq. ft.
1,000 k. w.	8'	43'× 8'	344 sq. ft.
5,500 k. w.	15'	50'×12'	600 sq. ft.

For comparison, the following is the floor space required by the vertical cross-compound, condensing engines of a well-known maker. The figures include the space required for an alternating-current generator between the frames.

Size.	Dimensions.	Floor Space.	R. P. M.
500 k. w.	15'×22'	330 sq. ft.	120
1,000 k. w.	21'×24'	504 sq. ft.	110
1,500 k. w.	22'×28'	616 sq. ft.	100
2,500 k. w.	23'×32'	736 sq. ft.	90
3,000 k. w.	23'×34'	782 sq. ft.	75

The height would in all sizes exceed that of a similar size of vertical turbine.

The steam consumption guaranteed for the above-mentioned Curtiss turbines are attractive, especially at light loads. The figures are given in dry steam per kilowatt-hour, and for purposes of comparison with results per indicated horsepower-hour, they have been reduced by assuming an efficiency for generator and turbine of 85.

			—Steam Per K. W. H.—		Lb. Per I.H.P.
Size.	Pressure.	Vacuum.	Full Load.	Half Load.	Full Load.
500	150	28	20¼	23	13
1,500	150	28	20¼	22	13
3,000	150	28	20¼	21.5	13
5,000	150	28	20¼	21	13

The simplicity of the turbine leads us to believe that the high efficiency will not decrease with use nor by reason of lack of adjustment. The method of guaranteeing the efficiency of generators and engines together, will permit this guarantee to be checked more closely than has ever been possible with large engines and generators, on which separate guarantees have been given.

I believe that the cost of labor for engine operation will be considerably cheapened with the turbine, and this and the other advantages shown should greatly reduce the necessity for very large units. If, therefore, steam turbines are to make the operation of smaller stations (with a suitable number of units to handle the load economically), equal in efficiency to some of the largest plants now installed, it will be advantageous in many cases to install several stations in place of one, and secure all the saving in distribution and safety against shutdowns that go with such an arrangement.

The advantages may be summed up from what has been previously said, and consist mainly of the following:

The location of the station on the one most suitable site for the coal and water supply.

The reduction of floor space by the use of large units.

The economy of fuel secured by the use of large generators and engines.

The economy of labor and general superintendence secured by the use of large units in one building.

The saving in first cost effected by the installation of a large station with large units.

The economy of operation secured by serving many sections of a city with different hours of maximum demand from one station, due to the better load factor obtained.

The installation of a large station presupposes supplying a very large territory from one source, and in order that the coal and water supply may be convenient, the chosen location is generally much further from the load than when it is divided among several plants. This involves a greater expense for a distribution system, although this may be minimized by the installation of high-potential current or by local conditions.

The economy of floor space by the use of large units will always be an important consideration where land is valuable, but the economy in this direction with the steam turbine may lead the designer of the future to give less consideration to this point.

The added economy of fuel, labor and general supervision in large units will also be reduced somewhat, even with the large turbine units, and the first cost of the machines themselves will undoubtedly decrease per unit capacity with increase of size. However, the reduction in cost of turbine-generator installation from the prices now paid for generators and slow-speed reciprocating engines should be considerable, and permit smaller units than are now feasible. This will undoubtedly be true after development charges have been cared for.

It is a question whether there is any saving in the first cost in the installation of very large stations, except in prime movers and generators. The construction of double and triple-decked boiler rooms, long coal-handling apparatus and coal pockets high above the ground, involves heavy expenditures without compensating advantages. It is probable in the case of some large stations in this city that they could have been built to half their capacity as cheaply per unit as to the ultimate size. The size of the units in either case would probably have been the same.

The principal disadvantage of the very large station is the danger to a system if the disabling of the station leaves the company without a source of power, or takes away a larger portion of its supply than can be cared for by overloading the remaining plants. It is with this point in view that I have attempted to bring out all the points which may make smaller stations worthy of more consideration than they frequently get.

The stations in this city are wonderful examples of good design in all features which tend to make them reliable and free from dangers of serious breakdown and interruption of service. As one designer said in describing his station, it was built to withstand anything but an earthquake or a bombardment. While it may be possible to build such a station, I do not believe that there has been a single station built, and I do not look to see one, which is free from weak points capable of causing interruptions. These features are apparently unavoidable, and while accidents due to them may not do any serious or expensive damage, they may render the building untenantable to employes or to enough of them to cause an interruption to the service.

I do not wish to go on record as advocating a greater refinement than is commercially justifiable, and perhaps this point has been reached by the designers of the large stations. The point I do wish to make is that smaller stations need not lack many of the advantages of the large ones, and with a number of them in place of one large plant, the necessity for excessive refinement ceases to exist.

Safety Devices in Central Stations and Sub-stations.

BY PHILIP TORCHIO.

Proceeding from the generating station to the transmission line and receiving sub-stations, we find the following characteristic features more or less generally adopted or considered desirable from the aspect of reliability of service:

Installation of storage battery on field-exciter bus, at generating station; equipment of reverse-current relays and circuit-breakers on exciter generators; equipment of overload relays, with time limit and circuit-breakers, on motors of motor-generator exciter sets; separation and mechanical protection of generator leads of different generators; connection

of each generator to bus-bars by means of two oil switches in series; subdivision of bus-bars; tie connections between different sections of bus-bars; overload and reverse-current relays on generator switches; selector switches on feeders; duplication of oil switches on each feeder circuit; overload relays on each feeder, with a variable time limit; separation of all wiring and buses inside the station; in connection with very high voltage step-up transformers, provide low-tension synchronizing buses for generators and switches on the low-tension side of step-up transformers; avoid installation of single-pole main switches for each phase of the circuit.

Duplication of transmitting lines to important centers of distribution; mounting of suitable end boxes on ends of cables at all terminals; protection of underground cables; protection of lead sheath of cables against electrolysis; protection of transmitting and receiving stations operating overhead transmitting lines by improved lightning arresters; grounding of neutral of three-phase transmission lines for very high voltages; possibly grounding of neutral for lower voltages and underground cables; avoid operation of high-tension lines at different frequencies when lines are mounted on same pole line.

Separate lines entering sub-stations should preferably be operated independently. In rotary sub-stations, while the rotaries operate in parallel on the direct-current side, they can be fed from independent high-tension lines not operated in synchronism. In the case of alternating-current stations with transformers feeding into a common secondary set of bus-bars, the primary lines must necessarily be operated in parallel, and therefore from same bus-bars at the generating station. Receiving lines should be equipped with oil switches and overload relays, with variable-time limit in inverse proportion to amount of current. Inside the sub-stations all high-tension wiring and construction should be laid out along the same lines mentioned in case of generating station. For protection of lines from overloads or short-circuits on transforming apparatus of large capacities, oil switches with overload relays should be considered preferable to high-tension fuses. Compound-wound rotary converters and eventually also plain shunt-wound rotary converters operated in parallel on a common direct-current bus, should be protected by some speed-limit device to trip the alternating-current and direct-current circuit-breakers on the rotary, when speed exceeds the normal by a certain fixed percentage. It is desirable to protect the direct-current side of all rotary converters with circuit-breakers to operate in connection with the speed-limit device above mentioned, and also in connection with a reverse-current relay on the direct-current side of the rotary. Emergency connections between different generating stations are considered desirable, and have found favor in connecting different waterpower plants and also in connecting large generating stations in the same city, as in New York. Of first importance in a lighting situation in a large city is the equipment of storage batteries at every sub-station.

In closing this list of safeguards, it may be added that in all high-tension work, great care should be used in applying tests to the apparatus, especially in making insulation tests on generators, cables, line and transforming apparatus. Breakdown tests can be made on samples, but it is unwise to strain unnecessarily the insulation of the complete plant near the breakdown point. Close inspection of the installation will finally give more satisfactory results than loose inspection and severe tests.

Multiple versus Independent Operation of Units and Central Stations.

BY PETER JUNKERSFELD.

Troubles of one kind or another, even with the best modern systems, are always possible on the many different links between coal-pile and translating device. In a large central-station system supplying direct current, these links might be enumerated, and troubles classed as follows: Mains and services; low-tension feeders; sub-station apparatus; high-tension transmission lines; generator, prime mover and auxiliaries; steam supply. Troubles in wiring or translating devices on consumer's premises are usually more directly under the control of the consumer than of the central station. In the discussion of these different classes of trouble the writer would, as a matter of illustration, refer to conditions in Chicago, where all 25-cycle, high-potential transmission and direct-current distribution is underground. In the outlying districts the four-wire, three-phase, 60-cycle distribution is overhead.

Any trouble, either on mains or services, is usually confined to a comparatively small area by the blowing of strips in the feeder junction boxes. The total amount of current that could be "pumped" into such a short-circuit is limited by the drop in mains and feeders, at least back to the sub-station bus-bars.

On account of the larger carrying capacity, the energy delivered on short-circuit is very much greater in feeders than in mains. The total length of conductor in feeders being much less than in mains, the number of troubles with equally good construction are correspondingly less.

In sub-stations supplying direct current, rotary converters, with their accompanying step-down transformers and potential regulators, are used almost exclusively. The direct-current ends of these rotary converters are often worked in multiple with an old generating station, at least during the peak hours of one or two months in the early winter. A storage battery with end-cell switches for discharging on two or sometimes three different potentials is an important adjunct to a sub-station.

In many large sub-stations all rotaries are operated from one set of bus-bars; in others they can be operated on either one of two sets of bus-bars. Another arrangement consists in running all rotaries from a single bus-bar arranged with disconnective knife switches, so that each rotary or group of rotaries could be operated independently from its own transmission lines. An improvement consists in replacing the disconnective knife switches with remotely controlled oil switches. With the latter arrangement, each rotary or group of rotaries can be operated all in multiple, if necessary or advisable, and be quickly sectionalized in case of trouble on any one transmission or conversion unit.

In most of the larger cities the 25-cycle transmission systems are operated at voltages varying from 6,600 to 13,000 volts. Much higher voltages have been successfully used on through trunk lines, in several other cities. This, however, is obviously a very different condition. The large transmission systems, with their multiplicity of lines, cable terminals and oil-switch connections, have grown into networks that are continually becoming more complex. As each and every case of serious trouble anywhere on a system having almost exclusively synchronous apparatus necessarily affects every part of the system, the possible chances for trouble affecting any one of the thousands of customers are also continually increasing. Commercially, this is a very serious matter, indeed, especially when we consider that with many of the more desirable customers the greatest possible security for continuous service is of first importance.

Realizing this fact, many central-station engineers have taken extraordinary pains with high-tension cable work, and in some cases have succeeded in making the transmission network in itself one of the most reliable parts of the central-station system, except in so far that inherently this high-tension network, with its synchronous apparatus, is lacking in elasticity.

The arrangement and installation of terminal appliances is obviously of great importance. All forms of fuses and air-brake switches have been abandoned, so that at present the main circuits are made and broken only under oil. Various forms and methods of making up joints and cable heads were tried. These are now made up in parts, so that the lead sleeve or cylindrical part of head is put in place after the individual joints have been made and insulated with paper tape. The sleeve or cable head is then filled with a special compound, which is a non-absorbent of moisture, and has a much higher dielectric strength than the paraffin, which was formerly used. The process of filling is such that every minute particle of moisture is expelled.

The selection of routes for transmission cable is made with a view to provide two or more lines on different streets, if possibile, at least in different groups of conduit for each sub-station. The cables are isolated and mechanically protected, so that the spreading of a bad "burnout" in either high or low-tension cables will be prevented as much as possible. A well-designed and constructed conduit and manhole system is therefore essential. Overhead connections to an extensive high-tension underground network are a source of trouble, to be avoided, if possible. When unavoidable, these overhead taps should be isolated by means of transformers.

The necessity for operating all units in multiple for long-hour periods in order to obtain good station economy, still exists to a very large degree. During the past 10 years the sizes of units in the largest stations have been increased from 800 and 1,500 kilowatts to 3,500 and 5,000 kilowatts. The number of units, however, in any one station has often been decreased, making multiple operation of at least a large portion of plant more necessary than before, and also placing much greater dependence on any one unit. Such stations have been and are still passing through a critical transition period. Every case of serious trouble on generator, engine or auxiliaries affects the entire system; but it frequently happens that the system cannot be sectionalized even into two parts without serious sacrifice in engine economy. The gradual increase in number of units will only partially relieve this situation.

A very decided advance would be the use of a prime mover giving practically a straight line economy, such as the steam turbine. The differences between one-half load and the full-load performance for short-hour periods will not be great enough to warrant much shifting.

The location of boilers in two or three different rooms or floors and the providing of means for closing valves from inside of engine room have lessened the danger of a shut-down. The placing in separate rooms, as far as circumstances will permit, of the boilers and piping corresponding to each generating unit and connecting only through fairly quick-acting remotely controlled valves will further lessen this danger.

A survey of the various classes of trouble between coal pile and customers' service indicates at once the unfortunate feature of large modern transmission systems. True, as has been done in some cases, induction motor-generators might be used instead of rotary converters. The sub-station apparatus would then be much less sensitive to sudden fluctuations in engine speed, or to line disturbances due to short-circuit on some other part of the system.

The first cost of motor-generators of 500 kilowatts and 1,000 kilowatts' capacity installed complete is, however, from 15 to 25 per cent. greater than for rotary converters with accessories. Under ordinary operating conditions there is a difference of from three to five per cent. in efficiency in favor of rotary converters. The power factor of the rotary converters is obviously much better than that of the induction motor. The characteristics of a rotary converter are often a practical advantage in cases of trouble on low-tension feeders or mains.

In some few cases where it is necessary to run a large number of converting units from a long-transmission line which itself is subject to heavy fluctuations in potential and frequent interruptions, it may be advisable to use motor-generator sets. In the large majority of cases, however, in both lighting and railway work, the rotary converter has been found the best and most economical. If the objectionable features thus introduced cannot be overcome, the result can at least be minimized by judicious sectionalizing in large systems.

The electrostatic capacity of these large high-tension cable systems is such that there is necessarily a practical limit to the mileage of cable that can safely be operated as an interconnected network.

In a rapidly-growing system provision for a reasonable amount of sectionalizing can easily be made. The investment in the portion of central-station system between coal pile and customers' service most directly involved, is, under most conditions, divided approximately as follows:

Station; real estate, building and generating apparatus	35% to 45%
Transmission system; cables and conduit	8% to 6%
Sub-station; real estate, building and converting apparatus	10% to 15%
Feeders and mains; cables, conduit and Edison tube	46% to 48%

A review of power houses indicates that there is a wide difference in cost of station buildings. This difference is a matter partly of engineering and partly of management. Taking the total cubical contents of six of the large modern station buildings, we find that from six to 10 per cent. is devoted to coal storage and that the complete buildings vary from 100 to 240 cubic feet, and from 0.95 to 2.5 square feet per kilowatt rated generating capacity. The boiler-room portion of the same stations vary in total net cubical contents from 65 to 130 cubic feet per rated boiler horsepower, while the engine-room portions vary from 40 to 90 cubic feet per rated engine horsepower. As practically the same types of boilers are used, the former depends almost entirely upon the design and arrangement; but the latter depends largely upon the type of generating unit adopted. In the case of vertical turbine-driven units, the figure for this portion of plant can be reduced by at least one-half.

The tendency, however, in power-house design is toward a much more liberal allowance for space for all equipment. The high-voltage generators of large capacity and multiplicity of lines demand extraordinary switching apparatus which requires considerable space. A suitable arrangement and reasonable isolation of switching apparatus and connections need not require any additional space and should preferably be much simpler than that in many existing stations.

In conclusion, it might be said that considering responsibility for the business and return on investment, every central-station system should be designed, if not for independent, at least for sectional operation. In the very large stations, the independent units from coal pile to distributing network, or to rails, should be effectively isolated to make a total shut-down practically impossible. The matter of independent, sectional or multiple operation at different hours of the day or days of the year is entirely one of local conditions, which may change frequently. Great care and constant attention is needed to maintain a fairly uniform and consistent coefficient of reliability on every part of the central-station system. Independent and even sectional operation will mean a small sacrifice in operating costs. With a system properly designed, this matter, then, becomes to the central-station management a plain business consideration; to take the risk of inferior service and possible shut-down, or to pay a premium in the form of very slight sacrifice in operating costs and thus obtain an additional safeguard for superior service to all or such groups of customers as business requirements may demand.

Discussion.

Henry G. Stott, New York city: The steam turbine is practically an unknown quantity to most of us, and while some results have been published, yet it has not been in use long enough to justify a prediction that it will displace reciprocating engines. Reciprocating engines to-day are built with higher steam economy than is claimed for the turbine. The larger units in operation in New York to-day are all, approximately, consuming about 13 pounds of steam per indicated horsepower. That corresponds approximately to 19 pounds per kilowatt-hour. The best of actual records of the steam turbine is just about that. By going into triple-expansion engines, a step which seems obvious for railway power plants, we can get down 20 per cent. lower than that, without any trouble at all. I had a message from the Boston Edison Company to-day, in which it advised me that with a 1,200-horsepower compound condensing engine, with 98 degrees of superheat at the throttle, it gets a steam consumption of 11.57

pounds per indicated horsepower. At the present time I feel personally, in regard to the steam turbine, that we will have to return the Scotch verdict of "Not Proven," and wait until we get actual results. I believe you will find that the limiting feature in all large stations—no matter what the size of the generator units—is that you must have a certain size of boiler unit, and to get the best distribution of steam, even though the units only occupied one-fourth of the space claimed for the steam turbine, you would have to space the steam-turbine units at approximately the same centering distance as you do the steam engine, so that the economy of floor space, I do not think, is a very important point.

I think the high-tension underground cable is the safest thing we have—a great deal safer than low tension. If you have a short-circuit in a low-tension cable it may burn up 1,000 feet of the cable before you can stop it. If there is a short-circuit on a high-tension cable, with proper safety appliances on each end of it, and a burn-out should occur, it does not destroy more than two feet of the cable. I think the storage battery has found its proper place as an assurance against shut-down and not as a means of economical operation.

The idea which seems to pervade in all of these papers, the returning to the single operation of units on a certain number of feeders or employing a certain number of sub-stations, and not multiple operation, seems to be a backward step. It is a confession of weakness in our safety devices. Is it not a better solution to improve the safety devices and operate in multiple, and thereby gain the maximum economy of station operation?

Herbert A. Wagner: I have recently been connected with the engineering work of the Boston Edison Company, and there we have so far operated all the alternating-current generators and feeders in multiple. We have had practically no trouble. The station is now used entirely for transmitting current to sub-stations, from which current is distributed on the three-wire direct-current system. All these sub-stations are equipped with motor-generators in place of rotary transformers, and I attribute the freedom from many of the troubles which other central stations had to the use of motor-generators in place of rotaries. A large proportion of the motor-generators are induction-motor-generators, and therefore the troubles which are often caused by a great amount of synchronous apparatus, are entirely obviated.

The company is now building a 50,000-kilowatt station in which turbines are to be used entirely in place of engines, 5,000 kilowatt units. That station will probably be operated in sections, but that has not been definitely determined upon yet.

E. H. Sniffin: There is one point which occurred to me in connection with the steam turbine, among other things, and that is the question of economy. I think we are all tolerably familiar with what the reciprocating engine will do, and it is probably a fair statement to say that the steam turbine will not give materially better results, under test, than the best-known results of reciprocating engines. That is a fair statement for full-load regulation, although under light loads the turbine is more economical, but I wish someone here were wise enough to tell us what reciprocating engines do in everyday service. I think, as we accumulate experience, we will find a distinct difference between the inherent, commercial, everyday efficiency of the turbine and the reciprocating engine. This has been already shown by the amount of experience we have had.

John W. Lieb, Jr., New York: I think that Mr. Lardner, in his statement of the case for a multiplicity of smaller stations, has probably not taken into consideration the extremely important factor in locating such smaller stations in such a city as New York. I certainly do not agree with his statement that it is not a difficult matter to locate smaller stations within the district of New York; I mean in the Borough of Manhattan.

I would say also that if prospective customers of the electric-light and power companies could read over this very formidable list of all kinds of automatic overload and underload relays, and other things tributary to the operation, that are a necessary concomitant of a large power station, I am afraid the contracts which would come in would be few and far between; but, as a matter of fact, these different requisites are rather in the direction of extreme refinement, necessary to secure the greatest regularity of service and the greatest freedom from disturbance. I think it is perfectly safe to say that the experience of all large central stations operating transmission systems to sub-stations has shown that the storage battery has impressed itself upon them as an absolute necessity, as much a necessity as an auxiliary as either the rotary converters or motor-generator sets, or some other of the equally essential pieces of apparatus.

There is one item which I wish particularly to emphasize, and that is, in the case of a large number of smaller plants, the volume of what may be called unproductive labor; in other words, the people you have got to keep at the smaller plant, no matter what its output may be, and even if there be practically no output. While the various matters which have been spoken of this evening might seem to indicate that the service from these larger plants may perhaps be less reliable than the service from a multiplicity of smaller plants, I think the experience that has been made in that direction already sufficiently demonstrates that the service which the large plants can produce is sufficiently constant and reliable for the most exigent and difficult conditions.

W. S. Rugg, New York: It surprises me somewhat that we have not heard brought out to-night, and especially we have yet to see the first attempt, so far as I know, to lay out actually an Edison multiple-unit station. In such a station I believe we could combine nearly all the advantages which have been brought out in the papers. I think such a station could be designed so that the operating expenses would be but very little more than the operating expenses in one room, or two rooms, and at the same time we would have the advantage of a number of stations. This principle is well recognized in the design of small stations. We would not have to tie two small stations up in one unit, but we do not hesitate to defend some of the large stations of the country, in which the entire station practically depends upon the continuity of operation of a single system.

Mr. Abbott: Would it not be possible for some of us to contribute to the general fund of information to endeavor to show, perhaps in the form of a curve, a certain relation between the number of accidents and delays between the large station and a multiplicity of small stations, and the amount of capital that would be invested therein, and reach some sort of a plan on which insurance companies could go into the field and insure electric-light companies and their customers against the probability of interruption of service? I wish to make the point that we should take this question up not solely from the engineering standpoint, but from the business standpoint as well. The engineer should make everything absolutely safe, so far as his knowledge would permit, because there are always sufficient exigencies in the unknown which we cannot recognize; on the other side there is the commercial point of view, and it seems to me that some light should be thrown on that phase of this question.

Mr. Junkersfeld: The question as proposed by the gentleman seems to be one of preference between a multiplicity of small stations as against one large plant. Mr. Lieb pointed out that a multiplicity of plants is impracticable, because you cannot get suitable real estate. For that reason the companies are forced to concentrate their power stations in places where coal and water can be easily secured. Mr. Lieb has covered the proposition very clearly, and I can only say that as far as Chicago is concerned we endorse his remarks. The same conditions apply in Chicago—a great multiplicity of plants is impracticable, and sites could not be secured for them, even though we tried to do so.

Mr. Stott made the remark, he would rather have trouble on a high-tension cable than a low-tension cable, and that in his experience there is really very little trouble from that source. In this I fully agree. In our experience in Chicago we have had very little trouble; hardly know what it is, as far as the cable itself is concerned, for the high-tension work in transmitting trouble from one part of the circuit to the other.

Returning to multiple and independent operation, it has been shown this evening that a multiplicity of plants has some safeguard over and above one large plant; and with this idea in view the work in Chicago has been carried on with the idea of centralizing these sub-stations in a transmission system. We have built and run them independently, as the units were quite large, and very little sectional operation was possible on that account. With the installation of the turbine units, with a good load economy, sectionalized operation will be entirely possible. I was glad to know that here in New York they had actually started operating their large plant in two sections where they are employing reciprocating engines. I think the fact that they have found that was possible here in New York will be given quite a good deal of consideration because, after all, what is done in these large lighting stations is based on wide experience and is a matter of interest to all stations.

Mr. Lardner: I did not advocate a multiplicity of plants. I do advocate subdividing into a few plants instead of one large plant; perhaps two or three.

Mr. Torchio: I want to take issue with Mr. Stott in his statement that there is no place for the storage battery from the standpoint of economy. Consider local conditions in New York city, for instance, where they have the big load of the station supplying the commercial district downtown below Eighth Street, where the load diagram is very light in the day time and then about five o'clock there is a full peak, and a sharp drop. A storage battery at that point, with a peak of short duration, can show advantages from an investment standpoint, because in this case you can discharge the battery in one hour, and you do not require the battery as a reserve. Having the battery, you have two advantages as to capacity and reserve during the operation.

War is on between the Big Four Railroad and the Columbus, Delaware and Marion Electric Railway. The latter company has been engaged in laying tracks for a new line, and when an attempt was made to place the frog at the junction of the Big Four tracks in Delaware, Ohio, trouble began. Two switch engines were stationed on the crossing and 100 men undid the work of the trolley gang as fast as it was accomplished. The two engineers and the yardmaster of the steam road were arrested for blocking the crossing. The courts will settle the difficulty.

Annual Report of General Electric Company.

The General Electric Company issued last week its eleventh annual report, covering its business for the fiscal year ended January 31, 1903. A very flattering showing was made. President C. A. Coffin, in his report to the stockholders, recites that the profits of the company for the fiscal year (including a profit of $973,649.74 upon securities sold), after deducting all general and miscellaneous expenses, and allowances for depreciation, losses and writing off $386,875.93 from patent account, and $1,908,324.11 from factory plants and machinery, were $10,277,169.16. Adding last year's surplus of $15,287,140.65 and deducting interest on debentures of $44,331.17, further deductions from the patent account for expenditures incurred chiefly in acquiring the patents of the Sprague Electric Company of $1,613,879.82, dividends of $2,677,263.50 and stock issued in restoring percentage of reduction made in 1898 of $16,746,133.33, leaves a surplus on January 31st of $4,482,701.99.

Attention is called to the fact that the amounts written off factory plant and patent accounts exceed the amounts written off those accounts last year by about $2,500,000. The present condition of the business of the company is shown to be satisfactory and to indicate a considerable increase in volume for the fiscal year over that of the last, largely due to the admirable work of those in charge of the engineering, manufacturing and selling departments.

The consolidated balance sheet and the consolidated profit and loss account as of January 31st are given on the next page.

The following are abstracts of the vice-presidents' reports:

Sales Department (Vice-President Griffin).

The total sales (amount billed to customers) during the year were $36,685,598, and orders received amounted to $39,944,454, as compared with $32,338,036 and $34,350,840, respectively, in 1902, and $28,783,275 and $27,969,541, respectively, in 1901.

Since February 1, 1900, the reported orders received have not included the items of services of experts and labor, freight and transportation, supply material, boilers, engines, etc., of outside manufacture and bare copper wire, which items were included prior to 1900. These items amounted to $1,558,371 during the past year. Including these items the total orders received for 1902 aggregate $41,502,825.

The orders received included generators and rotary converters, capacity over 590,000 kilowatts; railway motors, more than 11,000, capacity over 490,000 horsepower; transformers, capacity over 475,000 kilowatts; stationary motors, more than 16,000; arc lamps, more than 80,000.

In addition to the growth of the railway, lighting, power and supply business, there has been a marked increase during the year in special electric work, such as: The substitution of the electric for the mechanical drive in cotton mills; the application of electric motors for driving individual machines in mills, factories, machine shops, etc.; the use of electricity in mining operations for haulage, pumping, hoisting, drilling, etc.; the use of motors on warships and merchant steamers, replacing steam and hydraulic auxiliaries; the utilization of water-powers for the generation of electrical energy; the use of motors for electric automobiles; the use of electric pumps for water supply, sewage, etc.; the use of electric hoists for dock and ship work and in mills, factories, storage warehouses, etc., and a vast number of motor applications.

During the year the company delivered most of the motors and control equipments ordered by the Manhattan Elevated Railway of New York city. The electrical equipment of that road is now very nearly completed. Its electrical operation has been a complete success with the exception of a few days in December, 1902, when a sleet storm was encountered, for which the road was unprepared. The equipment had not progressed sufficiently to include proper facilities for coping with sleet. This was the cause of such difficulties as were encountered, and no blame was attached to the motors or control. During the two days of the storm the road carried 1,105,296 passengers, as against 1,059,167 passengers carried during the two corresponding days of the previous year. This fact is sufficient refutation of the exaggerated reports indicating that the Manhattan railway was out of service for a considerable portion of these two days.

After months of investigation, competitive tests and trials, in which the superiority of our control system was conclusively proven, the Interborough Rapid Transit Company awarded to the General Electric Company the contract for all of the control equipments of its cars.

The demands of modern transportation in the matter of schedule speeds, power required and flexibility of movement have resulted in the development of a new method of control known as the "multiple-unit" system, in which two or more of the cars in a train are each equipped with motors and controllers, and, in addition, with master switches and controlling lines, so that they may be operated either individually or in train combinations of any required length, with or without other cars which are not equipped with motors, and all may be controlled by the master controller on any car. This system is in direct contrast with the locomotive system, where all of the power is concentrated in the locomotive. The multiple-unit control is the most

important recent development in electric traction work, making possible the use of electric motors in urban rapid transit and standard steam railroad service in such manner as to secure rapid acceleration and quick service, which results cannot be obtained with a locomotive.

By the purchase of the Sprague patents the company has come into possession of the only fundamental and detailed patents, outside of those already owned by the company, covering a successful and satisfactory form of multiple-unit control. This system, now known as the Sprague-General Electric system, is in successful operation on many roads. A list of roads which have been equipped with or have contracted for this system of control is then given, headed by the Manhattan Railway Company with 900 cars. The total number of roads is given as 31, and the total number of cars equipped as 2,081.

My report of June 28, 1897, states: "Since the organization of the company in 1892, we have sold 30,912 railway motors, having a total capacity of 795,120 horsepower." Since that date we have sold 54,344 motors, having a total capacity of 2,304,986 horsepower. The grand total of railway motor sales in the last 11 years is 85,256 motors, having a total capacity of 3,100,106 horsepower. These motors are in operation in all parts of the world.

The growth of waterpower enterprises is shown by the fact that 221 plants are now in operation, which plants have been equipped with 428,269 horsepower in General Electric generators. There are also now in operation 24 plants equipped with 41,820 horsepower in General Electric generators, which plants are operated partly by steam and partly by waterpower. While the great majority of these plants are located in the United States there are many located in all quarters of the globe.

We received about 162,000 separate orders during the year (not including contracts), an average of 541 per day.

There has been no important change in the organization of the sales department during the year. The rapid growth of the business has greatly increased the burdens and responsibilities of our managers and salesmen, but we have been able to meet these conditions without too great an increase in our selling force. The selling organization is in good condition. The spirit of the men is excellent and their energy and thorough loyalty to the interests of the company deserve the highest commendation.

Manufacturing (Vice-President Rice).

Expenditures aggregating about $2,500,000, exclusive of the cost of patterns, small tools, etc., have been made during the year for real estate, extensions to existing buildings and the erection of new ones, and for additional machinery; all required to take care of the increased business. The floor space and the number of employes during the last five years have increased from 1,800,000 square feet and 8,000 employes to 3,000,000 square feet and 18,000 employes.

At Schenectady, the building for the manufacture of wire and cable and insulating materials, of 180,000 square feet, the building for the manufacture of switches and other small articles, of 60,000 square feet, and the addition to the Testing Department of 13,000 square feet, have been completed. The major portion of the machine shop of 117,000 square feet has been completed. The balance is nearing completion. The new power house of 27,000 square feet, adding 6,000 horsepower to our present equipment, has been somewhat delayed but will be completed in time to supply power for our winter load. The occupation of our new office building has enabled us to devote about 40,000 square feet in the old office building to manufacturing purposes.

At Lynn, the building for the manufacture of meters, instruments and small parts, of about 55,000 square feet is about completed. The increased demand for transformers, railway motors, small motors and accessories, has necessitated the erection of buildings containing about 180,000 square feet, which are now nearing completion.

At Harrison, additional buildings aggregating 42,000 square feet are in course of erection.

The method of estimating factory cost has been the same as that employed last year. The results of our inventory show that the percentages used to cover general manufacturing expenses have been sufficient for the purpose.

Engineering (Vice-President Rice).

Engineering work of the last year has been largely devoted to the development of established lines of apparatus. The number and variety of useful applications of electrical machinery have kept pace with the increased volume of our business. Our standard apparatus has been improved in quality and efficiency, and considerable special apparatus has been designed and manufactured to meet novel conditions.

There has been a large increase in the equipment of industrial establishments with electric motors; the advantages of the electric motor drive being more clearly recognized with the increase in the number of its applications. Our business in such applications showed an increase of 40 per cent. during the last year. This increased use of the electric motor has been especially notable in the case of cotton mills, steel plants, cement works, oil refineries and machine works.

The distance to which electricity has been delivered has been largely increased and many new long-distance plants have been installed, using pressures of from 60,000 to 80,000 volts and delivering power at distances of from 50 to 150 miles. A notable instance is that of the transmission of 6,000 horsepower from the falls of the Cauvery River 90 miles to the Kolar gold fields in Mysore India. The entire transmitting and receiving machinery of this plant, as well as the transmission line, was constructed by us. The plant was started by our engineers last year and has continued in most successful operation. We have installed other plants of larger power and greater distances, but none under such great natural difficulties. Its successful completion reflects great credit upon our engineering and manufacturing staff.

Six of the 11 5,000-horsepower generators for the new power station at Niagara Falls have been put in operation and are highly successful.

It is interesting to note that the size and voltage of generators and transformers used in connection with long-distance transmission have greatly increased. We have in successful operation transformers of over 50,000 volts, and have orders for others to be used at 80,000 volts.

The design of our mining locomotives has been so highly satisfactory as to result in greatly increased business. It is interesting to note that one coal company now operates some 50 of these locomotives over 200 miles of track, mostly underground.

We have made many improvements in the apparatus for use on vessels of the navy and merchant marine, and we now have orders for the equipment of about 30 vessels.

Switchboards for the proper control and regulation of installations employing high pressures and large amounts of power have increased in importance. The apparatus, switching devices and systems designed and manufactured by us are recognized as possessing great superiority, resulting in recent orders for important switchboards in this and other countries aggregating over $1,800,000.

Our series alternating-current arc-lighting system, developed during the last few years, has been remarkably successful, permitting, as it does, the operation of circuits for arc lighting from the same generator that supplies incandescent and motor service.

A large demand exists for an electric light intermediate between the arc lamp and the ordinary incandescent lamp. Our engineers have developed the "Meridian" lamp for this purpose, which, on account of its beauty and unusually effective distribution of light, promises to result in a large increase of our business.

The demand for direct-current generators of large size, 2,000 kilowatts and over, has fallen off. This has been due to the increasing use of alternating current in the generating station and its conversion, where needed, into direct current at sub-stations through the medium of rotary converters. This system, which has been mentioned in previous reports, has now become standard for all large undertakings in this country and is being rapidly introduced abroad. Its great economy and flexibility has undoubtedly contributed largely to the successful and extended use of electricity for all purposes. It is interesting to note that the capacity of some of these sub-stations is much greater than that of the largest generating stations that were in existence a few years ago.

Our engineers have continued to perfect and develop various small articles of our manufacture, such as arc lamps, meters, instruments, switches, controllers, incandescent lamps, motors, etc. As a result many improvements in design and a number of novel applications have been made. Important improvements have also been made in our meters, rendering them even more accurate and attractive than heretofore.

As far as possible letters patent have been applied for to protect the numerous new and important engineering designs and devices.

The successful, effective and original character of the work of our engineers is unequaled, and the energetic and economical work of our factory managers is worthy of the highest commendation.

Miscellaneous.

During the year there was expended for acquiring new patents and in general patent expenses outside of the Sprague patents $386,875.93. The stock and bond account has increased about $3,000,000, principally due to the acquisition of the capital stock and mortgage bonds of the Sprague Electric Company and additional investments in the preferred stock of the British Thomson-Houston Company, Limited. The total par value of all stocks and bonds owned by the company is $17,489,363.07. They are carried at an aggregate book value of $12,682,103.63.

The annual meeting of the stockholders of the company will be held at Schenectady, N. Y., on May 12th, for the election of 13 directors for the ensuing year and for the transaction of such other business as may properly come before the meeting. The stock transfer books were closed on April 18th and will be reopened on May 13th.

Consolidated Balance Sheet of January 31, 1903.

ASSETS.			
Cash			$ 3,632,556 17
Stocks and Bonds	$12,682,214 63		
Real Estate (other than factory plants)	431,455 98		
Notes and Accounts Receivable	12,816,607 04		
Work in Progress	1,769,456 49		
		27,699,734 14	
Merchandise Inventories.			
At Factories	$10,297,594 99		
" General and Local Offices	1,165,921 00		
Consignments	97,700 73		
		11,561,216 72	39,260,950 86
Factory Plants		5,000,000 00	
Patents, Franchises and Good-will		2,000,000 00	
			7,000,000 00
			$ 49,893,507 03

LIABILITIES.		
5 % Gold Coupon Debentures	$ 99,000 00	
3½% " " "	2,049,400 00	
Accrued Interest on Debentures	$25 00	
Accounts Payable	1,378,860 42	
Unclaimed Dividends	1,886 29	
		$ 3,530,071 71
Capital Stock		$41,880,733 33
Surplus		4,482,701 99
		$ 49,893,507 03

Consolidated Profit and Loss Account of January 31, 1903.

EXPENSES.		
Cost of Sales		$ 28,844,881 40
Interest on Debentures		44,331 17
Profit for the current year		10,232,837 99
		$39,122,050 56
Deduction from Patent Account for expenditures incurred chiefly in acquiring the patents of the Sprague Electric Co		1,613,879 82
Dividends paid in Cash		2,677,263 50
Stock issued in restoring percentage of reduction made in 1898		16,746,133 33
Surplus at January 31, 1903, carried forward to next year		4,482,701 99
		$25,519,978 64

EARNINGS.		
Sales	$ 36,685,598 00	
Royalties and Sundry Profits	814,958 66	
		$37,500,556 66
Dividends and Interest Received on Stocks and Bonds Owned	393,961 49	
Interest and Discount	253,882 67	
		647,844 16
Profit on Sales of Stocks and Bonds		973,649 74
		$39,122,050 56
Surplus brought over from last year		15,287,140 65
Profit for the year ending January 31, 1903		10,232,837 99
		$25,519,978 64

ANNUAL REPORT OF GENERAL ELECTRIC COMPANY.

New Cottrell Storage Battery.

A new type of storage battery has been invented by Herbert Cottrell of Newark, N. J., which for long life, efficiency and lightness is said to surpass all other types of secondary batteries. It is especially designed for automobile use, and is stated to be 25 per cent. more efficient and nearly half as light as other makes. The Cottrell cell is 11 inches high, 5½ inches wide and 3½ inches in thickness. A single cell weighs 10 pounds. Ten of the cells can be housed in a box 12 by 12 by 18 inches in size, and will weigh, with all connections, less than 110 pounds. It is said that two of these sets will have sufficient capacity to drive a runabout automobile for at least five hours at 10 miles an hour. The battery can be charged and discharged quickly and without injury, and it is said to be practically impossible to buckle the plates.

The plates are formed of carbonized woven cloth, enveloped in thin sheet lead, which is tightly pressed over each side of the cloth and clamped around the edges. In the sides of the sheet-lead envelope are circular apertures exposing the carbonized fabric to the action of the battery fluid. The fabric is entirely saturated with a mineral substance, the name of which is not disclosed. This material completely permeates the fiber of the carbon fabric and builds up on it. There are only three positive plates in each cell.

Mr. Cottrell's American patents on the battery have been allowed and he is taking out foreign patents. A company known as the Moto-tractor Company of America has been formed at Newark to manufacture and deal in the batteries. The company is capitalized at $100,000 and has the following-named officers: President, Dr. Livingston S. Hinckley; vice-president, Herbert Cottrell; secretary and treasurer, Burnett M. Straus; counsel and agent, Benjamin F. Jones.

Boys Steal an Electric Car.

Irving Bancroft, 17 years old, and Frederick Echhardt, 18 years old, were arrested in Lowell, Mass., recently, charged with unlawfully taking an electric car from the Boston and Northern Street Railway Company's car shed in Dracut, Mass. A companion of the young men who lived in Tyngsboro was complaining in the middle of the night of the long walk he was going to have to reach his home. The accused volunteered to get an electric car from the shed and take him home. The outward trip was made safely in good time, but on the return the car left the rails at a corner and was found overturned in the roadway.

DEVELOPMENT OF THE TELEPHONE FIELD.

Cross-talk Between Grounded and Metallic Lines.

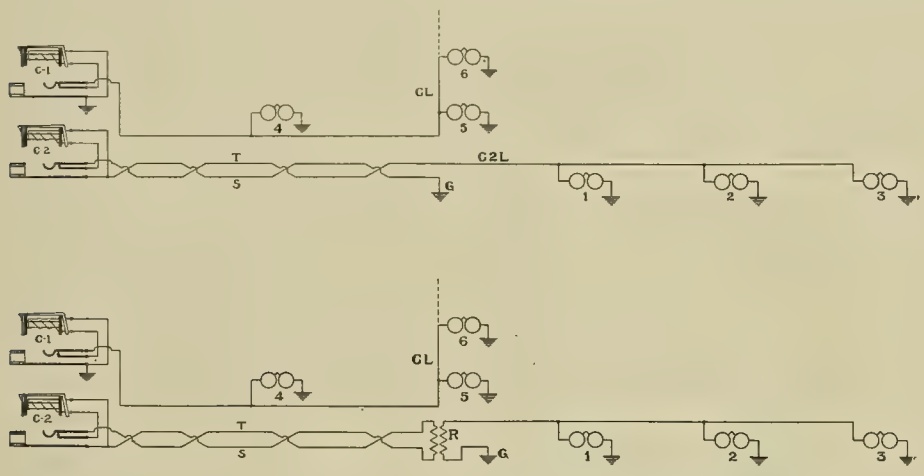
Frank Harrington of Washta, Iowa, submits a telephone problem to the Western Electrician, which, with reference to the sketch accompanying it, may be stated as follows:

"We have a grounded line which is metallic for two miles, one wire being grounded at the end of the two miles and the remaining wire continuing for several miles farther. The metallic portion of the line is properly transposed. Alongside of this circuit, up to the point where the metallic circuit ends, we have a parallel grounded line, and, even though the metallic-circuit portion of the line first mentioned is properly transposed, we find that we have cross-talk from the grounded line to the metallic circuit, and would ask whether we cannot connect a repeating coil to these circuits in some manner so as to prevent cross-talk between the grounded line and the metallic line?"

ANSWER.

The difficulty of cross-talk between the (C1) and (C2) circuits shown by Fig. 1, which is a copy of the diagram submitted by Mr. Harrington, is, of course, present, owing to the fact that the induced currents from the (C1) line are not prevented from acting upon the extension of the tip wire of the (C2) line. The fact that the sleeve or companion wire of the (C2) line is grounded, does not prevent cross-talk between the two circuits.

Thus, when a telephone conversation is passing over the (C1) line, it induces an approximate equal amount of current upon the (T) and (S) wires. Of course, the current induced upon the (S) wire does not cause any trouble, as it is conducted to earth, and thereby rendered harmless, as far as effects upon the telephones connected to the (T) portion of the circuit is concerned. However, the current induced from the (C1) wire upon the (C2) tip wire continues to pass over the (C2 L) line, and, of course, causes the cross-talk.



FIGS. 1 AND 2. CROSS-TALK BETWEEN GROUNDED AND METALLIC LINES.

There are two ways in which this difficulty may be cleared: One is by continuing the (C2 S) wire clear to the end of the (C2 L) circuit and producing, of course, a metallic circuit from one end of the line to the other. This plan, however, does not appear to be one which could be adopted by Mr. Harrington; therefore, the only remaining way to clear the difficulty would be to insert a repeating coil (R), Fig. 2, at the point where the (C1) circuit branches away from the (C2) circuit. In other words, a repeating coil must be inserted at the point where the sleeve wire of the (C2) circuit is grounded.

As will be observed by referring to Fig. 2, we have the same circuit conditions up to the point where the (C1) and (C2) lines separate, but it will also be observed that the repeating-coil primary is connected to the metallic circuit and the secondary to the grounded line. One side connects to the line and the remaining side to ground.

In relation to the probable proportions of a coil suitable for rendering a satisfactory ringing and talking service, it might be suggested that, under ordinary circumstances, the windings of the primary and secondary should be equal—equal, that is, as respects the number of turns. When ordering a repeating coil for this class of service, specifications should call for at least 6,500 turns or convolutions of wire on each the primary and secondary, and in order to prevent the resistance of the windings becoming too high, no wire smaller than No. 31 B. & S. gauge should be used. In one particular type of coil, the windings are divided up into four sections: First, second, third and fourth windings. Then the first and third windings are connected together for the primary, and the second and fourth windings are connected together for the secondary. This produces a total of 244 ohms for the primary and 294 ohms for the secondary, and in order to make this coil as efficient as possible, particularly for the ringing service, the core consists of very small iron wire formed around the outside of the winding. In order to prevent cross-talk between several coils placed alongside of each other, the entire arrangement is slipped into an iron tube, both ends of which are closed up with an iron plate.

The Evansville Situation.

The telephone situation in Evansville, Ind., is becoming more interesting as the work of the new municipal telephone company progresses. Many persons insist that the sensible course for the city to pursue in the interest of the people is to conduct its case in the courts, to show, if possible, that the Cumberland company has no rights in the city. They say if the city wins its case, and obtains the power to remove the Cumberland system from the city, the Cumberland company may have a complete exchange and system that may be for sale cheap to the municipal company, which will then have a clear field for its service. If the city loses the case, it will still have the same weapon of competition in its hands to demand better terms from the Cumberland company.

E. G. Williams and a force of construction men from the Western Electric Company of Chicago, are installing a new switchboard in the Cumberland company's new exchange building. Manager McGriff of the exchange says that within a short time the Cumberland company will have the finest and most complete telephone exchange in the country in operation in Evansville. The switchboard is of the common-battery, light-signal type.

TELEPHONE MEN.

Joseph Lockey of St. Paul has been succeeded as vice-president of the Twin City Telephone Company by L. L. C. Brooks, also of St. Paul.

Louis Middledorf has resigned as manager of the Interior Telephone Company of Grinnell, Iowa, and G. R. Van Dike from Belle Plaine, Iowa, has succeeded him.

W. J. Allison, for eight years manager of the United Telephone Company at Bluffton, Ind., has resigned to accept a similar position with the Bowling Green Telephone Company of Fort Wayne. Mr. Allison is a telephone man of ability as well as experience.

EXTENSIONS AND IMPROVEMENTS.

The Beaumont (Texas) Telephone Company has increased its capital from $120,000 to $200,000.

The Southern Bell Telephone and Telegraph Company has purchased the Hamlet telephone exchange at Hamlet, N. C., and will connect it with the long-distance line now being built in that section.

C. J. Simmons, president of the Standard Telephone Company, Atlanta, Ga., announces that the company has recently been reorganized and that extensive improvements, including a $40,000 switchboard, will soon be made.

The Chicago Telephone Company will open its new office located on Thirty-fifth Street, near Vernon Avenue, Chicago, about June 1st. All telephones south of Twenty-ninth Street, north of the Union Stock Yrds and Transit Company's railroad tracks, and east of the Rock Island railway tracks, will be operated from this exchange. New prefixes and numbers will be given subscribers located in this district.

Ohio Telephone Notes.

There was something of a flurry in the stock market at Cleveland the past week, due to a report that a plan of reorganizing the Federal Telephone Company had been adopted. As a result the stock took a big drop. In fact, however, no plan has yet been adopted. The one reported was to the effect that money to pay the indebtedness was to be raised by the sale of preferred stock to the present stockholders, which would mean that stockholders would be expected to take new preferred stock in proportion to the amount of stock they now hold.

The Pennsylvania Railway Company has arranged with the Bell Telephone Company to install a branch system in its office at Alliance which will connect it with all the departments, the homes of the officers and employes and all the important cities in this section of the country, including Cleveland, Pittsburg, Wellsville and a number of small places. This is rather an innovation in the telephone business in Ohio.

A report is current that a company known as the Ohio Valley Telephone Company is being organized with a capital stock of $200,000 to absorb all the Independent plants between Wheeling, W. Va., and Cincinnati, and to build lines to Portsmouth, Lexington, Ky., Lebanon and Wilmington, Ohio, and other points. A telegram from Portsmouth indicates that the Central Union or Bell interests are trying to secure some of the Independent plants in that section, in order to block the movement of the new company. President W. B. Seaton of the Lawrence Telephone Company at Ironton, denies that either the plant there or at Ashland will be sold to the new company.

The Citizens' Telephone Company of Springfield is arranging to build a number of new lines through the country this summer. An exchange will be built at Bowersville and a toll line several miles in length is to be built. Besides, lines will be built each way from the town along the Blaintown Pike to accommodate the farmers. Lines will also be built out of Jamestown on the Cedarville Pike and one will cross over to the Jeffersonville Pike and run some distance on it. Several other extensions and improvements are in contemplation.

An estimate on the telephone system to be installed by the Lake Shore Railroad from Chicago to Buffalo and from Ashtabula to Youngstown places the cost at $500,000. The total length of wire will be something like 1,200 miles.

The stockholders of the Cuyahoga Telephone Company, Cleveland, will meet on May 21st to vote on the plan of refinancing the company, which has been approved by the directors. This involves the shrinkage of the capital stock of the company from $3,000,000 to $1,500,000, by the reduction of the value of the shares from $100 to $50, afterward issuing $2,000,000 in six per cent. cumulative preferred stock, $1,200,000 of which will be sold to the stockholders at $70, and the remainder will be retained in the treasury, to be sold at not less than $80. The Federal Telephone Company, to which the Cuyahoga owes $569,240, will take stock for the debt.

The Orange Telephone Company, made up very largely of Kenton men, will build 200 miles of toll line in Texas this year. The company has several exchanges in that state already. The principal towns to be connected by the toll line are Dallas, Texarkania, Orange and Paris. O. M. C.

Telephone News from the Northwest.

The board of county commissioners of Ramsey County, Minn., in St. Paul, received a bill from the Northwestern Telephone Exchange Company for seven years' service, amounting to $1,750.73, and an extra bill for toll service of $374.50. The board refused the bill and ordered the Northwestern instruments removed from the building. An arrangement will be made with the Twin City Telephone Company for an extension of its interior exchange, covering the courthouse. The contract is for 50 instruments at $20 a month, and additional connections at 50 cents each. The Northwestern's bill will be fought in the courts before it will be paid, according to members of the board. They declare that the instruments were installed in the different offices, from time to time, without sanction of the board.

E. H. Moulton of Minneapolis, president of the Twin City Telephone Company, has returned from a trip East and declares that the controlling interest in the stock of the company has not passed to Pittsburg capitalists. On the contrary he has just secured a block of stock which has been held in Chicago. The Twin City stock, both common and preferred, is held in St. Paul and Minneapolis.

The Zenith Telephone Company of Duluth has asked a permit to construct a subway system in the business district of the city.

The Little Wolf Telephone Company, with headquarters at Fond du Lac, Wis., was sold at receiver's sale to Leander Choate of Oshkosh, Wis., for $65,000. The company has an exchange of 800 connections in Fond du Lac and 450 miles of lines. The purchase price covers the bonded indebtedness.

The Northwestern Telephone Exchange Company has cut the toll rate between the Twin Cities and Mankato, Minn., the new rate being 20 cents for two minutes and five cents for each additional minute. This is done in competition with the Minnesota Valley Telephone Company, which made a 30-cent rate.

An automatic telephone exchange is to be installed for Towner, N. D., as soon as the materials arrive.

The Bloomer (Wis.) Telephone Company has increased its capital stock to $15,000.

The Cherokee and Correctionville exchanges in Iowa and the connecting toll line have been sold to the new Cherokee County Telephone Company, which is controlled by the New State Company.

The Wisconsin Telephone Company is building a direct long-distance line between Kaukauna and Manitowoc, Wis., to handle the Green Bay and northern Michigan business. This will shorten the distance and simplify the service.

The Appanoose County Telephone Company has been organized at Centerville, Iowa, as the successor of the Centerville Telephone Company. The capital stock is $60,000, and numerous extensions and improvements will be made. R.

Indiana Telephone Items.

The Uniondale Telephone Company, a farmers' system, and lines running from Osian, Sheldon and Roanoke, respectively, will make connections and put up a new switchboard at Zanesville. There is no free talk over these farmers' lines by outsiders. A fee of 10 cents is charged; five cents goes to the company and five cents to the farmer from whose house the person is talking. This plan has provided quite a little revenue for the companies.

The Knox County farmers' telephone systems are being connected with the Vincennes company, and soon the city wires will reach a thousand farmers.

An important meeting of representatives of all the telephone companies of Sullivan County was held in Sullivan on April 25th, at which arrangements were made for unifying the various lines and installing a complete county service. It is estimated that it will give Sullivan direct communication with 12,000 telephones in Sullivan and adjacent counties. Under the agreement the local company will operate all telephones in Hamilton Township. The general exchange will be located in Sullivan and the arrangement made will give free service with all telephones in Greene, Daviess and Clay Counties and Crawford County, Ill., and connection with the Independent system will give free service in Vigo and Knox Counties.

The following new telephone companies filed articles of incorporation in this state during last week. The name and address of the company, amount of capital stock, territory to be served, and name of one director are given:

Sulphur Springs Telephone Company, Sulphur Springs; $7,000; Sulphur Springs and in Henry County; J. W. Whitworth.

Mt. Lebanon Telephone Company, Brandywine Township, Hancock County; $3,000; in Brandywine Township; Emanuel Smith.

Local Union Telephone Company, Washington County; $10,000; in Washington County; T. T. Morris, Washington, Ind.

Mooresville Telephone Company, Mooresville; filed amendment to articles of incorporation and increased capital to $12,000.

F.

Indiana Long-distance Company.

The stockholders of the New Long-distance Telephone Company of Indianapolis have authorized a $5,000,000 mortgage to take the place of the $1,000,000 mortgage issued in July. President Sheerin of the company says that the growth of the business has been a surprise to the company as well as to the public. The company will make a number of extensions, complete its lines between Indianapolis and Louisville and St. Louis, and construct additional circuits between these cities. It will also build lines to Logansport and Peru. Mr. Sheerin also stated that it is now definitely settled that Indianapolis and Chicago will have Independent telephone connection by fall. The Independent people have got a foothold in Chicago and will build lines radiating from that city and will connect with the long-distance lines at Lafayette and other points further east. At a recent meeting the stockholders re-elected the old board of directors, who in turn re-elected S. P. Sheerin, president; A. M. Ramsey, vice-president; H. B. Sales, secretary, and A. H. Nordyke, treasurer. The report of the secretary for the fiscal year showed $16,602.49 passed to the surplus, after the payment of the expenses of every kind (including quarterly one per cent. dividends), which, added to the $14,085.77, surplus of last year, makes the present total surplus $30,688.26.

More Telephone Patent Litigation

Injunction suits have been brought by the Kellogg Switchboard and Supply Company of Chicago, in the United States Circuit Court, against the Stromberg-Carlson Telephone Manufacturing Company of Rochester and Chicago, and the Louisville Home Telephone Company of Louisville, Ky., asking that the former be restrained from infringing (by manufacture and sale) patent No. 718,855, granted to Kempster B. Miller, for a telephone wall set, and that the latter be restrained from infringing (by purchase and operation) reissue patents Nos. 12,031, granted to Francis W. Dunbar for a two-wire telephone system, and 12,090, granted to William W. Dean, for a two-wire testing system.

In relation to these suits, an officer of the Stromberg-Carlson Telephone Manufacturing Company said that the action based on patent No. 718,855 related only to woodwork purchased by his company in the open market and not used by the Louisville Home Telephone Company. The other suits are directed against the Louisville company.

Monopolistic Law in Connecticut.

The Connecticut legislative judiciary committee has adversely reported the bill repealing the general telephone law by which no new telephone company can install a service without securing a Superior Court order stating that public necessity and convenience demand such service. This law was enacted through the influence of the Southern New England (Bell) Telephone Company. As that company covers the state, it would be practically impossible for an Independent company to obtain the necessary court order.

GENERAL TELEPHONE NEWS.

The People's Mutual Telephone Company of Hillsboro, Ill., has been authorized to increase its capital from $5.000 to $10,000.

A telephone system will be installed at Capon Bridge, W. Va., by the recently incorporated Capon Bridge Telephone Company, which is capitalized at $10,000. Edward Oats is among the incorporators.

The automatic telephone system in use at Fall River, Mass., seems to be successful. The number of subscribers' stations is now over 1,000. A delegation of citizens from Lewiston and Auburn, Maine, recently visited the Fall River plant and made an investigation with a view to installing a similar system for the two towns. The committee was favorably impressed and will recommend the installation of an automatic exchange.

The London Home Telephone Company has recently been incorporated and has absorbed the Madison-Clark Telephone Company of London, Ohio. The officers of the new company are: President, W. M. Jones; treasurer, R. W. Boyd; secretary and manager, W. J. Much. These, with E. L. Barber and H. S. Mitchell, constitute the board of directors. The company will do some rebuilding and intends to dispose of the South Charleston and South Solon plants to S. B. and J. F. Rankin of South Charleston, Ohio.

MANUFACTURERS AND DEALERS.

The Swedish-American Telephone Company of Chicago has issued a new catalogue in the form of an "art souvenir." Illustrations of the company's products, including telephone switchboards and parts, are artistically set off by pen drawings, and descriptions of the different pieces of apparatus are given at the end of the book. The cover is of dark green with the name of the company embossed in gold.

In a 100-page catalogue, known as Bulletin No. 2, the publication department of the Stromberg-Carlson Telephone Manufacturing Company of Chicago has compiled information and data which not only describe the company's apparatus in a clear and simple manner, but which should also prove of assistance to farmers and small buyers of telephone apparatus, for whom the bulletin is intended. The publication is devoted to bridging telephones and gives apparently all the information needed to proceed with the organization, building and maintenance of a rural telephone line. The illustrations of the apparatus and of the various details of line construction are of an excellent quality, the wiring diagrams being particularly clear. A chapter is devoted to village telephone systems, troubles and their remedies are discussed, and the book closes with a model constitution and by-laws for a telephone company and samples of petitions for right-of-way and permits. A full index completes the bulletin, which is a credit to its compiler.

The Automatic Electric Company of Chicago has begun the shipment of automatic telephone equipment to the Dayton Home Telephone Company of Dayton, Ohio, and the Citizens' Telephone Company of Grand Rapids, Mich. The Dayton company will begin business with 6,000 stations, and its ultimate capacity will be 19,000. The Grand Rapids company will have a present installation of 5,000, with an ultimate capacity of 19,000. Both of these companies have erected new buildings which were designed especially for the automatic exchanges. An interesting feature of both of these large installations will be that no party lines will be used, each subscriber having a private wire. The Automatic Electric Company is also manufacturing complete equipment for the Citizens' Telephone Company of Columbus, Ohio, in which plant 7,000 stations will be installed at first, with an ultimate capacity of 19,000. The Northeastern Telephone Company of Portland, Maine, has also placed an order with the Automatic Electric Company for 2,500 telephones and switches, the switchboard to have a capacity of 10,000. The recently organized Commonwealth Telephone Company of Manchester, Iowa, has placed an order with the Automatic Electric Company for the equipment of 1,200 stations, with a capacity of 10,000. An order has also been given by the Wettstein Construction Company, which will build the new exchange in Burlington, Iowa. This order calls for the present equipment of 800 stations and an ultimate capacity of 10,000.

New Combination Ohmmeter.

The accompanying illustration shows a new form of Sage ohmmeter that is being placed on the market by Machado & Roller of New York city, the licensees under the Hanchett and Sage patents. This new instrument differs from the old form in having added a galvanometer and an induction coil. Two switches are also provided and with the aid of one either the telephone receiver or the galvanometer may be used as the current detector at will. The other applies either direct current from the batteries or alternating current from the secondary winding of the induction coil at will.

The galvanometer is of the D'Arsonval form, unaffected by external magnetic influences, well balanced so that care in leveling is not required, and of a sensibility even superior to that of the telephone receiver. It is of course also unnecessary to place the meter in any particular meridian in order to bring the galvanometer to zero. The galvanometer is a valuable adjunct in that it enables the set to be used where there is too much noise to make the employment of the telephone receiver possible

NEW COMBINATION OHMMETER.

and further gives a means of working from a false zero in making the Murray test.

The induction coil makes it possible to compare capacities and inductances and to measure the resistance of electrolytes or internal resistance of batteries. It also comes into play when locating faults on lines where an electromotive force exists at the fault, as for instance in a submarine cable where one or more conductors are grounded or both open and grounded. By keeping the telephone-receiver circuit closed the electromotive force at a fault of this kind causes a continuous current to flow which does not affect the telephone receiver, the alternating current from the induction coil of the instrument alone being effective for use in obtaining a balance.

The number of cells of battery has not been reduced and the overall dimensions have not been increased, while the weight is only about a pound more than that of the original form of apparatus. It is asserted that tests that have recently been made under the most severe service conditions show this form of meter to be superior in every way to a bridge and galvanometer for the location of faults.

Rauscher Push Buttons.

The accompanying cuts illustrate three styles of push buttons manufactured by John Rauscher of St. Paul, Minn. These buttons are finished in maple, oak, ash, imitation walnut, cherry, mahogany and

RAUSCHER PUSH BUTTONS.

rosewood. Brass springs are used in all the push buttons. Mr. Rauscher is well known as one of the largest manufacturers of push buttons and other similar products and supplies some of the largest dealers in the country. Every known make of push button is turned out at the Rauscher factory, from the cheapest to the most expensive. Mr. Rauscher has recently added improved machinery and is, therefore, able to supply the demand for his products more quickly than heretofore.

The Illinois Union Railway Traction Company has filed articles of incorporation with the Warren County, Ill., recorder of deeds. The capital stock is $500,000 and principal offices are at Monmouth. The company proposes to construct a system of interurban electric roads north from Monmouth to Aledo, Rock Island and Muscatine, and from Monmouth south to Roseville, Macomb, Hamilton and Keokuk. W. W. McCullough, Monmouth, Ill., is one of the directors.

Why Tidal Energy is not Economical for Industrial Purposes.[1]

By C. P. Baillairge.

The mean or average rise and fall of the tides in the vicinity of Quebec on the Lower St. Lawrence may be taken at, say, 12 feet, the neaps being seven to eight feet and the high and spring tides 14 to 18 feet.

It is thus seen that one of the difficulties of dealing with the problem is the constantly varying velocity which any system of gearing to be operated by the tides must be subject to, and which must be sometimes as great as from one to three; since a rise at neaps of six feet can only create directly a motion having a velocity equal to but one-third of that due to a rise at springs of 18 feet in the same number of hours; because of the varying attraction or power of attraction of the moon and sun and according as they are in conjunction, as during what are called the sizygies, when the moon and sun both pull the same way, or in opposition, as at full moon, when their pull or influence is exercised in opposite directions; and a minimum when the moon is in quadrature, when the then influences of the two attracting bodies are counteracting each other.

Again, as there are, during the 24 hours, two rises and falls of the tides, and as at high tide, there is a momentary lull before the tide begins to ebb and at low tide a similar interval of what is called "slack water," there must also be in the working of any machinery actuated directly by the tides, the same dead points or nearly complete stoppages, which would render such a power as that of the tides absolutely out of question, even if it could be economically utilized for such services as electric tramways, electric lighting or other services which require to be continuous, and which, even if the motion of the tides were continuous, could not either be of uniform intensity; since, as already said, the varying velocities of motion must at certain moments of the day, more so during certain periods of the month and still more so during the varying seasons of the year, be subjected to constantly varying fluctuation.

But this alternating action of the rising and falling tide water can be made continuous in its results, as with the wind, which is another intermittent or irregular source of power. In the same way as the wind can be utilized at irregular intervals for work not necessarily consecutive or continuous; as in pumping water into a railway or other tank, sawing firewood, threshing grain, pumping out the bilge water of a pontoon or other vessel, grinding corn, etc.—so could the tides be utilized; but for continuous action, the only and best way in which the power afforded by them can be brought to bear, or one of the best ways in which this can be done, is by pumping and storing sufficient water in a reservoir or cistern of adequate dimensions, to hold out from tide to tide, or from day to day, moon to moon, and season to season. The dimensions of the recipient would have to be regulated so as to equalize the outflow from it or nearly so, and the outflowing stream could be used to revolve an overshot or breast wheel; or, better with a turbine, to give the continuous motion sought for. Tide motion, it is evident, might thus be utilized successfully, more especially in such inlets or estuaries as the Bay of Fundy, where the rise of the tide attains to 40 and even 60 feet, and, in some such estuaries, in other parts of the world, where the tidal amplitudes are very great.

The mechanical action of the tide above alluded to may be secured in two ways, viz., either by a float or pontoon rising and falling with the tide, and by means of a connecting rod, as between the crank and piston of a steam engine, through or without the intermediary of a working or oscillating beam, procure a rotary motion capable of being multiplied by gearing into a speed practicable for some purposes; or by a more direct method of tidal action resorted to in a good many cases already, which consists in enclosing as large an area for the storage of tide water, as can be had by damming a ravine or the mouth of an estuary or river so as to permit the rising tide to overflow the dam in a way to fill the enclosure. Upon the tide receding, the volume of water impounded (especially when supplemented as it may be by the flow of the river itself, or even if there be no other delivery of water into the enclosure) will suffice to keep a turbine or other wheel going during the whole interval between two successive tides, with, of course, increasing energy as the tide falls, and again decreasing power as it rises.

As early as 1847 the writer advocated the damming of the St. Charles estuary, across from the city of Quebec to the Beauport side, a distance of quite a mile at the site proposed. This would have kept up the water within the dike to high-tide level all the year round. Now it is conceivable how, in this case, the falling tide might be rendered useful and, so to say, operative, though in an indirect or negative manner, by having along the dike, on its outer side and running its full length or less, a line of shafting laid below low-water level and causing it to be worked or rotated at intervals along the line, by as many turbines driven by the outpour of water through sluices provided for the purpose. The shaft, as in the hold of an ocean steamer, is carried along on proper pillar blocks to the screw propeller prolonged into a power house at either or both ends, on the opposite shores of the river, the size of the basin being such that, continuously replenishing by the flow from above, such a sheet of water would fall but very little until supplemented by the next rising tide through overflow weirs for the purpose, with their crests at the proper level and with gates adjustable to suit.

Still, however, would this be an expensive mode of getting power, and especially power of such a constantly varying nature as that due to the greater or less velocity of action of the actuating turbines under the constantly varying head of water, consequent upon the rise and fall of the tide on the outside of the dike, and applicable only to intermittent work; while shifting again, with the hour of the day and night, and thus most unsatisfactory.

It will be immediately evident that in order to subserve any practical purpose in the arts and trades, the very slow motion of the rising or falling tide must be converted into one much more rapid. It has already been said that the average direct motion or velocity obtainable at Quebec and vicinity may be taken at 12 feet rise and 12 feet fall, or 24 feet per tide, or say, per 12 hours; though, due to the retardation of the moon's motion, the tides be some 50 minutes later on each successive day. This is equivalent to a motion of two feet per hour; or, taking it another way, the rising and falling tide can only cause one revolution of a wheel in 12 hours, if actuated by crank action.

Such motion or rotation of a wheel can be conceived of as actuated from a floating body rising and falling with the tide, the wheel being equal in circumference to the combined flow and ebb, or, say, 24 feet, and, therefore, of a diameter of eight feet, or a little less, a vertical rack taking hold of and lifting one side of the wheel through half its circumference during rise of tide and the ebb pulling it down by an equal amount by a corresponding vertical rack on the opposite side, while several revolutions per diem might be obtained by applying the rack to a pinion on its shaft, and thus get, say, one revolution per hour instead of only one in 12 hours.

But this system of causing the wheel to rotate, while true in theory, would be difficult to carry out in practice. Now, supposing all the difficulties of construction and rotation overcome, still have we as yet but a wheel rotating only twice in 24 hours, or, of course, too slow for anything but astronomical purposes, and too irregular for that.

We are told in mechanics that the net duty derivable from machinery in general, due to loss by friction of the operating mechanism, is but 85 per cent. of the initial power, or a 15 per cent. loss of energy; and the machinery in this case, to arrive at a reasonable velocity for any purpose must not only be doubled, trebled or quadrupled, but it must be multiplied by five or quintupled; and if the same allowance for retardation by friction obtained throughout, the loss would be not less than five times 15, or 75 per cent., leaving but one-quarter of the initial power to the good.

If, however, the loss by friction, as may sometimes be warranted, be taken at only 10 per cent. instead of 15, there would still be but four horsepower realized out of every 10 of the direct lifting or falling power of the tide, and this alone is enough almost to dissuade anyone from falling back upon or appealing to the tides for a lucrative mode of creating or utilizing power; and if we attempted to reach such higher velocities of revolution as required for electric power purposes, it is easy to see how the whole or nearly the whole of the initial power of the tides might be absorbed in so doing, and not enough of it remain to make it a paying business.

Therefore, it is probable that if the tides have not as yet been utilized by man, it is because he has by mental processes gone through the line of reasoning here laid down, and thus become convinced of the futility of making the trial, especially under the discouraging consideration that not only is there the loss by absorption by rubbing surfaces, but the other allowance of 10 per cent. for wear and tear, and consequent repairs, etc.

The tide wave has no greater power than that which is required to raise its own weight of water to the average height of one-half a tide, or one-half the weight of water to the full height or amplitude. In other words, the lifting force of the tide per square foot or of the moon and sun which actuate it, is, for an average rise and fall of 12 feet, here assumed approximately equal to 12 cubic feet of water, or 750 pounds raised to an average height of six feet, viz., 4,500 foot-pounds, or, as said before, to one-half the weight of 750 pounds, or 375 pounds lifted to a height of 12 feet.

But we have the same force or power developed in the falling tide, as with an ordinary waterpower, or the power exercised by falling water.

The 4,500 pounds has thus to be doubled to be representative of the power developed by a whole tide of rise and fall, or flow and ebb; and as there are two such tides, roughly, in 24 hours, which (unlike a horse that must have rest and can only labor for eight to 10 hours a day), are constantly and automatically at work, we thus get at the fact that one and every square foot of water surface exercises a power of 18,000 pounds during the 24 hours.

Now a horsepower (H. P.) is estimated to be equivalent to 33,000 pounds raised to the height of one foot in one minute of time, or 330 pounds raised to a height of 100 feet in one minute of time. Thus, then, every square foot of water surface in such a tidal river as the St. Lawrence from above the gulf, to somewhere above Quebec, or in any other river with an equal rise and fall of tide, is a source of power only equivalent to about one-half or two-thirds of a horsepower in 24 hours.

But a horsepower, as just set forth, is equal to 33,000 pounds raised one foot high in one minute of time, or 33,000 foot-pounds; and in 24 hours there are 1,440 minutes; therefore, must we utilize double the number of feet, or 2,880 square feet of float area to secure the power of one horse working during 24 hours at the rate of 33,000 foot-pounds per minute.

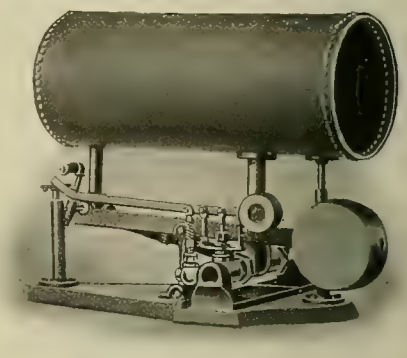
And even if we take but 30,000 foot-pounds per minute for a horsepower, as some would have it, and suppose this power to be exerted only during eight to 10 hours out of 24 hours, still do we arrive at the conclusion that in round numbers it requires an area of 800 to 1,000 feet, or thereabout, of water surface, to represent one horsepower, or a float of, say, 40 or 50 feet by 20 feet, or for 100 horsepower, say again, one of 800 to 1,000 feet by 100. And, therefore, if the writer's figures be correct, it is not to be wondered at that the power of the tides has never as yet been, nor is ever likely to be, economically utilized for industrial purposes.

1. Abstract of paper read before the annual meeting of the Canadian Society of Civil Engineers at Montreal, Que., January 27 to 29, 1903.

Morehead Return Steam Trap.

The condensation from any steam-heating or cooking apparatus must be removed and the more quickly it is removed the drier and more effective will be the heating surfaces. It is extravagance to waste it as it is pure water, and hot. The most effective way to utilize the heat it contains is to deliver it into the boiler before it loses its latent heat, and in no other manner can the condensation be handled as quickly and with the same economy as with a return trap.

The Morehead return trap is constructed of steel, the heads and longitudinal seams being closely riveted and caulked, to withstand any pressure carried on the boiler without breaking. It is simple and all working parts are on the outside, in plain sight, and easily accessible. This trap is located six feet or more above the water line of the boiler. The water from the condensing surfaces is forced by the pressure of steam from behind, through a pipe leading to the trap, with a swing check valve close to the latter. As soon as sufficient water has entered the receiver to overcome the counterbalance weight, the receiver tilts down, allowing the water to pass through the discharge pipe, at the same time opening the steam valve, which has a pipe connected with the dome of the boiler.



MOREHEAD RETURN STEAM TRAP.

By equalizing the pressure on the surface of the water in the receiver with that in the boiler, the water, in simple obedience to the laws of gravity, flows into the boiler. As soon as the receiver is empty it tilts back as before, and again refills. The trap is prompt in opening and closing, its action being entirely due to gravity. When once set up it requires no further attention. It takes the water from the condensing surfaces whether they are above or below the water level in the boiler, and automatically returns it to the boiler at the temperature due to the pressure at which the steam is condensed. There is no outlet by which the steam can be wasted. The trap is quick and positive in delivering the water into the boiler against any pressure, and regardless of fluctuations of pressure. It supplies all the water needed in the boiler from the main water pipe, providing there is enough pressure on the main to lift the water to the trap, thus performing the duties of a pump or injector. It operates equally well with high or low-pressure coils, or coils using exhaust steam, allowing no condensation to collect in them.

For a boiler plant of 200 horsepower having an efficiency of 65 per cent, and an evaporation of 6,900 pounds of water per hour, from and at 212 degrees, under average conditions, the saving effected by a Morehead return trap for a year is said to be more than twice the cost of installing one large enough to handle such a plant.

Where a Morehead return trap is not employed, the usual way of handling condensation is by means of a pump. A comparison of the two methods shows many points of advantage in favor of the former.

The manufacturer of the Morehead return trap, the American Blower Company of Detroit, Mich., asserts that it requires practically no attention, needs no lubrication, will not race or run away, is noiseless, and requires little room and no foundation.

McGarvey Vibratory-motion Devices.

About four years ago Edward McGarvey of Bellefonte, Pa., began a series of experiments on vibrators of different kinds, with a view of constructing, if possible, an automatic weight recorder for railroad scales. After experimenting on various devices embodying the principles of harmonic vibration he is said to have obtained satisfactory results with a thin steel ribbon stretched between pivoted nodes, which was so acted on by the levers or beams of a scale that any change in the weight applied would produce a change in the rate of vibration of the ribbon by increasing or decreasing its tension. The vibrating rate was maintained by electromagnetism and transmitted by the same means to the recording mechanism, wherein a set of musical reeds was acted upon. It is stated that certain ones of these reeds would vibrate in sympathy with the ribbon and produce an accurate record of the weight. A special self-adjusting interrupter was constructed, and the tendency of the parts to stick by the action of the current was overcome by the addition of a special electromechanical tapper. Mr. McGarvey was ably assisted in this work by Guy C. Linn of Cleveland, Ohio, and the machine described was protected by patents.

Mr. McGarvey's attention was also attracted to valuable uses of the harmonic principles along other lines, several of which have since been worked out. One of these devices, for which a patent has been applied, is a party-line, selective-call and locking-out telephone system, by which, according to the assertions of the inventor, any number of subscribers up to 25 can be placed on a line, any one of which can call, or be called, without ringing the bells of the others. This device is said to be of simple design and to be applicable to instruments of any make.

By using the principles of harmonic vibration this same inventor has also devised a syntonic space-telegraph system, which is said to do the work in a thoroughly practicable manner. The ordinary tapper used with the coherer is replaced by a thin vibrating reed tuned in unison with the vibratory rate of the interrupter at the sending station. Mr. McGarvey has also found the vibratory system applicable to the following systems, some of which have been worked out: A selective annunciator system for use in elevators, hotels, etc.; a system of recording watt, volt and ammeters for light and power installations; indicators to show the number of alternations per second in an alternating-current circuit; an automatic and autographic telegraph system by which printed matter and sketches can be transmitted and recorded.

For the purpose of patenting, perfecting and marketing these and other inventions of Mr. McGarvey relating to harmonic vibration, the International Electric Company of Bellefonte, Pa., was organized last fall with Hugh S. Taylor as president. The patent rights of this company have quite recently been purchased by the Central Electric and Manufacturing Company of Youngstown, Ohio, a corporation composed of a number of local business men of Youngstown. Mr. McGarvey will take a position with the Central company and will develop new ideas along the line of harmonic vibrations. A factory will be erected at Struthers, Ohio, a suburb of Youngstown, where these goods, together with a complete line of electrical supplies and specialties will be manufactured.

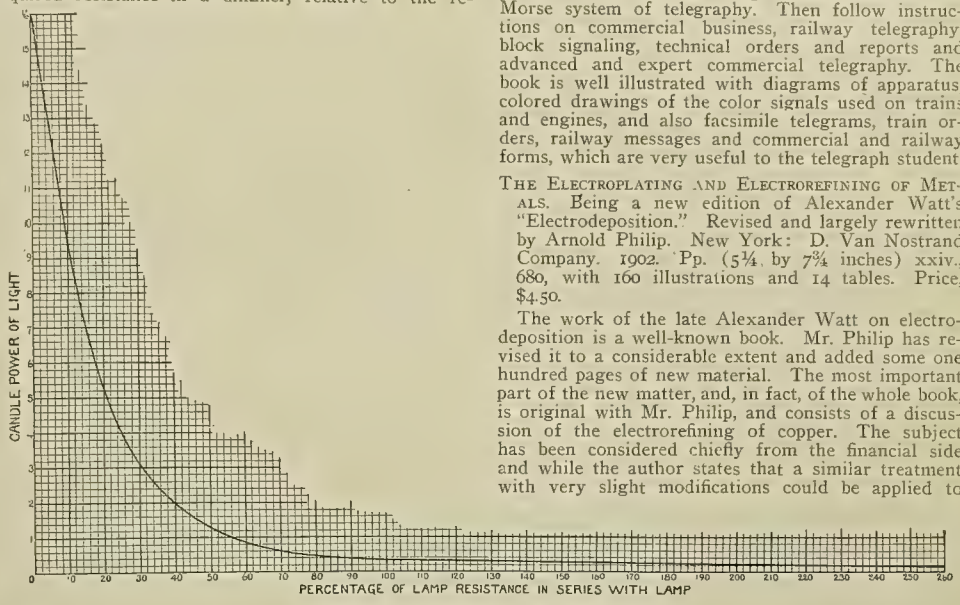
Power Transmission for Clermont-Ferrand, France.

The gas company of Clermont-Ferrand, France, is now making an interesting hydro-electric installation which is designed to reinforce its existing electrical plant. The new works are situated on both sides of the River Sioule, below a large dam which forms a lake about four miles long, having an average breadth of 130 yards and a surface of 250 acres. Independent pipe lines, fixed in masonry, will supply each of the six 1,000-horsepower turbines, which are of the horizontal-axle Francis type. Each turbine will be connected to a Westinghouse three-phase, 1,000-volt, 800-kilowatt alternator, operating at 333 revolutions per minute. The two exciters, of 37.5 kilowatts each, are driven by small auxiliary turbines. The voltage will be stepped up to 20,000 by means of single-phase transformers, grouped in threes. The overhead transmission line is to be double, and about 30 miles in length. Poles and cross-beams will be of wood, the latter being boiled in paraffin and then covered with a layer of tar. The setting up of the line, as well as the construction of the electrical and mechanical apparatus, has been undertaken by the Société Anonyme Westinghouse of Havre. The hydraulic part of the work has been hurried forward during the last year and is now well advanced, while the mechanical and electrical equipment is just finished. Current will be sold at Clermont-Ferrand, which is a great center for the rubber trade, for both lighting and power, and considerable development of the existing works is expected.

The City Council of Harrodsburg, Ky. (J. H. Grimes, mayor) has voted to issue $18,000 of bonds for the installation of an electric-light plant.

Curve of Candlepower and Resistance.

After making several attempts to obtain accurate information as to the relation of candlepower and resistance of incandescent lamps and being unable to get from photometrists reliable measurements at low candlepower, the Wirt Electric Company of Frankford, Philadelphia, has had prepared the accompanying candlepower and resistance curve. Professor J. W. Langley of Case School of Applied Science, Cleveland, made the tests and obtained the data from which the curve was drawn. The curve is plotted with candlepower as ordinates and percentages of lamp resistance in series with the lamp as abscissæ. The curve begins at 16 candlepower, with normal resistance and shows how the candlepower decreases as resistance is added. It is correct for incandescent lamps with an efficiency of 3.1 watts per candle. The curve shows the required resistance in a dimmer, relative to the resistance of the lamps, for any dimming effect to two-tenths of one candle on each 16-candlepower lamp. If extended, the curve would reach zero at about 1,000 per cent., or, in other words, to bring a lamp down to a black carbon (viewed in the dark) 10 times the hot-lamp resistance will be needed. This curve will be found especially valuable by the designer of a lamp dimmer, as it enables him to proportion the different steps in the resistance properly and indicates the total amount of resistance that can be used effectively.



CURVE OF CANDLEPOWER AND RESISTANCE.

National Electric Light Convention Notes.

H. T. Hartman, editor of the question box for the coming convention of the National Electric Light Association, Chicago, May 26th, 27th and 28th, has already received over 200 answers to the preliminary list of questions sent out April 1st. Nearly every one of the 125 questions has been answered. A supplementary list, nearly as large, has just gone to the members, and the question box this year promises to be an encyclopædia of useful knowledge for central-station managers.

Robert L. Elliott of Chicago, reporter on theft of current, has prepared an excellent report for the Chicago convention, describing different ways in which electric current is stolen, showing means for detecting the guilty persons, and suggesting methods for preventing the possibility of theft. The report will also show which of the states have laws punishing this crime and what uniformity exists in the laws of the different states. It is hoped that a uniform law can soon be exacted in all the states.

C. O. Baker, Jr., master of transportation for the National association, announces that the New England Passenger Association, the Trunk Line Association, the Western Passenger Association and the Southeastern Passenger Association have granted a rate of a fare and a third, on the certificate plan, from all points in their respective territories to Chicago and return for members and delegates attending the convention.

Receivers for Helios-Upton Company.

A Boston dispatch, dated April 28th, says: "Norman W. Bingham of Somerville and Edward Davis of Philadelphia to-day were appointed by Judge Colt in the United States Circuit Court receivers of the Helios-Upton Company, a New Jersey corporation, with places of business at Peabody, Mass., Philadelphia and Chicago, and engaged in the manufacture of electrical appliances. The receivers were appointed in a suit brought by King Upton of Salem, a creditor with a claim exceeding $76,000, and the largest stockholder in the corporation. The debts of the company, it is alleged, exceed $235,000."

BOOK TABLE.

TWENTIETH CENTURY MANUAL OF RAILWAY AND COMMERCIAL TELEGRAPHY. By Frederic L. Meyer. Chicago and New York: Rand, McNally & Co. 1902. Pp. (4½ by seven inches) 249, with diagrams and illustrations. Price, $1.

This is a practical book written by a practical man who has had 14 years of telegraphic experience on some of the fastest wires of the United States, Canada and Mexico. The work is intended for the beginner in commercial telegraphy, but contains much information for skilled telegraphers and will also be found useful by the business man or anyone who uses telegraphy for the transaction of business. Brief instruction in elementary electricity is given in the first part and the following section describes the Morse system of telegraphy. Then follow instructions on commercial business, railway telegraphy, block signaling, technical orders and reports and advanced and expert commercial telegraphy. The book is well illustrated with diagrams of apparatus, colored drawings of the color signals used on trains and engines, and also facsimile telegrams, train orders, railway messages and commercial and railway forms, which are very useful to the telegraph student.

THE ELECTROPLATING AND ELECTROREFINING OF METALS. Being a new edition of Alexander Watt's "Electrodeposition." Revised and largely rewritten by Arnold Philip. New York: D. Van Nostrand Company. 1902. Pp. (5¼ by 7¾ inches) xxiv., 680, with 160 illustrations and 14 tables. Price, $4.50.

The work of the late Alexander Watt on electrodeposition is a well-known book. Mr. Philip has revised it to a considerable extent and added some one hundred pages of new material. The most important part of the new matter, and, in fact, of the whole book, is original with Mr. Philip, and consists of a discussion of the electrorefining of copper. The subject has been considered chiefly from the financial side and while the author states that a similar treatment with very slight modifications could be applied to the electrolytic refining of any other metal, it is to be regretted that the lack of space prevented his attempting it in this volume. In those parts of the work for which the reviser is responsible a successful attempt has been made to avoid theoretical considerations as much as possible. The importance of the financial side of the question has been brought out in every case. In some instances the old material has not been revised or brought up to date with as much care as might have been expected, but on the whole the book forms a valuable reference book for the electrotyper or anyone interested in electroplating and electrorefining.

The first part of the book covers in a thorough manner such subjects as primary and secondary batteries, thermopiles, dynamos, electrodeposition of copper, gold, silver, nickel, tin, iron, zinc and other metals and alloys, gilding, recovery of gold and silver from waste solutions, etc. In the second part, which treats of electrometallurgy are handled copper refining, electrolytic gold and silver-bullion refining, electrolytic treatment of tin, electrolytic production of aluminum, electrogalvanizing, etc. The tables of specific resistances, specific gravities, wire gauges, temperatures and other electrochemical data are valuable as an aid to a study of the text.

THE UNIVERSAL ELECTRICAL DIRECTORY. By J. A. Berly. London: H. Alabaster, Gatehouse & Co. 1903. Pp. (six by 9½ inches), 1,448. Price (in England), 10 shillings.

In this, the twenty-second edition of The Universal Electrical Directory, are given the names of members of the electrical and kindred industries throughout the world. In addition to the new names incorporated in the present issue, much financial information is given. The book is valuable for reference and accurate in the classified sections as a buyer's guide. The book has been thoroughly revised and for simplicity and facility of reference is divided into four groups—British, Continental, United States of America and Colonial. These groups are again subdivided into alphabetical and classified sections, making in all nine subdivisions containing a total of 30,990 distinct names. Of this number, 11,080 names are in the British section, 9,405 in the Continental section, 7,040 are attributed to the United States, and 3,465 to the British colonies. The section devoted to the United States is inadequate, and the value of the "Red Book," as it may be called, to American users lies in its lists of British and Continental addresses.

The Norman Milling and Grain Company has just completed the installation of an electric-light plant at Norman, Okla. The company has a contract for lighting the town for 10 years. D. L. Larsh is manager of the company.

Northern California Power Development.

The installation of the Valley Counties Power Company's plant on the North Fork of the Feather River in California is being vigorously pushed. While the corporation is an independent organization, it is associated with the Bay Counties Power Company of Colgate, Nevada County, Cal., the officers of the two being the same. They will, therefore, co-operate with one another in the generation and distribution of power. The new plant will exceed all other electric power-generating works in the northern part of the state, excepting the establishment at Colgate. Power for the operation of the Valley Counties plant will be taken from French Creek, a tributary of the North Fork of the Feather River. An immense storage reservoir is to be formed there by the construction of a dam 110 feet in height. To carry the water to the head of the pipe line a tunnel 1½ miles in length must be pierced through the solid rock. Inside this tunnel large steel pipes will be laid and carefully incased in a bed of concrete two feet thick, which will form a channel for the water after the metal has rusted away. The pipe line serving the impulse wheels at the power house will have a vertical fall of 1,340 feet, and deliver 3,000 horsepower. With the exception of the San Joaquin electric power plant in Fresno, and that of the Redlands Electric Power Company at Mill Creek Canyon, San Bernardino County, the Valley Counties' service pipe will have a higher head than any other in California. The head of the service pipe of the San Joaquin Power Company's plant is 1,400 feet, while the Mill Creek plant's pipe has a vertical fall of 2,000 feet. The drop of the Bay Counties' feed pipe at Colgate is only 700 feet, or a little more than one-half of that of the new plant.

Everywhere throughout the northern part of California electricians are conserving the drainage of the water-sheds for the generation of electric light and power. The Valley Counties is only one of a number of important plants that are now in the course of development. One of them is being constructed on the McCloud River by a South Dakota corporation. This enterprise has become temporarily embarrassed, however, through the alleged dishonesty of its manager, and has been placed in the hands of a receiver. When the plant is fully installed it will serve a large mining section in Shasta, Siskiyou and Trinity Counties with light and electric power. The completion of the Cloverdale electric plant, with a maximum capacity of 2,000 horsepower, adds to the electrical enterprise of the state. It is estimated by competent hydraulic and electrical engineers that there is at least 1,000,000 available horsepower of electric energy within a radius of 200 miles of San Francisco. Most of this is in the northern counties. At present probably less than 100,000 horsepower has been utilized.

Laboratory for Scientific Research at Niagara Falls.

The Niagara Research Laboratories is the name of a $100,000 company which filed incorporation papers at Albany, N. Y., recently. Its objects are stated as follows: To maintain a research laboratory for scientific investigation at Niagara Falls; do analytical and experimental work for the general public; act as consulting engineers and experts in perfecting and improving existing processes; rent space, power and the use of its laboratories for physical, chemical and electrochemical investigations; manufacture and sell chemicals and allied products, apparatus and supplies. The technical men interested are F. M. Becker, R. A. Witherspoon and L. E. Saunders, who have been aiding in the development of processes now in successful operation at Niagara Falls. Among the directors are J. G. White and W. S. Gray of New York city, W. B. Rankin of Niagara Falls, N. M. Pierce, Binghamton, N. Y., and H. J. Pierce, E. B. Stevens, W. G. Case and Dr. Elmer Starr of Buffalo.

New Technical Index.

A publication which, if maintained and developed along the lines proposed, will prove very valuable to all engineers has been started by the Association de la Press Technique of Brussels, Belgium. It is known, in English, as the Index of the Technical Press and is to be published monthly. It will contain a series of indices giving the title with brief explanation, the name of the author, the origin, the date of publication and the length of the articles of general interest appearing in the principal journals of the technical press throughout the world. English, French and German reviews are indexed in those languages, respectively, while for Italian and Spanish the French language is employed and for Scandinavian and Dutch journals, the German. The references are printed only on one side of the page and are classified by the decimal system, so they are convenient for pasting on cards for a card index. The publisher also furnishes press cuttings, and, if desired, translations of the articles.

The transportation facilities of Keokuk, Iowa, are to be materially increased soon. According to reports an electric railway is to be built to Warsaw and another to Fort Madison. The Davenport and St. Louis railroad will also touch the east end of the city.

CORRESPONDENCE.

London Letter.

London, England, April 15.—The experiment with the Lorain surface-contact system of electric traction at Wolverhampton has had an interesting sequel. Up to the end of April, 1902, only 1¾ miles of track were running, but at the end of the period of the contract for the experimental line with the Lorain Steel Company, the system was extended, and at present there are 11 miles in operation. The interest in the system at the present moment lies in the report which has recently been issued by the Wolverhampton's corporation's electrical engineer with regard to the first year's working of the full system, and naturally full consideration is given to the safety of the system. From the report, only two cases of electric shock, due to charged studs, have been notified as having occurred to pedestrians, and five to animals, although the number of studs which have been detected as being charged at over 50 volts when no car was on them has varied considerably. Quite apart from the question of cost (which, however, is of vital importance), the report in question considers that the system compares favorably with others, and that there is less danger to be apprehended than from an overhead-trolley system. But it is an admitted fact that there is a larger consumption of electrical energy per car-mile on the Lorain system, than is generally the case with trolley systems in Great Britain, and that the cost of maintenance is greater, in addition. As the safety of the public has never seriously been threatened through the construction of the many trolley lines which now exist here, it is to be feared that the theoretical risk involved will hardly justify a very wide adoption of surface-contact traction, if the figures in Mr. Shawfield's report are to be relied upon.

For some months past a committee, entitled the engineering standards committee, composed of eminent members and officials of our leading engineering societies, has been doing good work in attempting to standardize engineering details generally. Subcommittees, dealing with numerous specific branches have been formed, and the work of the committee has practically taken a permanent form. Under these circumstances, funds are necessary to continue the objects aimed at. Private contributions have not been lacking, but the very satisfactory announcement has been made that the government will contribute for this year at any rate $15,000 toward the necessary expenses. A special committee has now been formed to regulate the expenditure of the funds as accumulated, and the liveliest satisfaction is felt at the action of the government in the matter. The work of the committee includes the preparation of standard specifications for engineering works, and of standard sections of rolled iron and steel, together with the standardization of parts of locomotives and electrical appliances, all of which will tend to reduce the cost of production and the time taken in completion, as well as being of the highest value to the country at large.

The views of the corporation of the city of London concerning the appointment of a special tribunal for the administration of traffic in London, as expressed by a member of that body, before the Royal Commission, as means of transport in London, are somewhat ambiguous. In short, the corporation favors the creation of a special tribunal, but does not wish to surrender any of the powers which it at present holds. How the two are to be made compatible is rather puzzling, but this little piece of maneuvering only serves to emphasize the difficulty and magnitude of the task placed upon the Royal Commission.

Now that the Tunbridge Wells telephone system is gone over to the National Telephone Company, the progress of the Glasgow undertaking is watched with no little interest. At present there are 8,500 telephones in operation, and there is a traffic of over 30,000,000 messages during the year. There are now 15 exchanges open, and 4,000 new instruments have been erected during 1902.

A good deal has been read in Great Britain, at one time and another, concerning trolley omnibuses and the like without running rails, but nothing of a practical nature has hitherto been suggested. The Halifax corporation, however, is now considering the possibilities of this form of traction in connection with a service of public motor cars.

The London County Council, at the first meeting after the refusal of Parliament to allow the clause in its general-powers bill relating to the wiring of houses for the electric light, expressed great indignation at this action, and a good deal of ridicule was cast upon the government and the London members.

The Board of Trade officials have made their inspection of the electrified Mersey railway, and permission has been given to start the new service immediately. I believe, however, that the company does not wish to unduly expedite matters, and that a little more time is to be given to training the employes, etc. W.

New York Notes.

New York, April 25.—Commissioner Monroe's plan for a municipal electric-light plant for street lighting has gone down to defeat in the Legislature, and central-station interests shed no tears at the funeral. However, it is announced that Mr. Monroe will continue the fight against the lighting companies in the next session of the Legislature. Before adjourning, however, the Legislature passed three important bills relating to this city. The bills provide in brief for the elimination of steam as a motive power in the Park Avenue tunnel; for the enlargement of the terminal facilities of the New York Central Railroad, for the depression of its tracks and for the abolition of all grade crossings. The Elsberg rapid-transit bill, which was favored by the Citizens' Union, was defeated.

At the close of an all-day session of the employes of the elevated roads it was announced that the settlement schedule arranged by the executive committee with the management of the Interborough Railway Company had been ratified unanimously.

Officers of the New York, New Haven and Hartford railroad say that a project is under consideration to convert the Harlem River branch of that system into an electrical line for passenger service. It is the desire of the management to strengthen this company's trolley system running west of Stamford, Conn.

In the hearing to determine whether there is a probable cause for holding President Vreeland of the Metropolitan Street Railway Company on a charge of criminal libel brought by M. M. Amory, the plaintiff denied that he had started the rumors respecting the Metropolitan Company. Regardless of the outcome of Magistrate Barlow's inquiry into the merits of Amory's libel charges against President Vreeland, it is asserted that Messrs. Osborne and Philbin will present to District Attorney Jerome, with a demand for action, the fraud allegations they claim to have proved against the company. President Vreeland has issued a circular to the stockholders of the company based upon the report of the public accountants to whom he had referred the charges formulated against the company, and in which he says that it is absurd to base a charge of corporate mismanagement upon the fact that a disagreement does exist between the cash statement and the balance sheet.

The General Electric Company of Schenectady, N. Y., has secured the contract for supplying the switchboard and its equipment for the Interborough Rapid Transit Company's large new power house in this city. This board will be operated on the distant-control principle, and will be the largest switchboard in the world. The contract price for this board and for the sub-station switchboards is in the neighborhood of $500,000.

A technical school, to be known as the New York School of Technology, was incorporated yesterday with a capital of $100,000. The directors are William Seaton and Charles Macy of this city, and C. H. Ingalls of New Brighton.

The following New York state companies were incorporated during the week: Johnson Electric Company, New York, capital $10,000; L. F. Johnson of Chicago and E. R. Hunckel of New York being among the directors. Long Acre Electric Light and Power Company, New York; capital $50,000; William Harris of New York being one director. United Light, Power and Traction Company, Buffalo; capital, $500,000; L. B. Grant of New York being one director. Cortlandt Electric Construction Company, New York, capital $5,000; W. J. Berg of Brooklyn being one director.

The Block Light Company, with a capital of $1,000,000, was incorporated in New Jersey this week. The company proposes to acquire the business now carried on by the Block Light Company of this city. The incorporators are G. A. Griffin, J. B. Richardson and G. W. Kimball of East Orange, N. J. O.

New England News.

Boston, April 25.—The Meriden Electric Railroad Company and the Middletown Street Railway Company have reached an agreement whereby each will build a section of an electric railway connecting Meriden and Middletown, Conn. The fare will be 20 cents. The Meriden company's lines are to be operated by power from the New York, New Haven and Hartford Railroad Company's third-rail power station at Berlin. The railroad company owns the Meriden company. The line between Meriden and Middletown will receive its power from the same station, it being transmitted by a three-phase alternating system.

A. F. Gerald of Fairfield, Maine, Hon. F. O. Beal of Bangor, Maine, and A. R. Gould of Presque Isle, Maine, are obtaining subscriptions for the construction of an electric railway between Washington ad Presque Isle, the first line of the kind in Aroostook County.

A dispatch from New Haven, Conn., states that the New York, New Haven and Hartford Railroad Company is preparing to convert its Harlem branch into an electric line. By connecting this with its electric line west from Stamford, Conn., the company will form a route for competition with the New York and Portchester electric railway.

The Connecticut General Assembly has passed a resolution incorporating the Norwich, Mystic and Westerly Street Railway Company, which is authorized to build an electric railway in the towns of Norwich, Preston, Ledyard, Stonington and North Stonington, and it can extend its line into Rhode Island. The company's capital is $700,000, and it has wide powers in the matter of making traffic agreements and merging with other corporations.

The Buhl-Kimberley Company of Bridgeport,

Conn., has been incorporated. It has a capital of $5,000,000 and proposes to build or acquire railroads, gas and electric-lighting plants, and other works of public and private utility. The incorporators are Ashley T. Cole, Richard F. McKiniry and W. J. Bagnell of New York.

The Connecticut Senate has passed a resolution authorizing an issue of five per cent. bonds, amounting to $750,000, by the New London Gas and Electric Company, the proceeds to be used in retiring bonds, funding floating indebtedness, and enlarging the company's plant. The resolution also authorizes the company's consolidation with any other lighting or traction company. B.

Michigan.

Detroit, April 27.—The Western Michigan Interurban Railway Company has been organized with a capital stock of $100,000 to build an electric line from Muskegon to Grand Rapids. The general offices of the company are at Muskegon. Surveys of the line are to be made at once.

The Grand Rapids, Grand Haven and Muskegon electric railway is expecting to build a branch line from Coopersville to Ravenna, a distance of 12½ miles. Coopersville is midway between Grand Rapids and Muskegon, and Ravenna lies directly north of Coopersville. This extension will open up a rich farming section.

The Rapid Motor Car Company of Grand Rapids has been incorporated with a capital of $100,000.

The Grand Haven Street Railway Company has increased its capital from $25,000 to $100,000.

The M. B. Wheeler Electric Company, Grand Rapids, has increased its capital stock from $25,000 to $50,000.

The Detroit, Monroe and Toledo Short Line has placed a contract with the John Stephenson Car Company for 10 fine cars. These cars, which will be 55 feet long, will be equipped with four 75-horsepower motors. The interior finish will be mahogany and the seats will be of the plush, high-back, head-roll type.

The Detroit United Railway has filed a statement with the city treasurer for nine months, ending January last, showing the number of express cars run in and out of the city as 7,750. The company is to be taxed at the rate of 50 cents a car for the privilege of handling freight through the city streets.

The Thomas E. Clark Wireless Telegraph and Telephone Company will erect a manufacturing laboratory on a site recently purchased overlooking the Detroit River.

A new electric city line for Detroit is being projected. It will run across country from River Road, Delray, through Delray, Springwells and Woodmere to Grand River Avenue. This line, which connects the western suburbs with West Detroit, is much needed. C. G. W.

Information from Indiana.

Indianapolis, April 27.—The Union Traction Company, which controls nearly 500 miles of interurban electric lines in this state, has secured franchises from Winamac, Valparaiso, Hobart and Hammond for a line which will connect Indianapolis with Hammond, by way of Logansport, and there connect with the electric line in Chicago.

W. H. Hubbard and associates were granted a franchise by the commissioners of Clark County for an electric line from Madison to the county line.

A deal was closed on the 21st for the purchase of the Logansport city electric-railway system and the Wabash Valley Traction Company, with a view of merging these lines with the Fort Wayne lines and the Lafayette lines and the Rochester and Northern Traction Company's lines. James Murdock of Lafayette, Bayard Henry and J. Levering Jones of Philadelphia and George F. McCulloch, leaders in the merger movement, made an inspection of all the lines last week. It is understood that the merger companies will incorporate in a short time. The property of the merged companies is worth $2,500,000.

The Eastern Indiana Traction Company and A. H. Lamar & Co., New York bankers, have closed a deal for the construction of 86 miles of electric line between Richmond and Marion. Peter Schwab and ex-Governor Campbell of Ohio are interested. Work must begin within 60 days. The line, when completed, will connect Richmond, Winchester and Marion and more than 20 other towns.

The Jenny Electric Manufacturing Company of Indianapolis has increased its capital stock from $80,000 to $450,000, of which $150,000 is preferred stock, on which a six per cent. dividend shall be paid semi-annually. F.

From the Buckeye State.

Cleveland, Ohio, April 25.—It would seem that the Appleyard people will make quite an addition to their already large electric-railway system this summer. Construction work is now progressing on the line between Newark and Zanesville, where it will connect with the steam road, which will be transformed into an electric. It is very probable that the entire line from Columbus will be known as the Columbus, Newark and Zanesville when this is completed. At Washington Court House work has begun on the line between that point and Columbus, and it is not improbable that another track will be built between Dayton and Springfield. Other lines north from Springfield will be built. There is no doubt but that this syndicate will own one of the largest systems in Ohio within the next few years.

The Westinghouse Electric and Manufacturing Company has been awarded the contract for the equipment of the Toledo, Port Clinton and Lakeside line, and ground has been purchased at Genoa for a power house.

Former Governor Asa S. Bushnell has given out an interview in which he says no plans have been made for the extension of the Springfield and Xenia traction road, although it may be built to Lebanon at some time. The work of the Piqua and Troy line is taking the attention of the persons interested now. It will have a large power house, to cost about $225,000, and it is probable that both it and the Xenia line will be operated from the one power plant. They may be operated under one management, but that has not as yet been decided.

The Bellaire Gas and Electric Company and the Belmont Electric Light and Power Company of Bellaire have been consolidated under the name of the Bellaire Light and Power Company. They have a capital stock of $150,000.

The Board of Control at Cleveland has recommended the acceptance of the bid of the Cleveland Electric Illuminating Company to furnish street lights at $75 each, the lowest figure ever offered. O. M C.

West Virginia and Kentucky.

Lexington, Ky., April 25.—A company is being organized to build an electric line from Paducah, Ky., to East Cairo, in the same state. It is supposed the capital stock will be about $500,000, and it is estimated that it will take about $400,000 to construct the road. Several Paducah men are interested in the company. The line will follow a right-of-way obtained by the Ohio River Railway Company several years ago.

The Columbia Interurban Railway Company of Columbia, Ky., has been incorporated and about $15,000 has been paid in. The officers of the company are as follows: President, Professor W. K. Azbill; vice-president, Captain W. W. Bradshaw; secretary, C. S. Harris; treasurer, Judge W. W. Jones.

There seems to be every assurance that the Williamstown and St. Marys railway will be built from a point about 12 miles above Parkersburg, W. Va., to Moundsville, below Wheeling, a distance of about 80 miles. The entrance to Wheeling will be over the Wheeling Traction lines. It is estimated that it will require something like $2,000,000 to build the road. Rights-of-way and franchises have already been secured over a portion of the route, and the work of completing this is being pushed as rapidly as possible. Under agreements made in order to obtain franchises, the road is to be completed within 17 months.

The property of the Fairmont and Clarksburg Electric Railway Company has been purchased by a number of Fairmont men. Walton Miller, Lee L. Malone, S. C. Denham and M. L. Hutchinson were chosen on the new directorate. S. L. Watson has been retained as vice-president, but the office of president has not been filled. The road has been completed from Fairmont to Monongah.

The Colon Electric Illuminating Company, a West Virginia corporation, has secured the contract for lighting the streets of Colon, Panama.

The joint committee on railroads and bridges of Covington, Ky., has completed an ordinance through which the city may offer for sale five different electric routes in the city, which will give entrance to as many outside railway lines. It is provided that the successful bidder shall build all five of the lines within the corporation, and besides shall build a big fill across a strip of low lands. It is difficult to say what will be done with the ordinance, as it is a question as to whether any company will pay for the privilege of building the lines and then build an expensive fill also. C.

Northwestern Notations.

Minneapolis, Minn., April 25.—The village of Breckenridge, Minn., is in need of a new engine for its electric-light plant.

The expert engaged by the Board of Water Commissioners of St. Paul to investigate the street-railway company's accountability for electrolysis, will report the double trolley as the only solution for the trouble. The company undertook to show, by a series of tests, that a return system of its own, instead of the trolley return, would do the work as well. The board's expert, D. C. Jackson of the University of Wisconsin, regards the street-railway company's tests as a failure. The company has until May 1st to demonstrate the worth of its system of return, after which the water board may resume the prosecution of the suit against the company.

Frank Wendler of St. Paul has sued the Red Wing (Minn.) Gas and Electric Company for $50,000 damages for the loss of both arms. He was pulling two plugs on the switchboard connecting the arc lights of the city with the dynamos, when he received a shock which burned him so badly that both arms had to be amputated.

The electrical workers of Duluth went on a strike for raise of wages to $3.25 for eight hours' work, and other changes. The strike was ended by the dispute being submitted to arbitration.

The Polar Star Electric Company of Faribault, Minn., has bought a waterpower plant near that city and proposes to develop electric power from the new property and transmit it to the city.

The officials of the Great Northern Power Company of Duluth are considering transmitting power from their system to the iron mines on the Mesaba Range, north of Duluth. Their plant is under construction.

Louis Johnson, a fireman at the Camden Place pumping station of the Minneapolis waterworks, has devised a system of purifying water, by means of electricity, aeration and sedimentation. He has patented his idea. Tests have shown that the three processes result in killing 85 to 90 per cent. of the germs of the water. What proportion the electric treatment is responsible for, is uncertain, for tests after the current had been turned on, and before aeration and sedimentation had been used, did not show any such degree of purification. An electric current of 400 volts is sent through the water, after the other processes are used. R.

Among the Rockies.

Salt Lake City, Utah, April 23.—A large shipment of electrical machinery, including a 500-horsepower generator, arrived recently at Lewiston, Idaho, and will be used in the installation of a power plant at Asotin. The management expects to furnish sufficient electrical power for Lewiston and several other towns in that vicinity.

The Washington and Oregon Railway Company has a definite project for the construction of electrical railroads which will cover many miles of territory and will cover several small cities in both states. From Pendleton, Ore., the line will extend over 85 miles to a terminus at Dayton, Wash. The work will begin as soon as the exact route is definitely settled upon and the necessary equipment can be secured.

Two new power plants are shortly to be installed in Utah, one near Richfield and the other at Mount Pleasant. The power for the Richfield plant will be secured from a canal at Joseph City, where a fall of 70 feet is available.

M. R. Rutherford, secretary and manager of the Missoula Light and Power Company, has been granted an electric-light franchise at Land Point, Idaho, by the council of that town. Mr. Rutherford will at once install a 2,000-light plant. Land Point is one of the best of the new towns in northern Idaho.

The City Council of Bozeman, Mont., on April 21st, by a unanimous vote, let the contract for the electric lighting of the city to John W. Gates and his associates, the bond being placed at $2,000. H.

On the Pacific Slope.

San Francisco, April 25.—The Bakersfield-Ventura trolley line is to be built by Los Angeles and Ventura County people. Surveys for the line have been completed and construction work will begin within 30 days. A 5,000-horsepower plant will be built at the summit on Mutaw Meadow. John W. Burson is one of the promoters of the road.

C. E. Hadley, who has a franchise to install an electric-light system at Tillamook, Ore., expects to put in a plant on the North Fork of the Wilson River this summer, to cost $10,000.

Actual construction of the power plant of the Walla Walla Gas and Electric Light Company, located on the south fork of the Walla Walla River, about 20 miles from Walla Walla, Wash., will begin within 30 days, according to an announcement made by C. E. Burrows, manager of the company. The plant will cost $100,000, will require one year for its construction, and will have a capacity of 4,000 horsepower, supplemented by 2,000-horsepower steam reserve. It is the intention of the company to supply not only Walla Walla with power and light, but also the Oregon cities of Pendleton, Athena, Adams and Weston. Sixty-five miles of high-voltage wire will be used in transmitting electricity from the plant to the several cities. Above the site a dam will be built which will insure a full flow at all times through the large pipes, which will carry the water to the penstock in the power house. The pipe will follow an hydraulic grade on the hillside for a distance of 15,000 feet. The preliminary survey and engineering experiments have shown that the plant can at any time be increased to from 10,000 to 15,000 horsepower.

The new engine and generator unit at the Traction Company's power house on Georgia Street, Los Angeles, has been started. The engine and generator are direct-connected, the generator being a Bullock rotating-field flywheel alternator, as the coils are built on the rim of the flywheel. The generator, at 88 revolutions per minute, gives 60 cycles. It is capable of generating 2,000 horsepower at 2,400 volts. The engine is a Hamilton-Corliss direct-connected, direct-acting, capable of giving 2,000 horsepower at 135 pounds steam pressure.

The Buffalo Hump Power and Light Company, Ltd., has been incorporated at Lewiston, Idaho, with a capital stock of $100,000. The incorporators are George K. Reed, W. W. Brown, Claud Flint, Rufus Hawley and James Witt. The company owns a valuable water right, and no trouble will be experienced in developing 1,000 horsepower.

Bids will be opened in Los Angeles, Cal., on May

25th, for a franchise for an electric street railway, as applied for by Alexander Culver. A.

Seattle, Wash., April 22.—A company composed of C. E. Fredrick, J. K. McConack and C. W. Pettycord, has asked the City Council of Palouse, Wash., for a 25-year franchise to build and operate an electric railroad in that city. The road is to be in operation by the first of October.

James E. McMurray of Chicago, who received a franchise for the electric line from Everett to Seattle, Wash., is in Seattle preparing for the preliminary work on the new road. Contracts will be let and work will be commenced at once.

Kilbourne & Clark of Seattle, Wash., have leased the electric-light plant of the city of Ballard, Wash., for a term of 50 years.

The Puget Sound Electric Company succeeds the business and franchises of the Seattle-Tacoma Interurban railway. The deed includes the light plant at Kent, Wash., and all the holdings of the company in Seattle and Tacoma, Wash.

Charles F. Nolte, George Nolte and W. J. Mallroy have asked for a franchise for building an electric railroad through the principal towns of Whatcom County, Wash. The proposed line will extend from Whatcom to Marietta, Ferndale, Birch Bay and Blaine and back by way of Lynden. P.

PERSONAL.

Edward Tremlett Carter, editor of the London Electrician, died at Clevedon, England, on April 16th.

Benjamin H. Rogers of Lenox, Mass., superintendent for the Berkshire Electric Company, and Miss Florence G. Dyer of Medford, Mass., were married at Hotel Bellevue, Boston, on April 20th.

Vice-president Milton J. Budlong has been elected president of the Electric Vehicle Company of Hartford, Conn., to succeed George H. Day, who has resigned the presidency, but will remain on the directorate.

Last week Manager W. H. Jacob of the Triumph Electric Company, Cincinnati, was a visitor in Chicago. Mr. Jacob expects to return to be at the Auditorium during the coming electric-light convention.

H. O. Stafford, who has been manager of the Western Union telegraph office at Sandusky, Ohio, for more than 30 years, died suddenly at his home in that city of heart disease on April 18th. He had, apparently, been in his usual health up to that day.

The many friends of A. T. Naugle, manager of the cedar-pole department of the E. E. Naugle Tie Company of Chicago, will be interested to learn that he was married on April 28th, at St. Paul's Church, Rogers Park, to Miss Ethel Morier. Mr. and Mrs. Naugle left immediately after the wedding upon an extended trip.

At last week's meeting of the board of directors of the American Institute of Electrical Engineers the following-named associate members were transferred to full membership: Frederick Darlington, Great Barrington, Mass.; S. E. Johannsen, Pittsburg, Pa.; M. Von Recklinghausen, New York; Robert Robertson, Glasgow, Scotland; William Esty, Bethlehem, Pa.

On Monday of last week Secretary Thomas R. Mercein of the Northwestern Electrical Association passed through Chicago from Milwaukee on a southern trip, en route to Georgia and South Carolina. Mr. Mercein went in the capacity of a civil engineer to investigate, for friends, the value of several asbestos and mica properties; he will be in the South about 10 days.

Colonel R. C. Clowry, president of the Western Union Telegraph Company, was the guest of honor at the annual dinner of the Magnetic Club, given at the Hotel Vendome, New York city, on the evening of April 18th. Two hundred and fifty members and their friends assembled to do him honor. At the conclusion of the dinner President F. W. Jones introduced the guest of the evening, who was heartily applauded and who made a speech.

Dr. Adolf Franke, technical director of Siemens & Halske, Berlin, Germany, is visiting the United States and was a recent guest at a meeting of the American Institute of Electrical Engineers in New York city. Dr. Franke has put into service the longest Pupin telephone circuit which has been installed, 450 miles from Frankfort to Berlin. Only one-fourth of the usual amount of copper was required, and the talking quality of the line is said to be excellent.

ELECTRIC LIGHTING.

The city of Monroe, La., has purchased the electric-light and waterworks plant of the Monroe Water Works and Light Company for a consideration of $60,000.

The Snake River Electric Light and Power Company has been incorporated at Rexburg, Idaho, with a capital of $100,000. J. H. Wilson, J. H. Hendricks, Thomas Elliott and others are the incorporators.

The Sunderland (England) Town Council has decided to supply electricity for the lighting of the workmen's dwellings owned by the municipality on the penny-in-the-slot principle, one penny to pay for an eight-candlepower light lasting five and one-fifth hours.

The Georgia Railway and Electric Company has secured the contract for lighting the streets of Atlanta, Ga., for a period of five years at a cost to the city of $75 per arc per annum, which is $7.50 per arc cheaper than the present price. There were six other bids.

Electric lights have been introduced into the famous cathedral of Notre Dame, Paris. This is considered to be one of the greatest innovations ever known in Paris, as it took the cardinal and his cathedral chapter six months to decide whether or not they should permit the innovation.

J. H. Grave of Seattle has been in Hayden, Mont., looking over the situation with a view to putting in an electric plant to light the town and furnish power. Now that the Great Northern is to pass through the city, buildings are going up fast, and there appears to be an excellent opening for Mr. Grave's enterprise.

The plant of the Evanston Yaryan Company in Evanston, Ill., which was bid in recently at foreclosure sale by Lyman A. Walton, vice-president of the Equitable Trust Company of Chicago, for $219,295, has been conveyed by him to the Evanston Heating Company, organized to succeed the Yaryan company. The consideration is $285,000.

The United Electric Company has commenced the work of removing its wires from poles in the central section of Newark, N. J., and placing them underground. More than 70 miles of wire will be removed, 2,000 cross-arms taken down and 16,000 glass insulators and 200 transformers carted away. Then the poles will be taken from the ground.

The commissioner of public works of Tacoma, Wash., asserts that several persons have been stealing electricity from the city by attaching "jumpers" to circuits leading into their houses and tapping the wires on each side of the meter in such a way as to cut the meter out of business altogether. In this way a considerable amount of current has been used without the city getting any credit for it whatever.

The Edison Electric Light Company of Des Moines, Iowa, has filed a protest with the Board of Review and asks to have its assessment for this year reduced from $602,080 to $360,000. The company admits that it invested $210,000 in conduits since it was assessed $266,000 two years ago, but the sole addition to the income, it is stated, is $1,200, which the city granted the company on account of the conduits.

Municipal lighting is being agitated in Owosso, Mich. The Owosso and Corunna Electric Company wants a five-year contract for lighting the city at the rate of $60 per lamp per year for midnight lights and $90 for all-night lights. This rate is considered excessive by some of the citizens, but A. N. Richardson, manager of the electric company, has submitted figures by which to prove that the rate is only a fair one, and in asking for a renewal of the contract invites a rigid investigation and comparison with rates in other cities.

It is reported from Columbus, Ohio, that the Columbus Railway Company and the Columbus Edison Company, furnishing light and power, will be united under the management of a holding company, the plans having been made within the last few days at the office of E. W. Clarge & Co. at Philadelphia. This firm is largely interested in the Columbus Railway Company at the present time. President Robert E. Sheldon and General Manager E. K. Stewart of the railway company and C. H. Lindeberg and Emil Keiswetter of the Edison Company, have been in Philadelphia for some days.

ELECTRIC RAILWAYS.

It is stated that an electric railway will be constructed in Philadelphia to cover the entire length of Broad Street, a distance of 13 miles. The line will be constructed with sub-surface conductors, the power being communicated to the motors from wires running in a conduit beneath the surface.

W. B. McKinley, who represents capitalists who own and operate street-car lines in many cities in the United States, has recently secured control of the Galesburg (Ill.) street-car lines. He announces that work will soon begin on the construction of a system of interurban lines which will make Galesburg the hub of a large number of radiating lines.

Jesse J. Moore of Peru, Ind., has recently secured a patent on a signal system and safety gear designed to prevent wrecks on steam and electric railways. An electrically operated device is so constructed that when two engines, each carrying a contact with insulated conductors along the track, enter the same block, an electric current will immediately be established, and, through electrically controlled mechanisms on the locomotives, the trains will be brought to a standstill without any action on the part of the engineer.

At a recent meeting of the directors of the Jamestown and Warren Electric Railway Company the franchise granted by the city, giving the company the right to construct a loop within the city limits for the proposed line from Warren, N. Y., to Jamestown, was accepted. It is the intention of the company to have the line completed by fall.

Plans are being made and a company is about to be formed for the construction of the Saginaw Southern electric railway, which is to extend from Saginaw to Owosso, Mich., taking in St. Charles and Chesaning. The company is to be composed of three Owosso and three Saginaw gentlemen, backed by Cleveland financiers. The road will traverse the Saginaw coal district and rich farming region, and its possibilities, both for freight and passengers are regarded as exceptionally promising.

Reports come from Philadelphia of a meeting held by W. Kelsey Schoepf, Briggs S. Cunningham and other Cincinnati men, with Randal Morgan, Thomas Dolan, William L. Elkins and other members of a Philadelphia syndicate, at which plans were formulated for the establishment of a new trust company in Cincinnati and the reorganization of the Citizens' National Bank, this action to be preliminary to the merging of the city and interurban railroads about Cincinnati and Columbus under the management of a holding company, which is to be organized.

SOCIETIES AND SCHOOLS.

The individual salaries of the class of 1892, Massachusetts Institute of Technology, have been given as averaging $1,669 for the fifth year and $3,272 for the tenth year after graduation. The salaries ranged from $900 to $4,000 for the fifth and from $1,200 to $7,500 for the tenth year.

The American Electrotherapeutic Association has just issued a neat 30-page pamphlet in which is given an historical sketch of the organization, its constitution, by-laws, list of members, officers, etc., together with an announcement of the next annual meeting, which will be held at Atlantic City, N. J., on September 22d to 24th. At this convention the X-ray will receive a large share of attention. The association is the oldest in existence devoted to its specialty, and its members have been more or less intimately connected with all electrotherapeutical discoveries and developments of recent years.

The committee for the investigation of photometric values of arc lamps of the National Electric Light Association is preparing for the twenty-sixth convention, to be held at Chicago, May 26th, 27th and 28th, a very elaborate report upon the tests made at Purdue University during the last year, under the supervision of Professors Goldsborough and Matthews. Henry L. Doherty, who is chairman of the committee, states that the report will include results of comparative tests of arc, incandescent, Nernst and Welsbach lamps, which ought to prove very interesting to central-station managers.

TELEGRAPH.

After mature consideration, the Navy Department of the United States government has signified to the State Department that it will not object to the landing of the Dutch-German cable on the island of Guam, and instructions have been sent forward to that end.

The Western Union Telegraph Company has closed its telegraph office at Butte, Mont., and will suspend business there until the messenger boys' strike is settled. Recently men were employed at $5 per day, but were pelted with eggs and driven back to the office. The telegraph officials complain that the police do not protect their employes, and declare that until the business men of Butte bestir themselves to protect the company in the discharge of its duty, no telegrams will be delivered.

PUBLICATIONS.

"Cogs That Fit" is the title of a neat booklet issued in the interests of the Engineering Agency of Chicago.

The Electric Appliance Company of Chicago is out with a new fan catalogue listing a complete line of direct and alternating-current fans.

The Wagner Electric Manufacturing Company of St. Louis, Mo., has issued an illustrated bulletin of its series transformers for instrument and switch work.

An illustrated catalogue of electrical specialties manufactured by Edwards & Co., 405 East One-hundred-and-forty-fourth Street, New York city, has been recently issued. It lists in its 140 pages a great variety of goods, including annunciators, burglar and fire alarms, clocks, bells and gongs, door openers, door locks and catches, push buttons, electric gas lighters, spark coils, switches, etc. Much of the apparatus is new, and it is all illustrated and described clearly. The Edwards specialties are handled by the Western Electric Company and its allied agencies.

The Star Dynamo Company of Jefferson City, Mo., has issued an attractive catalogue of its direct-current dynamos and motors ranging in size from one-half to 7½ kilowatts. The machines are evidently correctly designed and well built. For gas-engine lighting a dynamo with a weighted pulley or "momentum disk" is provided. The company makes this guarantee: "We will replace free any part of the dynamo or motor that gives trouble or fails,

within one year from date of sale, and we will replace free any part of the dynamo or motor that shows a defect in material or workmanship at any time."

Both electric motors and dynamos are described and illustrated in their various types and applications in a bulletin distributed by Roth Brothers & Co., 27 and 29 South Clinton Street, Chicago.

A recent bullein of the Whitehead Machinery Company of Davenport, Iowa, contains a detailed list of the steam-power equipment, such as engines, boilers, heaters and pumps, which it has for sale.

SPACE TELEGRAPHY.

Experiments on the military railway between Berlin and Zossen, Germany, in carrying on communication between moving trains and various points by means of space telegraphy have been successfully carried out. Correspondence was maintained between the train and Marienfeld and Rangsdorf stations with accuracy. The Braun system was used.

The London Times has been forced to discontinue its department headed "By Marconigraph," which was inaugurated on March 30th, with about 200 words of dispatches received by space telegraphy. Owing to the breaking down of a subsidiary device employed in connection with one of the Marconi company's stations, no messages have been received for some time.

MISCELLANEOUS.

It is said that there is now in course of development 750,000 electric horsepower in New York city.

By an improved method of producing galvanized iron, the hot process is discarded for an electrolytic process, whereby the zinc is deposited upon the iron. The advantages of this method over the old dipping process is that 75 per cent. of the dross is saved, the thickness of the deposit can be regulated, and articles such as springs, can be galvanized without altering their temper. A uniform thin coating of zinc can be deposited over bolts without clogging up the threads. By the old process these threads had to be recut, which in most cases resulted in exposing some of the original metal.

TRADE NEWS.

C. H. Wilmerding, the well-known consulting engineer of Chicago, has moved his office from the Temple to 1100 Old Colony Building.

The American Blower Company of Detroit, Mich., has recently opened an office at 615 Hale Building, Philadelphia, in charge of Benjamin Adams, and another at 318 Frick Building, Pittsburg, in charge of H. P. Curtiss.

H. E. Mason, who did such excellent work on the road in the Iowa territory for the Electric Appliance Company, Chicago, has accepted a position with M. B. Austin & Co., Chicago. Mr. Mason will travel Iowa, as before.

The Northern Wire and Cable Company has incorporated with a capital of $300,000, fully paid, and will at once erect a plant in Milwaukee for the manufacture of lead-covered telephone, telegraph and power cables and wires. It is now in the market for the factory power equipment. J. B. Adams is general manager, with offices in the Wells Building, Milwaukee.

The offices of the Prometheus Electric Company of New York city have been removed to handsome quarters at 39 Cortlandt Street and its factory has been moved into larger quarters at 81 Dey Street, where the company will have better facilities for turning out its heating and cooking apparatus, for which there is an increasing demand.

Copper (Lake) was quoted at 14.75 to 15 cents a pound at the end of last week. The production of the metal in the Lake Superior region in 1902 was larger than ever before, being 170,831,593 pounds, against 155,716,248 pounds in 1901.

Sealed proposals will be received by the State Commission in Lunacy at Albany, N. Y., up to May 6, 1903, for installing engines, generators, switchboard, electric-light wiring and fixtures, telephone and watchman's clock systems, etc., at the Rochester State Hospital, Rochester, N. Y. Drawings, specifications and blank forms may be obtained at the institution or by application to G. L. Heins, state architect, at the capitol building, Albany, N. Y.

Secretary and Treasurer Harry G. Osburn of the Osburn Flexible Conduit Company of New York visited Chicago last week. In company with General Western Sales Agent Calvin B. Roulet, Mr. Osburn called upon his many Chicago friends. The Osburn Flexible Conduit Company has made a success with its flexible conduit, and the value of "flexduct" is without doubt due to the excellent machinery which was designed by and stands to the credit of Secretary Osburn.

Manager P. J. Morgan of the Osborn-Morgan Company of Cleveland, Ohio, visited Chicago last week. The Osborn-Morgan Company has recently placed on the market an interchangeable arc lamp—one that will work on direct current and also on an alternating circuit. This lamp has made a favorable impression on the trade, and the Osborn-Morgan Company's factory is now working to its full capacity turning out these lamps. It is expected that this interchangeable arc lamp will be exhibited by the Osborn-Morgan Company at the coming National Electric Light convention, Chicago.

George G. Frelinghuysen and Frederick T. Fearey, representing the Continuous Rail Joint Company of America, have concluded the purchase of about 20 acres of land at Troy, N. Y., with the rolling mills, machine shops and numerous other buildings formerly owned by the Troy Steel Company, part of which they have been operating under lease for the last three years. The property has a dock frontage on the Hudson River, and the New York Central Railroad runs through it. The plant will hereafter be known as the Albany Iron and Steel Works Department of the Continuous Rail Joint Company of America. The output of the products of the company will be greatly increased. The general offices will remain in Newark, N. J.

An interesting shipment of large steam-turbine machinery has recently been made from the shops of the Westinghouse Machine Company, Pittsburg Pa., which will be the first turbines of a large size and of American manufacture to be exported from this country. The shipment consisted of two 1,000-kilowatt Westinghouse turbine generating units of the most recent design. They are destined for light and power service in the De Beers mines, at Kimberly, South Africa. Steam-turbine equipments have also, within a month or so, been shipped from the Pittsburg factory to the B. F. Goodrich Company, Akron, Ohio; Johnson Harvester Company, Batavia, N. Y.; Consolidated Railways, Light and Power Company, Wilmington, N. C.; Nassau Light and Power Company, Roslyn, L. I., and S. D. Warren & Co., Cumberland Mills, Maine.

BUSINESS.

The Scioto Valley Traction Company has recently placed its order for third-rail insulators with the Standard Vitrified Conduit Company, 39 Cortlandt Street, New York city. There will be in the neighborhood of 45,000 of these insulators required.

The Metropolitan Life Insurance Building of New York city is to be wired throughout with Habirshaw red-core wire, supplied by the India Rubber and Gutta Percha Insulating Company of Yonkers, N. Y. The order was taken by J. B. Olson, manager of sales of the company. The contractor for the wiring of the building is the Western Electric Company.

The Electric Storage Battery Company of Philadelphia, manufacturer of the Exide battery for electric vehicles, has recently placed on the market a new battery for sparking purposes. The great increase in the use of gasoline vehicles has convinced the company that a reliable sparking battery, which will furnish a "fat and hot" spark will be greatly appreciated. The company has prepared a number of sizes, which are found fully described in a pamphlet recently issued.

A novel application of electricity is a recent installation of the Sprague Electric Company's direct-current motors in the new bakery of the American Pastry and Manufacturing Company in East Fifteenth Street, New York city. A large number of electric motors will be used to operate the machines for mixing dough for crackers, biscuits and pies. An ingenious apparatus has also been perfected for electrically operating the ovens, which is a new departure in this industry.

The E. E. Naugle Tie Company of Chicago states that its tie and pole business is exceedingly brisk. The Naugle company is one of the largest concerns in this line of business and supplies many of the largest consumers. Owing to its steadily increasing business, the Naugle company has been obliged to seek larger quarters, and is now located in the National Life Insurance Building, 159 LaSalle Street. The new quarters contain about four times as much floor space as the old ones.

The Nernst Lamp Company of Pittsburg, Pa., through the H. C. Roberts Electric Supply Company of Philadelphia, has secured the contract for lighting the new Roberts Hall, Haverford College, Haverford, Pa., with two, three and six-glower Nernst lamps. The main auditorium of the college is also to be lighted by Nernst lamps. The Westinghouse Trust Company Building of Washington, Pa., has been fitted throughout, including offices and billiard room, with two and three-glower Nernst lamps.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 21, 1903.

725,663. Electrical Resistance Device or Heater. Johann F. Bölling, Frankfort-Bockenheim-on-the-Main, Germany, assignor to the Prometheus Electric Company, New York, N. Y. Application filed April 4, 1902.

In the device are strips of mica having resistance layers fixed on them, insulating covers on the resistance layers, metallic terminals in contact with the resistance layers and a sheet-metal strip connected with the strips of mica and forming a support for same.

725,664. Outlet Box for Interior Conduits. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, Utica, N. Y. Application filed March 19, 1902.

The box has a plate with a convex spherical surface, a support for a lamp bracket having a screw-thread at its outer end, and adjustable means for holding the plate and support to each other and to the box.

725,667. Trolley Pole. Charles A. Bray and Florien C. Fry, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed September 17, 1902.

The pole has a bent portion intermediate its ends, whereby it may adjust itself to contact with the conductor when above the level of the top of the vehicle or when at the side of and not higher than the top of the vehicle.

725,675. Driving Mechanism for Self-propelled Vehicles. Patrick J. Collins, Scranton, Pa., assignor to Richard J. Bourke, trustee, Scranton, Pa. Application filed August 29, 1902.

In the vehicle combined with a suitable driving power is a dynamo electric machine comprising a hollow field frame having a central compartment and two side compartments, a generator armature in the central compartment and connected to the driving power, and armatures in the side compartments geared to the driving wheels of the vehicle.

725,681. Method of Controlling Induction Motors. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed December 26, 1901.

The method of controlling an alternating-current induction motor consists in supplying successive voltages of different values thereto and momentarily introducing ohmic resistances into the primary circuits of the motor, between voltage steps, in such amounts as will prevent injurious rushes of current.

725,692. Regulator. James B. Foote, Jackson, Mich., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 23, 1901.

In the apparatus are a main contact controlled by the quantity to be regulated, and a co-operating contact normally stationary but adapted when engaged by the main contact to be withdrawn electrically from engagement with the main contact and returned mechanically as soon as such engagement is broken.

725,703. Electric-lamp Glower and Method of Attaching Terminal Wires Thereto. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed October 31, 1902.

The method of forming glower terminals consists in winding terminal wires around the glower ends, then applying an alloying material to the turns of wire and subjecting the same to a high degree of heat

725,708. Electric Meter. Frank Holden, London, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed October 23, 1901.

The meter has a main registering train and an auxiliary registering train, and means controlled by the field-coil of the meter for connecting the trains when the rate of consumption exceeds a given amount.

725,719. Trolley Stand. George F. Johnson, Pinners, Va. Application filed June 26, 1902.

A spring is provided for holding a pivotally mounted trolley arm in operative position, and other means release the arm from the tension of the spring when the trolley leaves the wire.

725,730. Controller. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 4, 1902.

In a reversing switch for an electric motor are segments for one position comprising two contact pieces, each adapted to connect two adjacent contact fingers, and segments for the other position comprising an intermediate contact piece adapted to connect two adjacent contact fingers and two end segments electrically connected together and adapted to connect the two outside contact fingers.

725,731. Cataphoric Electrode. Samuel H. Linn, Rochester, N. Y. Application filed August 9, 1901.

In the electrode are an anode of spongy or absorbent material and means for forcing an electrolyte therethrough under pressure and against the tissues to be treated.

725,754. Electric Headlight. John A. Mosher, Chicago, Ill. Application filed June 17, 1902.

An arc lamp and an incandescent lamp having independent circuits are combined with a circuit-breaker in the circuit of one of the lamps, an electromagnet in the circuit of the other lamp and controlling such breaker, and a manually controlled switch for each circuit, such switches being connected so as to act simultaneously and similarly. (See cut on next page.)

725,765. Volt-ampere Meter. Louis M. Pignolet, Orange, N. J. Application filed September 27, 1901.

In the meter are combined a permanent magnet, a solenoid within inductive action thereof, a plate of iron on one side of the elements and within inductive action thereof, a needle governed by the solenoid, and an angle-iron, whose portions are respectively at the end of the solenoid and at that side which is opposite the plate.

725,767. System of Control for Electrically Propelled Vehicles. William B. Potter, Schenectady, N. Y., assignor to the General Electric

Company, Schenectady, N. Y. Application filed July 22, 1898.

Electric motors on the several cars are combined with interconnecting electric conductors, and means whereby the breaking of the conductors will cut off the current leading to the motors and cause the motors to act as generators.

725,773. Revolving-field Magnet for Alternating-current Generators. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 18, 1901.

A spider has a rim-flange provided with a web projecting outwardly in a plane of revolution, and a mass of metal sheets is secured to the web and parallel therewith, the ends of the sheets in the same row abutting and breaking joints with adjacent sheets. (See cut.)

725,776. Electric-motor Sewing-machine Transmitter. Julius Rosenberger, New York, N. Y., assignor to the Rosemont Electric Transmitter Company, New York, N. Y. Application filed October 14, 1902.

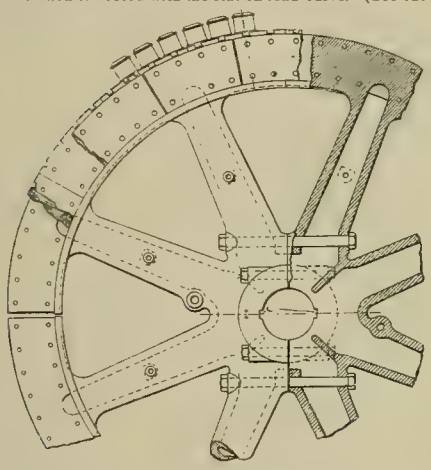
Parts of the invention are a brake for the motor, a rheostat, a starting pedal connected up with both the brake and rheostat, retractile springs for returning the rheostat, brake and pedal to their normal phases, connecting rods and a bell-crank connecting the pedal to the rheostat, and means for making and breaking the circuit of the motor.

725,777. System of Electrical Distribution. Norman Rowe, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed June 18, 1897.

In the system are a direct-current generator, a distribution circuit supplied thereby, translating devices connected in multiple series in the circuit, two motors having no mechanical connection with a source of power and having their armatures mechanically connected to rotate together and their armature and series field-magnet coils connected in series across the distribution circuit and their shunt field-magnet coils connected in series with each other around the series field-magnet coils in combination with a neutral or balancing conductor connected to the armature and series field-magnet circuits intermediate the motors.

725,798. Multiple-rate Meter. Elihu Thomson, Swampscott, and Frank P. Cox, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed February 25, 1899.

Combined with a recording electric meter are means for progressively and automatically varying the rate of registration to accord with the station-load curve. (See cut.)



NO. 725,773. ROTATING-FIELD MAGNET FOR ALTERNATOR.

725,799. Automatic Potential Regulator for Dynamos. Allen A. Tirrill, Laconia, N. H., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 13, 1900.

Combined with a dynamo having mains extending therefrom, is an automatic potential regulator having a controlling magnet in a shunt from the mains for controlling the regulation of the voltage in the mains, the magnet being a stopped-core and plunger magnet having a stop-core and a movable core, one of the cores having a laterally expanded head. (See cut.)

725,800. Automatic Potential Regulator. Allen A. Tirrill, Concord, N. H., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 16, 1901.

A regulator for a dynamo having a regulating resistance comprises a pair of contacts which by their mutual approach and separation control the regulating resistance, each of the contacts being controlled by its own magnet.

725,826. Electric Current-shunting Device. Edward R. Cliff, New York, N. Y. Application filed March 22, 1902.

A device for an electric lamp post is described.

725,827. Sprinkler Apparatus. Alfred A. Cowles, New York, N. Y. Application filed January 20, 1902.

The sprinkler apparatus is divided into a number of circuits or sections, and electrical means are provided for automatically opening different sections separately or together.

725,850. Telephone-receiver Holder. Gábor Königstein, San Francisco, Cal., assignor of one-half to Max Horwinski, Jr., and Edward Horwinski, San Francisco, Cal. Application filed January 13, 1902.

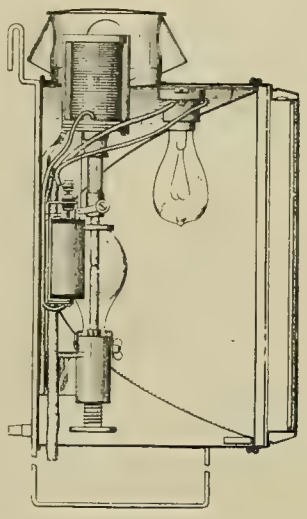
The device consists of an extensible and adjustable carrier a swiveled adjustable arm upon the outer end of the carrier and having bearings in it arranged at right angles, whereby the bar may be held in different positions as with a table transmitter, or when attached to a wall, and elastic holding-clamps fixed to the arm.

725,900. Electric Time Controller. Joseph Weatherby, Jr., Philadelphia, Pa., assignor to S. O. Spring, Peoria, Ill. Application filed August 11, 1902.

An improved combination of parts is described.

725,927. Canal and Power-generating System. Charles S. Bradley, New York, N. Y. Application filed October 11, 1901.

An hydraulic system comprises a canal connecting two bodies of water at different levels but both located below the canal level. A pump supplies water from the higher body to the canal. An hydraulic motive device delivers water from the canal to the lower body of water and an electric transmission system includes an electric generator operated by the motive device. An electric distributing circuit from the generator includes an electric driving device for the pump.



NO. 725,754.—ELECTRIC HEADLIGHT.

725,938. Trolley Wheel. Fred P. Crockett and Osro P. Johnson, Kalamazoo, Mich., assignors to the Star Brass Works, Kalamazoo, Mich. Application filed January 23, 1899.

The wheel has a suitable hub containing a receptacle therein and bushing inserted tightly forming a sealed chamber, which bushing contains receptacles supporting graphite in position to form part of the bearing surface.

725,985. Electromagnetic Brake. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed December 16, 1899.

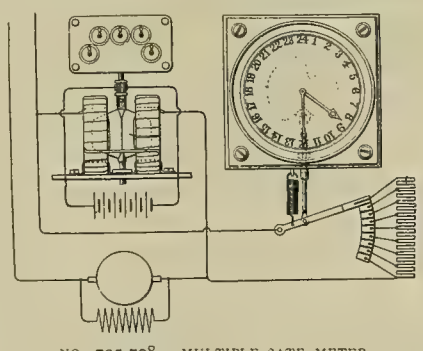
In the apparatus are a brake magnet provided with a number of coils and connections, whereby the magnetic force and the braking force of one or more poles may be varied respectively by varying the effectiveness of one or more coils.

725,992. Electric Lighter. William Roche, Jersey City, N. J. Application filed April 18, 1902.

The lighter comprises a receptacle adapted to contain a liquid fuel, a handle provided with a coil arranged to dip into the liquid and disposed transversely so that it will normally be in a horizontal position, the coil being adapted to become heated upon the passage of an electric current.

725,998. Electrolytic Separation of Copper and Nickel from Mattes or Ores. Ernst A. Sjöstedt and Joseph H. James, Sault Ste. Marie, Canada, assignors to Francis Hector Clerque, Sault Ste. Marie, Canada. Application filed September 20, 1901.

Part of the process consists in electrolyzing the solution while being agitated with a current of air, using copper cathodes and platinum (or graphitized carbon or other insoluble anodes) with a gradually (step-by-step) reduced current commencing with a normal density of about 0.3 ampere per 100 square centimeters of cathode surface to deposit the copper.



NO. 725,798. MULTIPLE-RATE METER.

726,020. Artificial Fish Bait. Thomas A. Bryan, Baltimore, Md. Application filed May 15, 1902.

The bait comprises a body, movable parts thereon, and electrically controlled means for actuating the movable parts independently of the body.

726,044. X-ray Tube. Theodor Friedlander, Chicago, Ill., assignor to R. Friedlander & Co. Application filed July 15, 1902.

Combined with a ray tube are an obliquely arranged open-ended water-chamber located at one side of the ray tube, an anti-cathode mirror, and a terminal for such mirror comprising a platinum tube having a closed inner end and sealed intermediate its length in the inner end of the water-chamber aforesaid, a metal plug fitting the bore of the platinum tube, and a terminal wire adapting the mirror for connection with the anode terminal of the ray tube.

726,061. Safety Device for Automatically Preventing Accidents from Trolley Wires. William A. Heyes and Lancelot O. Heyes, Wigan, England. Application filed January 3, 1902.

The device comprises a guard-wire normally "dead;" an electromagnet connected in series between the guard-wire and the tramway rails, a cut-out switch in the main circuit, a catch adapted to engage with a notch on the switch and mounted in such manner as to be drawn out of engagement by the electromagnet in the guard-wire circuit when the latter is energized, and means tending to pull back the switch when released by the catch.

726,105. Spring Jack for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed June 21, 1897.

One claim reads: In a spring jack, the combination with a supporting plate having a tubular opening therein adapted to receive a connecting plug, of a spring contact-piece of substantially spiral section in the tubular opening, the outer portion of the spiral being rigidly secured to the wall of the opening and the inner end thereof being free to encircle and grasp the plug.

726,124. Electric Incandescent Lamp and Circuits and Conductors Therefor. Gustave Weissmann, Paris, France. Application filed August 16, 1902.

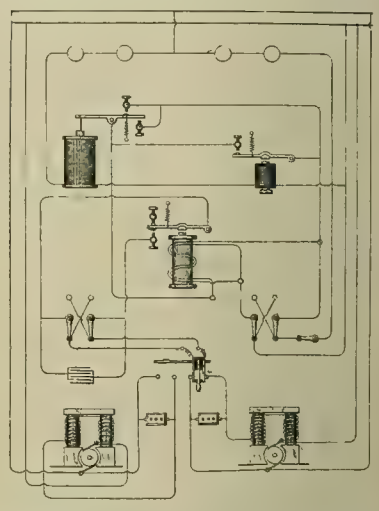
Combined with an incandescent electric lamp, each of the poles thereof terminating in a hook or loop are a conductor attached to each of the hooks or loops, and a non-conducting body movably mounted on each of the conductors and provided with a recess to receive the adjacent hook or loop.

726,177. Electric Motor or Engine. John Massey, Anderson, Ind. Application filed December 2, 1901. Renewed December 10, 1902.

In the motor are opposite perforated standards, opposite electromagnets within the standards and having their cores in alignment and reciprocatory armature rod engaging the perforations of the standards, the driven shaft having an operating connection with the rod.

726,211. Trolley. William H. Bachtel, Canton, Ohio. Application filed March 10, 1903.

The invention consists of a suitable standard, a pole adjustably connected thereto, an arm and a roller connecting therewith to engage the trolley wire, and a suitable spring connecting the arm with the pole.



NO. 725,799.—AUTOMATIC DYNAMO POTENTIAL REGULATOR.

726,215. Circuit Arrangement for Lamp Jacks. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Original application filed October 12, 1901. Divided and this application filed December 30, 1901.

An electrical signaling system comprising a number of lamp jacks arranged close together in a row or series, lamps in the jacks, the like spring-contacts of the alternate jacks being connected up in common with the opposite spring-contacts of the intermediate jacks, suitable connection between the spring-contacts thus connected up in common and one terminal of the source of current supply, a number of circuit-closing devices connected up in common with the other terminal of the source, and suitable connections between the circuit-closing devices and the unconnected spring-contacts of the jacks.

726,217. Refrigeration System. Clyde J. Coleman, Chicago, Ill., assignor to Clarence W. Coleman. Application filed January 22, 1900. Renewed July 25, 1902.

The apparatus has electric means connected with the cooling chamber for automatically controlling the compression device.

726,225. Mechanism for Cutting, Crushing and Dislodging Ice or Sleet on the Third Rail of Electric Railroads. Henry Klein, Hoboken, N. J. Application filed February 17, 1903.

The mechanism consists of a cross-piece and guides, and a spring bearing on the cross-piece, with a toothed cutting wheel.

726,233. Multiple-rate Metering. Elihu Thomson, Swampscott, and Frank P. Cox, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Original application filed February 25, 1899. Divided and this application filed August 29, 1902.

The invention consists in progressively and automatically increasing the rate of registration as the average load comes on at the station and decreasing the rate as the load falls.

726,234. Automatic Potential Regulator. Allen A. Tirrill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed December 16, 1901. Divided and this application filed September 25, 1902.

The method of regulating the voltage of a dynamo-electric machine, consists in exciting the field of the machine controlling the excitation in response to the voltage at the regulated point, and causing the excitation voltage to react upon the control independently of its action through the fields of the machine and of the exciter.

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Electrical Equipment of Two New Rolling-lift Bridges in Chicago.

The rolling-lift type of bridge, which was invented by the late William Scherzer, now used extensively in Chicago, is to be found in nearly every civilized country of the world. The first bridge of this type was built for the Metropolitan West Side Elevated Railroad Company in 1895, and since then the Sanitary District and the city of Chicago, as well as different railroad companies, have erected many of the bridges across the Chicago River and its branches. The two most recently constructed span the river at State Street and the South Branch at Randolph Street. The State Street bridge, shown in Fig. 2, was opened for traffic a few weeks ago, and the Randolph Street bridge is nearly completed, one-half of it being open to traffic, as shown in Fig. 1. Both of the bridges are electrically operated, although the electrical equipment of the two is not entirely identical.

The State Street bridge has a total length of 249 feet eight inches and the length from center to center of end bearings is 161 feet eight inches. A clear waterway of 140 feet in width is left between the foundations when the lifts are raised. The advantage of this wide open channel is well contrasted with the two narrow channels formed by the center pier of the Dearborn Street bridge, as seen in Fig. 2. The State Street bridge is a two-truss structure, the space between the trusses being 40 feet six inches wide and accommodating a roadway and two street-car tracks. A sidewalk 12 feet wide is left on the outer side of each truss. The lifting speed of the bridge is about 40 seconds.

Fig. 2. State Street Bridge, Looking West on Chicago River.

Fig. 1. Randolph Street Bridge, Looking West.

ELECTRICAL EQUIPMENT OF TWO NEW ROLLING-LIFT BRIDGES IN CHICAGO.

Two electric motors are used to raise each side and they are placed, with their gearing, underneath on the outside. One of the motors with its gearing, brakes, etc., is illustrated on the next page in Fig. 3, while the gears of another one may be seen at the right in Fig. 2. The motors are of the Westinghouse street-railway series type, with a capacity of from 50 to 56 horsepower. They are operated by a series-parallel control on a 500-volt direct-current circuit. Between the shaft of each motor and the rack on the bridge there is a set of four reduction gears. These are well illustrated in Fig. 3, and the rack may be noticed in the upper left-hand corner.

Each lift is controlled separately by an operator stationed in a small house at his end of the bridge. The interior of the operator's house on the south end of the State Street bridge is illustrated in Fig. 4. At the right may be seen the switchboard, which contains the necessary ammeters, voltmeters, switches, fuses, circuit-breakers, etc., for operating both sides of the bridge. At the left are two series-parallel controllers, each controlling one side of the bridge. The operator in this tower can operate both lifts of the bridge if necessary, while the other operator has equipment for only his side.

The electric power is obtained from the lines of the Chicago Union Traction Company, and a reserve supply connection will probably be made with the Union Elevated Railroad Loop. There are four locks on the bridge, and they are operated by electric solenoids from the towers. Indicator lamps are provided for the operators to show the position of each half of the bridge and to show also the condition of the locks. At the center of the bridge are electric-signal lanterns, which show red and green lights at night and red and green targets by day, according to the established river regulations. At the entrances to each side of the bridge are pneumatically controlled gates, which are operated from the controlling houses.

There are four brakes on each side of the bridge, two for each set of machinery. One of these is a hand brake and the other is an electric solenoid brake, being set by gravity and released by electricity. The brakes are 30 inches in diameter and are provided with three-inch friction bands. In Fig. 3 the hand brake is seen at the right and the solenoid brake at the left. Ten incandescent lamps are provided for the machinery on each side and five for each house. The wires under the river and to the different motors and lights are carried in lead-covered iron-armored cable. In addition to the above equipment, there is a 10-horsepower motor driving a centrifugal pump on each side for pumping out the water from the bridge pits.

The Randolph Street bridge has three trusses, dividing the structure into two roadways of 22-foot clear width each. The total length of the bridge is 267 feet five inches, and between centers of end bearings it is 169 feet two inches long. As with the State Street bridge, a clear waterway of 140 feet is provided. The electric-motor equipment is different, in that each span is operated by three 37-horsepower General Electric motors, connected to a cross shaft, and controlled by a controller. This bridge has no electric locks, but its signal lights and other equipment resemble closely those of the State Street structure. One distinguishing feature, however, of the design of this bridge is that the motors, instead of operating a straight rack underneath, gear into a curved rack at the ends of the trusses. The teeth of these racks are plainly discernible in Fig. 1.

The two bridges were built by the Scherzer Rolling Lift Bridge Company of Chicago for the Sanitary District, which will later turn them over to the city of Chicago. All the electrical equipment of the bridges was supplied and installed by George P. Nichols & Bro. of Chicago.

Electrical Exports for March.

The electrical exports from the United States for the month of March, 1903, amounted to a total value of $861,878, as compared with $675,717 for the corresponding month in 1902, thus showing a gain for the month over last year's figures of $186,161. The figures of March of the present year also show a decided gain over those of February, 1903, the amount of increase being $199,735. For the nine months ended with March, 1903, there has also been a gain in electrical exports to the amount of $953,432 over the figures of the corresponding period ended with March, 1902. The figures are: For the nine months ended with March, 1903, $7,688,821; for the nine months ended with March, 1902, $6,735,389.

The increase for March of the present year over that of last year is due to the great amount of electrical appliances (as distinguished from machinery) exported; this class of goods, including telephone and telegraph instruments, showing a gain for the month of $213,672, while in the matter of electrical machinery exported there has been an actual decrease of $27,511. The returns are as follows: Electrical appliances—March, 1902, $235,686; March, 1903, $449,358. Electrical machinery—March, 1902, $440,031; March, 1903, $412,520.

Classified according to destination, the exports of electrical machinery to some of the principal buyers during March, 1903, were as follows: British North America, $116,565; Mexico, $47,542; Brazil, $19,960; Japan, $18,244; Argentina, $7,559; British Australasia, $5,031; Chinese Empire, $4,965; British Africa, $3,841; British East Indies, $2,907; Philippine Islands, $1,700; Cuba, $1,048.

Possibilities of Lignite, Peat and Coal-dust Fuel.

Considerable interest is being taken in the United States in the manufacture of artificial fuel, and recently two experienced engineers—one from New York, the other from Minnesota—visited Germany to make careful scientific studies of the subject for the purpose of assisting to transplant the industry, or such of it as may be adaptable to American conditions, to this country. Both these experts have declared themselves astonished by the proportions of the fuel-briquette manufacture in Germany, the size and number of factories engaged, the amount of capital invested, the technical excellence of machinery employed, the permanent fireproof buildings, and the modernized methods of handling materials and product.

Meanwhile, says Frank H. Mason, United States consul-general at Berlin, each American mail continues to bring inquiries from owners of lignite, peat and coal properties in many states and territories, all asking for further details concerning German processes, the cost, capacity and productiveness of machinery, thermal values, and market price of the various kinds of briquetted fuel, and other information.

One instance of American adaptation of the German methods is that of the San Francisco and San Joaquin Coal Company of San Francisco, which has decided to install machinery for the briquetting of coal dust, the high price of coal in California rendering this profitable. The briquetting presses will be driven by electric motors, arranged to give any desired speed from 20 revolutions per minute to 550 revolutions per minute, in about 15 steps. Two 40-horsepower, slow-speed, 500-volt, direct-current Westinghouse motors have recently been purchased for this purpose; together with speed-controlling rheostats designed to vary the speed of the motors within the above limits.

In a recent report Mr. Mason says that samples of lignite from near Bismarck, N. D., and from Troy, Ala., have been received at the Berlin consulate, turned over to a syndicate and molded experimentally into briquettes with entire success. The Dakota lignite is old and hard, contains 38 per cent. of water, but crushes and pulverizes easily and forms, without binder, briquettes of firm structure, which burn readily, are practically smokeless, and leave only four per cent. of ash, while the best German brown-coal briquettes yield from nine to 12 per cent. of inorganic residue. The percentage of water contained is rather low, but by adapting the heating-drying process to that proportion of moisture, this obstacle, such as it is, can be easily met, and the reduced task of evaporation will be an economy in the general process.

The Alabama lignite, on the other hand, is an ideal material, and from the one sample submitted is conceded to be even superior to the standard brown coals of Germany. It contains the correct percentage of moisture, crushes easily, and molds readily into firm, shining, black briquettes, so clean that, as one of the experts at Magdeburg said, "they might be used for paper weights."

The importance of these simple demonstrations will be inferred from the fact that, according to a recent state geological report, there are 55,000 square miles of lignite beds in the Dakotas and Montana, all near the surface of the ground, and ranging in thickness from 20 to 80 feet. The extent of the lignite deposits in the gulf states is perhaps less exactly known, but they certainly cover a large area. There is also lignite in Missouri, Iowa, and several other western states and territories, and it is from all those hitherto practically neglected deposits that an inexhaustible future supply of smokeless domestic fuel will be derived.

Peat as a material for fuel ranks next in natural order below lignite, in that it is of similar but much more recent geologic origin, contains more water, is but slightly carbonized, and has a correspondingly lower thermal value than brown coal. The task of converting peat into serviceable fuel consists in cleaning the material of roots and rubbish, reducing the water to a small percentage, and so condensing the peat in volume that its thermal value shall be raised to practical efficiency. This is done by various methods, some of which are in Germany as yet partially covered by patents, but they may all be grouped under three heads, according to the form which the ultimate product is to assume, viz.: (1) Compressed peat, with or without admixture of coal dust or other inflammable matter; (2) peat coke; and (3) briquettes made by compression, with or without heat, of the material prepared by the first of these processes.

There are in the state of New Jersey, within easy distance of the coast, extensive peat beds which have not hitherto been utilized. There are at the terminal coal yards in Jersey City and Hoboken large quantities of coal dust, both anthracite and bituminous, that are treated as waste. May not the neglected peat and the worthless dust of the coal yards be combined by processes already perfected and successful in Germany, into a clean, cheap and effective fuel for household purposes? asks Mr. Mason.

But by far the most modern, scientific, and rational method of utilizing peat appears to be that of converting it into coke, by carbonization in retort ovens with recovery of the gas, tar, and other by-products of distillation. This has been the subject of many years' study and experiment in Germany, the best results of which have been embodied in the system perfected and patented by Martin Ziegler, a chemical engineer of high reputation, which gives to the manufacture of peat coke the dignity of a perfected industrial process. Concisely stated, the Ziegler method consists in carbonizing peat in closed ovens, heated by burning under them the gases generated by the coking process itself. Such a plant is, therefore, self-sustaining, the only fuel required being coal or wood sufficient to heat the oven for the first charge, when the gases generated by the coking process become available and enable the operation to be repeated and continued indefinitely. Not only this, but the off-heat from the retort furnaces passes on and heats the drying chambers in which the raw, wet peat is prepared for the ovens by drying to the point of economical carbonization.

While Germany is pre-eminent in the scientific utilization of lignite and peat as materials for prepared fuel, it is not apparent that this technical superiority is so absolute in the treatment of coal dust. It is true that the coal-briquette manufacture is fully organized and developed in Germany, that there are several German builders of coal-briquetting machinery who are masters of that branch of construction, but the same is true of France, Belgium and England, where the conversion of coal waste into briquettes for locomotive and other steam fuel, as well as for grates and heating stoves, has long been a standard and established industry. It is not known that it has anywhere been found possible to make a marketable briquette of bituminous or anthracite coal dust without the use of a matrix or binder to hold the pulverized material together. The percentage of binder required varies with the composition of the coal, from two to 10 per cent. and the pitch of coal tar, which is the binder ordinarily used, costs in Germany from $10 to $12 per ton, and at that price its use for briquetting purposes in a higher proportion than six to seven per cent. is commercially unprofitable.

The ingenuity of inventors in European countries has of late years been directed especially toward improvements in binders and the discovery of materials other than coal tar which would answer the same purpose. An English process takes good coal, condenses and renders it compact to transport and, to all practical purposes, smokeless. It is stated that a machine costing $4,500 will produce 50 tons of briquettes per day, and plans are matured by which one or more of them will be exhibited in operation during the coming exposition at St. Louis.

FIG. 3. ELECTRIC MOTOR AND GEARING ON STATE STREET BRIDGE, CHICAGO. (PAGE 359.)

Australian Customs Duties.

The new tariff for the commonwealth of Australia provides that there shall be a penalty of $500 paid on the importation of any goods which are prohibited by law. If any goods enumerated in the tariff are or can be classed under two or more headings or descriptions, with a resulting difference as to duty, then the higher duty shall be charged. The various duties include the following: Electrical machinery, 12½ per cent. ad valorem; electrical appliances, 12½ per cent. ad valorem; metal-working machinery, free; electrical material, including accumulators or storage batteries and glass cells, cable and wire covered, carbons, incandescent lamps, testing meters and instruments, dry cells, transformers, porcelain fittings, including lamp holders, free; motor vehicles, 20 per cent. ad valorem.

FIG. 4. OPERATOR'S HOUSE ON STATE STREET BRIDGE. (PAGE 359.)

Electric-railway Power Distribution.

By W. B. Gump, Jr., A. S. M. E.

There is scarcely a branch of engineering which involves such perplexing problems as are confronted in electric-railway work. This is true especially from an electrical point of view, because of the fact that the growth and conditions of traffic constantly change. This affords rather uncertain conditions for the engineer to build upon, since he must design the system of transmission entirely upon the probable conditions of traffic, which cannot be predicted with accuracy.

Numerous formulas for calculating conducting systems have been devised which greatly aid the engineer, but so many variables enter into such formulas that they are useful only in the hands of those having had extensive experience with similar problems.

Since space is limited, and few details can be taken up, we shall present only those of the greatest importance. The features to be treated here will be as follows: (1) Grades, (2) the line, (3) the load curve, (4) the methods of distribution, (5) the return circuit, and (6) the power house. Before taking up the items just given, let it be understood that the present description will deal entirely with the single-trolley system, which is the most common, and will not include the conduit, double-trolley, and third-rail systems, since the latter three are special examples rather than simple ones.

Grading and Drop in Voltage.

In planning a railway system the first thing to be done is to make a careful survey of the grades over which the road is to be built; in fact, the survey determines the most available route to be chosen, and gives the basis for plotting the load curve, which is first in importance in determining the general character of the power plant. The work necessary for surveying for an electric road is con-

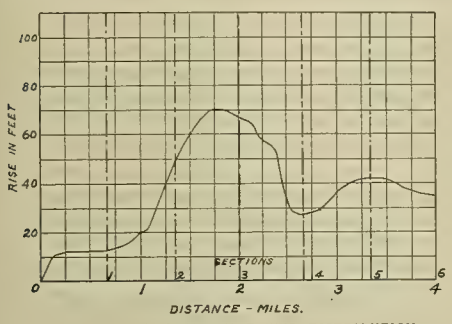


FIG. 1. ELECTRIC-RAILWAY POWER DISTRIBUTION. DIAGRAM OF CONTOUR.

siderably less than that required for a steam road, since the former may run over medium grades without any serious difficulty while the latter must of necessity operate on a comparatively level plane. The reason for this is evident from the fact that the car motor has its speed reduced through a pinion which drives the wheels, and hence is geared to climb a considerable grade, while the locomotive driver on a passenger engine is connected directly to the main rod, and is "high geared." From this it may be seen that a much greater amount of excavating would be necessary for a steam road than for a trolley road, hence the latter has this point in its favor, which is quite important. It must be kept in mind, however, that first cost is often offset by other conditions, and a car cannot be propelled over a grade without consuming more power, and this must be paid for by supplying additional current, and therefore a greater amount of cross-section of copper.

The surveying of a road is ordinarily done by a civil engineer; the electrical engineer must thoroughly understand the nature of these grades, however, since the contour of the country is an important factor in planning the conducting system. Suppose that Fig. 1 represents the contour of a road which has been surveyed for a trolley line. The diagram is self-explanatory and a description is unnecessary. Let us suppose this to be a city line four miles long. It is practicable to assume that cars are to be run on an average of five minutes apart, and with this assumption we may divide the line into equal sections, assuming a speed of, say, eight miles an hour. Upon this assumption it is obvious that one car will run the total length of the line in 30 minutes; if, therefore, the cars are scheduled five minutes apart the road may be conveniently divided into six sections, as shown in the drawing. Now, suppose that there is practically a uniform load upon the trolley line at each section. The condition we have is represented by the curve (AE) in Fig. 2. Suppose we are operating at 500 volts, the total current carried being 300 amperes, and the resistance of each section to be 0.05 ohm. The first section will evidently carry the entire 300 amperes and its drop CR is $.05 \times 300 = 15$ volts. The second carries $300 - \left[\frac{300}{6}\right] = 250$ amperes, with a drop of 12.5 volts; the third section carries 200 amperes with a drop of 10 volts, and so on, the last section carrying 50 amperes at a loss of 2.5 volts. The drop in a line loaded uniformly as described may be computed algebraically as follows: Suppose C to be the total current on the line; s the number of sections, and r the resistance of each section. Then the current in each section is $\frac{C}{s}$ and the drop in each section is evidently $\frac{C}{s} \times r$. Now, considering each section separately, the drop in the first section will be $10 \frac{C}{s} \times r$, in the second $9 \frac{C}{s} \times r$, and so on; there-

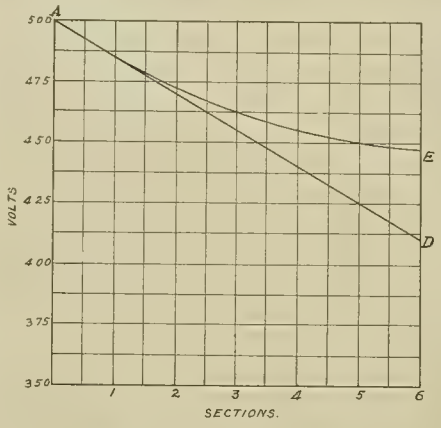


FIG. 2. ELECTRIC-RAILWAY POWER DISTRIBUTION DROP IN VOLTAGE.

fore, for s sections, $E = \frac{C}{s} r (1 + 2 + 3 \ldots\ldots s)$. The sum of such a series of integers is $s \frac{(1+s)}{2}$ therefore, we have $E = \frac{Cr}{2}(1+s)$.

Such a road will necessarily have a double track, and hence two trolley wires. If the line is divided into six sections, there will be two cars for each section, since six cars run one way and six run in an opposite direction. This fact will not change the formula just given, however, but will merely include two divisions of the main line and track, these being considered separately when calculating the size of the conductor to be used.

The curve (AE) in Fig. 2 has been plotted according to the drop in each section, as explained. Suppose that the entire load were concentrated at the end of the line. In such a case the line (AD) represents the drop that would result. A careful observation of these curves readily shows the advantage of a uniform load, and the latter is attained chiefly through good road equipment, and a time schedule which is consistent with the traffic. The first of these two conditions is of paramount importance because a breakdown at a remote point from the power station means a concentrated load at that point due to the bunching of cars. This is an emergency that may happen to the best of roads. It is, therefore, necessary to make every possible provision at the outset. Among the precautions necessary is to install a good system of feeders reinforcing the line at special points, as, for example, near an outing park, where it becomes necessary to accumulate a number of cars. The latter case is common to suburban lines, and is met by installing a special direct-feeding system or by the use of a rotary sub-station, transmitting by alternating current and stepping down to the line through a rotary transformer. For a distance up to 25 miles, 10,000 volts is good practice, this being stepped down through rotaries to 550, and sometimes 650 volts on the line.

Load Curve.

The next matter that concerns us is that of the load curve, the plotting of which will now be described. It is usual to construct such a curve by using the ordinates to represent the number of kilowatts and abscissæ the time of day. Observing Fig. 3, a curve is shown portraying the approximate condition existing on such a line. Supposing that the cars are to start from the car barn at 5 a. m., it will be seen that just one hour is taken for all of the cars to be distributed on the road; in other words, the first car is just returning to its starting point at 6 o'clock, and not until then is normal line current required at the power house. At the point (A), Fig. 3, there is a rise due to increased traffic caused by workmen going to factories and places of business. At (B) there is a dropping off, the traffic at this time being comparatively light. From 11 until noon, which is designated by (C), there is a rise which reaches its maximum at the noon hour when people are returning from stores and factories. From this it again drops down to normal

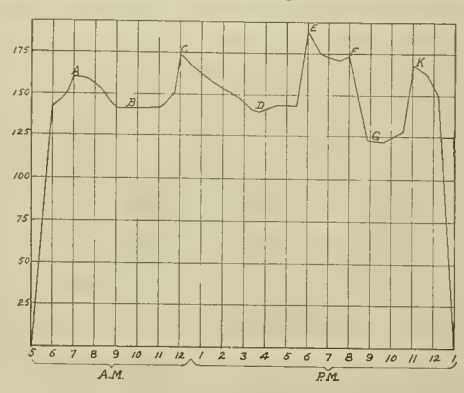


FIG. 3. ELECTRIC-RAILWAY POWER DISTRIBUTION. LOAD CURVE.

or below during the hours of 3, 4 and 5 p. m. At (E) it again rises, and at this point is the highest in the curve. This load remains nearly constant, for at (F) is the time at which the theater traffic is met. The drop from (F) to (G) is very marked, and is the lowest point in the load curve. At (K) the theaters are letting out, and for a short time traffic is again above normal. From this point it finally drops off, the cars being taken to the barn for the night.

Attention should be called to the fact that this curve does not take into account the stops and starts made by various cars, but assumes that the cars are evenly distributed and running at normal speed. It may readily be understood that the load is extremely variable, one minute nearly the entire current being cut off, and the following not un-

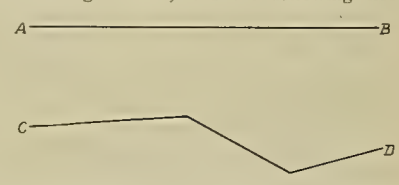


FIG. 4. ELECTRIC-RAILWAY POWER DISTRIBUTION.—FEEDER DIAGRAMS.

likely to be a heavy overload, which may be either interrupted or may continue for a considerable length of time. The greatest possible distortion of load occurs when all of the cars are bunched at the end of the line, as shown in Fig. 2.

Since each railway line is a separate and distinct problem, it is a hard matter to give illustrations which would be applicable to all cases, but it may be said regarding the curve just described that it furnishes a fair illustration of the general condition to be expected of a trolley line operating in a city having from 50,000 to 75,000 inhabitants.

Feeders.

The next point in our discussion brings us to the methods of distributing power for railways. There

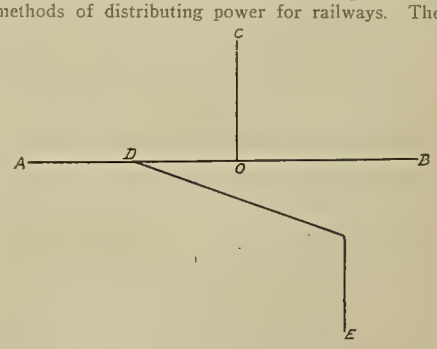


FIG. 5 ELECTRIC-RAILWAY POWER DISTRIBUTION.—FEEDER DIAGRAM.

are two general methods employed. The direct-feeding system and distribution through sub-stations. The former applies to the example described, which is common to most city lines, while the latter pertains to interurban and cross-country railway lines involving distances upwards of 20 miles, in which cases the alternating current is employed for transmission, and is reduced and transformed through rotary sub-stations for distribution. Fig. 4 repre-

sents the simplest form of distribution, and is known [illegible] its ideal form it is a straight line such as (AB). In practice, however, it more often assumes irregular curves and turns such as (CD). There are two other classes known as the branched and meshed, shown in Figs. 5 and 6. The branched type consists of a main line (AB), from which run branches such as (OC) and (DE). The ideal form of the meshed system is shown in Fig. 6, and in its simplest form consists of several lines crossing at right angles to each other. This system has the advantage of reinforcing any one of its lines by any other line, thus equalizing the load in a way not permissible in other systems. In

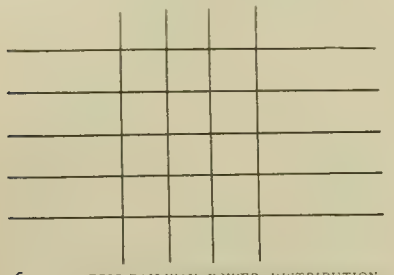


FIG. 6. ELECTRIC-RAILWAY POWER DISTRIBUTION. FEEDER DIAGRAM.

the diagrams shown the working conductors only have been described. These must be determined before the feeding system can be planned, the latter supplementing the working system by reinforcing the line and equalizing the voltage at various points.

Since the method of calculating the cross-section of copper is well known, it will not be described here, since the same method is applicable to trolley lines. It may be of some value to give a short rule for finding the net weight of copper. It has been found that 1,000 feet of copper wire of 1,000 circular mils cross-section weigh very nearly three pounds. Considering now the fundamental equation $CM = \frac{1\ C\ L}{E}$ where C is the current in amperes, L is the length in feet, and E the allowable drop, the constant being taken as 11, we may transpose and rewrite $W = \frac{33\ L}{E}$, the constant being three times that of the preceding equation where W is weight in pounds per 1,000 feet.

It has been shown by experience rather than by

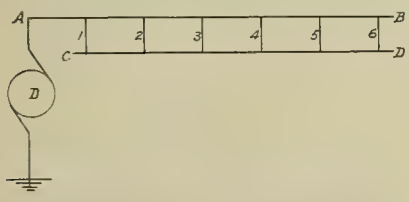


FIG. 7. ELECTRIC-RAILWAY POWER DISTRIBUTION.—DIRECT FEEDING.

theory that for certain conditions of road and traffic, a corresponding system of feeders is necessary in order to meet the requirements in the most economical way. It may be said that as a rule direct feeding is used, except on roads involving distances too great to be operated economically, in which case one or more sub-stations will be required. Fig. 7 shows the simplest method of direct feeding, (AB) representing the main feeder and (CD) the working conductor. The branches (1), (2), (3), (4), (5), (6) are sub-feeders which are spaced at intervals of a few hundred feet. In this system both the feeder and trolley wire are of uniform cross-section. It has the advantage of fur-

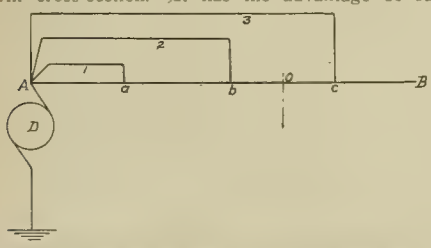


FIG. 8. ELECTRIC-RAILWAY POWER DISTRIBUTION. FEEDER DIAGRAM.

nishing the full conductivity of the system at a point at which an overload occurs.

A line upon which the demands of traffic call for a heavier system of feeders should be planned according to Fig. 8. This arrangement is advantageous in being able to maintain a more uniform voltage by having a larger cross-section on the longer feeders. In such a system the points (a), (b), (c), etc., at which connections are made to the trolley wire, are heavier than they would be otherwise. The distances between connections will generally be several thousand feet apart, except where traffic is unusually heavy. At distances of a few thousand feet No. 0 or No. 00 are good sizes to be adopted. Another advantage of this arrangement is that the current is fed to a car from two directions; for example, at the point (O) current will flow on the line (AO), being fed by feeders (1) and (2), and will flow also over feeder (3) and from (C) to (O). There is a serious disadvantage, however, from the fact that short-circuits are more severe, and portions of the line cannot be conveniently cut out in case contingencies arise to demand it. Since it is a decided advantage to isolate parts of the working conductor from the main line in cases of short-circuits, fires, etc., the arrangement just described may be modified as in Fig. 9. Sometimes it is feasible to join two feeders together, as shown by the dotted line; this is frequently done to reinforce a section which is exposed to extreme overloads.

Where there are grades of any consequence it is obvious that reinforcement from feeders is necessary. In order to ascertain the additional current required, some data relating to power required upon grades is useful. It is not difficult to determine quite accurately the amount needed to propel a certain weight over a given grade. The difficulty before us is to estimate the weight that is actually

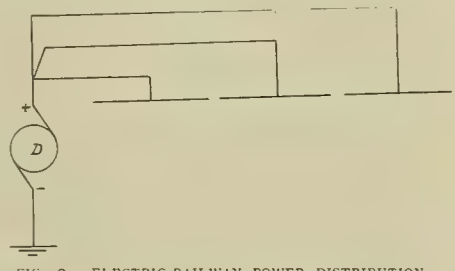


FIG. 9. ELECTRIC-RAILWAY POWER DISTRIBUTION. FEEDER DIAGRAM.

being moved, since it is so variable that at best a good guess is about as near the solution as any other means. An approximate rule may be expressed as follows: The power required at the car wheel for a speed of eight miles per hour, is .4 H. P. per ton + .4 H. P. per ton for each per cent. of grade, or H.P. = W (.43 + .43 G) where W is weight of car and contents in tons, and G is the per cent. grade.

Return Circuit.

It is of vital importance to investigate thoroughly the conditions of the return circuit; in fact, such an investigation must be made before any of the conducting system is planned, so that the overhead system may be designed to correspond. In the early days of electric railways little attention was given to the rails themselves with respect to ample cross-section, good bonding, etc., it being thought that since they are in contact with the earth as a conductor, the conductivity would naturally take care of itself. It is true enough that the cross-section of the earth as a conductor is almost infinite in comparison to the rails, but it has been found to be sadly insufficient to cope with the amount of current used in railway return circuits due to the fact that the earth's crust is composed of materials which have a great variation in their conductivity.

Let us consider first the rails themselves. Steel is a fairly good conductor, its conductivity as compared with copper, weight for weight, being about one-seventh that of the latter. An iron bar weighing one pound per yard, and hence a rail of the same units, has a cross-sectional area of 110,000 circular mils, which is equivalent to 16,000 circular mils of copper. The resistance of a copper wire of 16,000 circular mils section is approximately 1.6 ohms per 1,000 feet, therefore the resistance of a rail in ohms is $R = \frac{.6}{W}$ where W equals weight of rail per yard. Since two rails form a track the formula becomes $R = \frac{.3}{W}$. From these formulas the drop in the track may be computed, the results of which must be considered in planning the overload system.

Bonding.

In regard to the earth as a conductor it has been shown that the resistance of the earth between two metallic conductors placed therein practically remains unchanged as the distance of these conductors is increased, the lines of conducting current dispersing and the current density therefore decreasing as the metallic conductors are moved apart. The only satisfactory method of forming a good return is to establish good metallic connections between rails. This is done by bonding. In Fig. 10 (A) shows the simplest method and is about the earliest form employed. Such an arrangement is no longer used, because of the fact that the breaking of a single bond will cripple an entire side and leave but one remaining rail to carry the current. (B) is a better form, the bonds being connected in multiple. This is generally supplemented with an additional conductor, as shown in (C), which is analogous to a feeder system.

There are so many kinds of rail bonds that it is useless to undertake to describe them here. Fig. 11 is a typical one. It consists of a bar (B), the ends of which are enlarged, increasing the cross-section at the portion to be riveted into the rail, as shown.

Power Plant.

A few points of especial importance regarding the

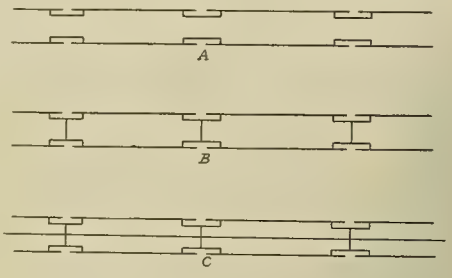


FIG. 10. ELECTRIC-RAILWAY POWER DISTRIBUTION.—BONDING.

power house will now be taken up; in the first place, its location. It is evident that the most economical point for its location from the standpoint of economy in copper would naturally be at the center of distribution of the system. In point of fact, however, the majority of plants furnishing power to railways are remote from the center of distribution, and especially city lines, since the cost of a site at the center of distribution nearly always offsets the advantage in copper economy. For this reason suburban and interurban lines are better able to place the power station nearer the center of distribution.

The general character of the power station will vary according to the special demands to be met.

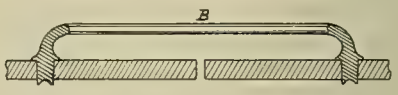


FIG. 11. ELECTRIC-RAILWAY POWER DISTRIBUTION.—TYPICAL RAIL BOND.

It has been stated that transmission over long distances is best manipulated through the alternating current previous to distribution to the working conductors. It often happens, however, that extensions on a 550-volt direct-current line are desirable. Such extensions have been made practicable by means of a "booster," whose function is to maintain normal voltage on the line at a remote point. The cost of copper to maintain normal voltage at 550, even by over-compounding, would be prohibitive. Therefore an arrangement, shown in Fig. 12, is used. It is merely a small generator usually driven by a motor, and is in series with the main generator. Supposing (AB) to be a section

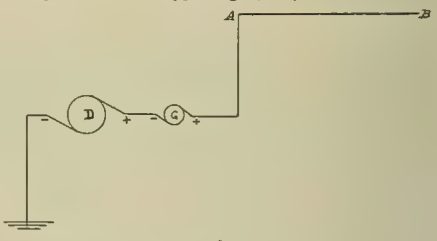


FIG. 12. ELECTRIC-RAILWAY POWER DISTRIBUTION.—BOOSTER ARRANGEMENT.

of feeder whose loss must be made up; then if (G) is a booster generating current at 200 volts in series with (D), the voltage on the feeder (AB) will evidently be 750 volts, and at (B) will have a possible drop of from 250 to 300 volts and still be within about normal working voltage at the trolley.

Electrolysis.

It is not out of place in concluding this description to make a brief statement regarding the effects of electrolysis upon pipes and rails in the neighborhood of electric roads. It is well known that the path of the return current is by no means confined to the rails, but strays to neighboring pipes, and cables, if any, causing serious corrosion at points where the current leaves said pipes. In instances where the positive terminal of the generator was connected to the earth a great deal of trouble from electrolysis was found to exist at remote points from the power station. These sources of trouble were quite difficult to trace and to remedy. Perhaps the best remedy is to reverse these connections, making the earth negative, and inserting a copper conductor along the danger area, connecting from it to points on the cable exposed to electrolytic action. In this manner the path of the current is definite, and trouble, if any, is confined to the vicinity of the power station, where any serious condition can be properly looked after and more easily remedied.

Great International Electrical Combinations Reported.

The New York Herald has information from Berlin, dated April 29th, to the following effect: "Important negotiations will be concluded in this city within a few days for the organization of a gigantic electrical trust, embracing the American General Electric Company, the British Thomson-Houston Company and the newly formed German electrical trust, consisting of the Allgemeine Electricitäts Gesellschaft and the Union company of this city. Messrs. Potter and Clark of the General Electric and the Thomson-Houston companies will arrive here shortly to confer with the German leaders. The new electrical trust proposes to obtain control of the British and continental market. It already controls the Union company in this city, which recently fused with the Allgemeine company under the leadership of Herr Rathenau. To contest with the trust Siemens & Halske and the Schuckert company recently formed a combination, and it is likely that the Westinghouse company will form an alliance with these companies, as George Westinghouse is due here shortly."

Inquiry has failed to elicit either confirmation or denial of these reports. President Coffin of the General Electric Company is abroad, but it is said that his journey is for rest and recreation merely.

Carnegie to Aid in Bringing Engineering Societies Together.

The long-cherished hope of Charles F. Scott, president of the American Institute of Electrical Engineers, for a unification of the principal engineering societies of the country and a general headquarters for meetings and the joint use of the societies seems to be nearing its realization. Andrew Carnegie has pledged his aid to the project to the extent of $1,000,000 and more if necessary.

The proposition involves the erection of two structures in West Thirty-ninth and West Fortieth Streets, New York city, one to be for the new home of the Engineers' Club and the other to be a magnificent headquarters designed for the joint use of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers.

When Mr. Carnegie was told by a committee of the plan to bring the several associations into closer relationship and have them housed in one building he is reported as saying: "Gentlemen, if you can gain the assent of the various bodies concerned in the development of that enterprise, go ahead, and do not let the cost of its realization worry you unnecessarily. You may draw upon me to the extent of $1,000,000, and I will give more than that should it be needed. America's achievements in the several spheres of the engineering arts are so noteworthy that America is justly entitled to pre-eminence as the engineering center of the world."

Inverted Third Rail for Electric Railways.

Leonard Wheeler of Wheaton, Ill., and John T. Murphy of Chicago, two gentlemen well acquainted with the workings of the third-rail line of the Aurora, Elgin and Chicago Railroad, have devised a special type of underrunning third rail which will be of special advantage in preventing trouble from sleet and also be a safeguard against danger from shock. Fig. 1 shows the position of the inverted rail

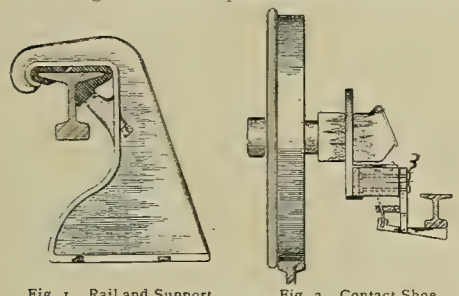


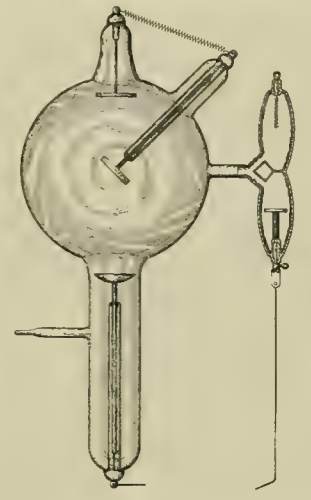
Fig. 1. Rail and Support. Fig. 2. Contact Shoe.
INVERTED THIRD RAIL FOR ELECTRIC RAILWAYS.

and a support for it. Between the rail and the standard is interposed an insulating material. The contact shoe for the third rail is supported from the car through suitable insulation, as shown in Fig. 2. The shoe is adapted for upward and downward movement, and a double-acting metallic spring interposed between the shoe and support is in constant electrical contact with both of the members, and tends to hold the shoe normally in definite position. The necessary electrical conductor adapted for connection to motor devices on the car is secured to the support.

Improved X-ray Tube.

An invention which has for its object a simple and efficient construction of X or Roentgen-ray tube, so that the degree of exhaustion or attenuation of the air or gas within the tube can be either increased or diminished to suit the particular operations in which the tube is employed has been patented by Theodor Friedlander of Chicago. This object is obtained through the use of an auxiliary tube provided with anode and cathode terminals. The auxiliary cathode is arranged within a subchamber, and is preferably provided with a coating of potassic hydrate or other analogous gas-producing substance.

The feature of an auxiliary cathode in connection with a gas-producing substance is common to a



IMPROVED X-RAY TUBE.

number of prior ray tubes, the object being to prevent too great an attenuation of the gas within such ray tubes during continued use by automatically supplying gas from such gas-producing substance to compensate for an undue increase in the stage of attenuation.

In practical use a regulation of the degree of attenuation within the ray tube to meet any particular condition or requirement in the use to which the ray tube is applied is effected by a manual adjustment on the part of the operator of the spark gap between the depending finger and the cathode terminal of the main tube.

When through long-continued use, prolonged inactivity, and the like, the atmosphere in the ray tube becomes overattenuated, such overattenuation, it is said, can be overcome with the present arrangement in a rapid and convenient manner by connecting the negative pole of the inductorium directly to the lower connecting eye of the secondary cathode until such overattenuation is reduced to the desired condition.

Boston Edison Extensions.

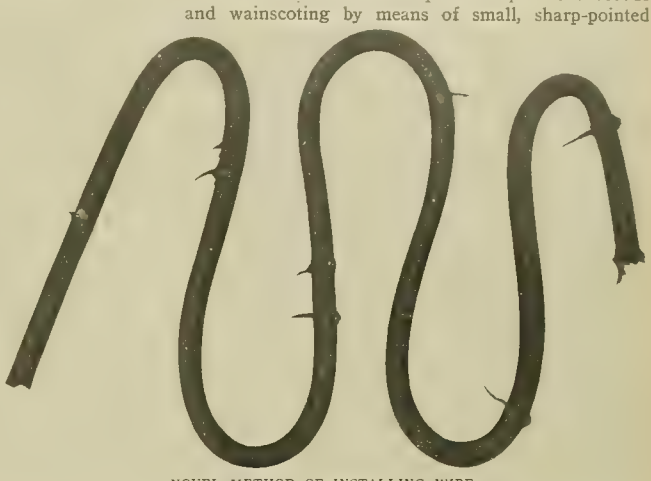
The stockholders of the Edison Electric Illuminating Company of Boston have voted to petition for authority to issue 20,000 shares of additional capital stock, the proceeds to be used in paying for the recently purchased gas and electric-lighting properties in suburban cities and towns. The gas and electric-light commissioners of Massachusetts have authorized 16,500 new shares of stock, of which 8,649 shares have not been issued but will be in about a month. It is expected that if the additional 20,000 shares are authorized, they can be sold for $200 a share. Of the proceeds, $2,000,000 to $2,500,000 will be needed to pay for the plants in Dedham, Milton, Canton, Needham, Natick, Woburn, Framingham and Somerville, and the electric plants of the Chelsea Gas Light Company and the Newton and Watertown Gas Company. The balance of the proceeds will be needed for increases within a year or two. The company has let the contracts for increasing the capacity of its South Boston L Street station. The boiler-room capacity is to be increased to 20,000 horsepower, or three times its present capacity. The company has purchased seven acres of land adjoining the station.

New Eight-story Building for Chicago Edison Company.

The Chicago Edison Company owns nearly half a block of property at the corner of Market and Washington Streets, Chicago, and occupies a portion of the present building with a repair shop. The company now plans to erect on a portion of the property at 82 and 84 Market Street an eight-story building at a cost of $220,000. The building will have a frontage of 55 feet and a depth of 85 feet. The first two floors will be used for a new sub-station, and the other floors will be used by some of the company's departments and for other purposes. Eventually, on the remaining property, buildings will be erected to conform with the new section now to be built.

Novel Method of Installing Wire.

The accompanying illustration, reproduced in the Western Electrician by the courtesy of the Underwriters' Electrical Bureau of Chicago, tells its own story. It is made from a photograph of a specimen forwarded by Mr. F. D. Varnam, city electrical inspector of St. Paul, Minn. This particular example of improvised interior construction work was discovered in a large shoe factory in St. Paul, where it formed part of a 110-volt incandescent-lighting system. The wire used is No. 14 in size and rubber insulated. It was held in place on pine backboards and wainscoting by means of small, sharp-pointed



NOVEL METHOD OF INSTALLING WIRE.

nails, driven through the insulation and into the wood. These nails were driven along the wire at intervals of from two to four inches, and considerable wire was put up in this manner throughout the factory. On making inquiry Mr. Varnam was told that the inventive genius who was responsible for this unique if not approved method of installation, was a "handy man" employed about the factory, whose object simply was to keep the wires close to the surface to prevent mechanical disturbance. It is perhaps needless to add that this home-made system of wiring is no longer in use.

Peoria Gas and Electric Company Wins Suit.

The city of Peoria, Ill., has lost the suit brought against the Peoria Gas and Electric Company to fix the maximum rate of gas. The decision just handed down by Special Master in Chancery I. C. Pinckney of the United States Circuit Court, is not only a signal victory for the gas company, but may redound to the advantage of public-utility companies everywhere.

The essential features of the master's findings are as follows: First, that the exercise of the right claimed by the city must be reasonable; second, that the question of reasonableness of such a right is for judicial determination—that is, that neither the city nor the Legislature of the state itself has the right to fix a rate in such a manner that the courts cannot inquire into its reasonableness; third, that in determining the cost of the manufacture and distribution of gas the depreciation of the plant and a reasonable interest on the money invested are proper elements of such cost; fourth, that a federal question is clearly involved because under the facts in evidence the enforcement of the ordinance would necessarily amount to a taking of the complainant's property without due process of law.

The case arises out of an ordinance passed by the City Council of the city of Peoria on September 4, 1900, which provided that the maximum rate thereafter to be charged by any gas company doing business in the city of Peoria should be 75 cents a thousand cubic feet, that the gas furnished should be of uniform 18-candle illuminating power at the point of consumption, and provided heavy penalties for violation of the ordinance. The gas company secured a temporary injunction against the enforcement of the ordinance and the case was bitterly contested for more than 18 months. Testimony of distinguished experts from all over the United States was adduced by both parties.

Traffic on the Chicago elevated railways for the month of April makes a good showing. In percentage of gain over April, 1902, the Northwestern leads, with an increase of 9.03 per cent. The South Side Elevated is second, with a gain of 8.07 per cent., and the Metropolitan gained 7.64 per cent. The figures of the daily average number of passengers carried for April are as follows: Metropolitan, 1903, 117,597; 1902, 109,246; South Side, 1903, 87,553; 1902, 81,009; Northwestern, 1903 71,340; 1902, 65,430.

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DATES AHEAD.

National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

FRENCH ingenuity, which devised the attention-arresting expression "white coal" for waterpower, is to be credited with the term "electric valve" for the Nodon electrolytic rectifier, briefly described on another page. The cleverness of the French nation is not unknown in the electrical field, and a correspondent in Paris describes for us, in a letter published in this issue, the novelties of an electrical nature exhibited at last month's exhibition of the Société de Physique. Most of these devices have an international value, and the article will be read with interest.

AN elementary, but nevertheless valuable, article on "Electric-railway Power Distribution," written by W. B. Gump, Jr., is presented in this issue. In our consideration of electrons (and, apropos of electrons, it may be noted that a portion of Sir Oliver Lodge's recent paper on this recondite subject is also given in the present number), mercury arcs, steam turbines, single-phase railway operation, automatic telephone exchanges and other new things, or old things newly considered, we must not forget that the old problems are still with us and that they are new problems to the successive accessions of students constantly appearing on the scene of action. Such students and many young engineers will, we are confident, find much that is helpful in Mr. Gump's contribution. The various factors in the problem of electric-railway power distribution are taken up and clearly discussed, and the standard practice in relation to the overhead-trolley direct-current system is plainly set forth.

ANDREW CARNEGIE is entitled to the gratitude of every engineer for his generous offer to give $1,000,000 for a magnificent headquarters building in New York for the various engineering societies of national scope. As readers of the Western Electrician are aware, we have not been over-enthusiastic in relation to the project of concentrating the central activities of the great engineering societies in one building in the city of New York, realizing the difficulties and drawbacks of the proposal, which has, however, many influential advocates. Nevertheless, Mr. Carnegie's offer is such a disinterested and notable one that it would be ungracious to suggest opposition to its acceptance. We note with regret, therefore, the statement that rivalry among the societies may defeat the benevolent intention of the philanthropist. An officer of one of them is reported to have said that it is doubtful if all can live in peace under one roof. Mr. Carnegie put his proposal in writing on February 14th last, and as the matter now stands it needs only the harmonious action of the councils of the associations concerned to utilize his gift. We hope that this desired co-operation will not be lacking.

DOES the boiler receive the attention that it deserves in the economy of electrical generating plants employing steam? Many operating and designing engineers declare that it does not, and say that some of the study lavished on the engine and generator might be bestowed, with advantage, on the boiler and furnace. At a meeting of the American Institute of Electrical Engineers in Chicago this week Mr. W. L. Abbott, chief operating engineer of the Chicago Edison Company, made the striking statement that the waste in boiler and furnace may be very possibly as much as 50 per cent. of the energy of the fuel fed into the combination. At least half of this waste may be prevented, and the engineers were urged by Mr. Abbott to devote attention to the problem. When we consider, as Mr. Abbott pointed out, that some of the new steam-raising electric power houses will require 3,000 tons of coal a day—two trainloads—the great importance of a saving of even five per cent. in the boiler room is at once evident. The speaker also stated that very large power-house enterprises should have their own rolling stock—coal cars, that is—and their own storage tracks, the latter quite independent of the usual storage capacity. The coal should be handled from the mine to the ash-dump without being touched by a workman. Automatic methods have reduced the cost of handling fuel at the Harrison Street station of the Chicago Edison Company from 40 cents to between 15 and 20 cents a ton. But the automatic stoker has the disadvantage that it cannot be hurried in case of an emergency demand on the station. This situation is met, however, by the installation of blowers to increase the draft with increased demand for steam. The whole subject of boiler-room economy is most interesting as well as obviously important. We are glad to observe that in the excellent programme prepared for the convention of the National Electric Light Association in Chicago this month one of the papers is devoted to this apt-to-be-overlooked topic.

HAVING successfully dedicated the Louisiana Purchase Exposition, St. Louis has still a year remaining before the opening of the show to finish the buildings and grounds and install the exhibits. This is none too long a time, yet should prove ample in view of the time already devoted to preparation. Indeed, St. Louis is particularly wise in assigning sufficient time to execute its immense task satisfactorily. That the result will justify the effort and money lavished upon it no one doubts. Electrical men are greatly interested in the success of the exposition; and throughout the West, and particularly in Chicago, where a similar experience has been undergone, only the sentiments of friendliest co-operation are entertained in relation to the great World's Fair of next year.

WITHOUT attracting as much attention, perhaps, as the massive, spectacular gasoline machine, the electric automobile is steadily gaining in popularity, and it promises to be the horseless carriage of the future for city use in this country. The electric automobile has great advantages—simplicity, noiselessness, lack of odor, graceful appearance and comparative cheapness. Its only drawback is the fact that the battery has a limited distance of travel, recharging being necessary from time to time. But with the multiplicity of charging stations now existing in all cities of considerable size this objection is reduced to the minimum. Actual experience has shown, too, that people do not make as long carriage trips or vehicle deliveries as they are apt to think likely; an electric vehicle with a 35 or 40-mile radius satisfies all ordinary city requirements, such as physicians' use, pleasure riding and delivery wagons, for one day. For touring in the country the gasoline or steam carriage is still indicated, but, unfortunately, American highways are in such a condition that this recreation is greatly handicapped, whatever type of vehicle is employed. These are the reasons that account for the increasing vogue of the electric machine and the consequent gratification of the storage-battery men.

THE passage of the Mueller bill by the Illinois Legislature marked the end of the disgraceful episode in muncipal-ownership politics to which we devoted considerable attention last week. Probably Governor Yates will sign the bill, which will then become a part of the statutory law of the state. The measure will enable any city in the state to "own, construct, acquire, purchase, maintain and operate" street railways within its corporate limits or lease the lines, if desired, for private operation. The exact method of procedure to be followed is set forth at considerable length, and when the bill actually becomes a law we shall publish the text in full, for it constitutes a departure in the relation of American commonwealths and street-railway companies. But it is to be remembered that while the Mueller bill gives the cities the power to own and operate street-railway lines, it by no means follows that the power will be exercised. Indeed, in Chicago the belief is general that the law is wanted simply as an "enabling act" to be used as a weapon in making terms with the companies.

In contrast to this victory for municipal ownership (although, as we showed last week, the sincere advocates of municipal ownership had little to do with the affair, which was almost entirely a matter of politics), two recent defeats for this "reform" are to be noted. One was in the Michigan Legislature, where a bill providing for a constitutional amendment to permit municipal ownership of the street railways of Detroit was defeated by a decisive vote. The other example was afforded by the Legislature of New York state, which put a quietus, for a year at least, to the project for erecting a municipal electric-lighting plant in New York city. No doubt the Legislature of Illinois would have followed these precedents had it not been for the overwhelming—but unthinking, as we believe—vote in favor of muncipal ownership in Chicago on April 1, 1902.

Chicago Street-railway Situation.

After most determined efforts on the part of Speaker Miller and several of the representatives to defeat it, the Mueller municipal-ownership bill was passed by the lower house of the Illinois Legislature on May 1st. The final vote stood 90 in favor and 20 against it. The bill was subjected to some amendments in the House and was confirmed by the Senate on May 5th with but one dissenting vote. The bill has gone to the governor for signature. When it becomes a law the full text of the bill will be given in the Western Electrician.

The special committee of the House which has been investigating the charges of bribery brought by Speaker Miller made its report last week. The committee found that the speaker had no evidence to support his accusations and that G. W. Hinman, editor of the Inter Ocean, in his general "boodle" editorials had based his utterances merely on idle rumors and innuendos.

Some of the large stockholders of the West Chicago and North Chicago Street Railroad Companies, the two subsidiary companies of Union Traction Company, have allied to protect themselves, and it is reported that one plan of this element is to wind up the affairs of the large company and let the North and West Chicago companies take back their property. Incidentally, it is proposed to demand that the common stock of the Union Traction Company be paid for now by the men who received it in 1899 as a bonus.

The receivers of the Union Traction Company and its underlying lines secured the permission of Judge Grosscup to borrow $200,000 with which to pay the interest on bonds which fell due last week. In order to head off the attacks being made or threatened by holders of North and West Chicago stock on the receivership, the three receivers have decided to petition the court and ask what they are to do under the circumstances. The most important question asked will be what the receivers are to do about the dividends due the holders of North Chicago stock, which falls due May 15th. Involved in it is the other question as to whether the receivers must also meet the dividends, under the leases, due the West Chicago stockholders July 1st. Out of the court's answer to both is expected a ruling as to the relation of the receivers to the stockholders of the two constituent companies.

A New Atomic Theory.

Prof. Stephen M. Babcock, professor of agricultural chemistry at the University of Wisconsin, has announced a new atomic theory, which, in brief, is that the weight of any substance is affected by the molecular changes which it undergoes, or, in other words, the weight of a body is inversely proportional to its inherent energy. This theory, according to Prof. Babcock, would offer a satisfactory explanation of the law of gravitation, for the generally accepted scientific explanation of ether as matter endowed with infinite energy and having no weight or high potential, and of the heavenly bodies as low potential or weight would account for the movement of the solar system on the law of physics, that bodies of high potential move toward bodies of low potential.

Prof. Babcock was first led to undertake this investigation by noticing the different results obtained in the atomic weights of the same substances under circumstances that were practically similar. His first strong evidence was gained by weighing the same chemicals in hermetically sealed test tubes before and after chemical reaction had been obtained. The difference in weights obtained through a long series of experiments, embracing a total of many years, he could not explain on any existing scientific hypothesis.

Census Report on Electric Railways.

A preliminary report on street and electric railways for the year ended June 30, 1902, issued by the United States Census Bureau, contains some interesting statistics. It shows that there was a total of 987 companies in operation their net income aggregating $30,955,233; dividends, $15,958,216; surplus, $15,047. The average number of salaried officials was 2,749, and their salaries amounted to $4,625,015; clerks 4,301, salaries $2,573,936; all other employes 131,133, wages $77,437,324. The length of line (first main track) was 16,698 miles, length of single track 22,589 miles. These figures do not include track under construction and not operated. The total number of cars was 67,199, steam engines 2,337; fare passengers carried 4,813,466,001; transfer passengers carried, 1,662,403,392; total car mileage, 1,097,806,884; persons killed, 1,216; injured, 47,428. The earnings from operation were $241,584,697; operating expenses, $139,012,004; net earnings, $102,597,693; income from other sources, $2,907,156. The totals indicate that during 12 years the length of line has increased from 5,783 miles to 16,647 miles, or 187.85 per cent.; the number of cars from 32,505 to 60,290, or 85.48 per cent.; the number of fare passengers carried from 2,033,010,202 to 4,813,466,001, or 137.94 per cent.

Dedication of St. Louis World's Fair.

The eyes of the world were turned upon St. Louis last week, when, during the three days of ceremonies marking the formal dedication of the Louisiana Purchase Exposition, there was gathered together one of the most unique assemblages of prominent men that has occurred in recent years. Foremost in the eyes of the thousands who fought for a glimpse of him was President Roosevelt, and his stay in St. Louis, where he was the guest of David R. Francis, was marked by the wildest enthusiasm. Ex-president Cleveland was also enthusiastically received, and his oration at the dedication ceremonies, in which he strongly commended the policy of expansion, was interrupted many times by the cheers of the 30,000 persons who occupied seats in the Liberal Arts Building.

Thursday, the centennial of the signing of the papers transferring to the United States the vast territory of Louisiana, was the gala day, and when the first carriage, containing President Roosevelt, D. R. Francis and T. H. Carter, president of the National Commission, started on from Grand Boulevard, fully 300,000 spectators lined the route. The troops reviewed by the president formed one of the most imposing parades ever seen in time of peace, over 12,000 being in line.

After a hasty lunch the president was driven to the Liberal Arts Building, where his entrance brought the assemblage to their feet with a hearty cheer of welcome, and when he was introduced by T. H. Carter, president of the National Commission, the deafening applause continued for some moments. Finding the platform too low, the president leaped upon the table and delivered his address, which was a masterly effort.

The immense chorus of 2,500 singers, led by Weil's Band, rendered several numbers from Wagner and Handel. Cardinal Gibbons, the head of the Roman Catholic Church in America, pronounced the invocation, and Bishop Potter of New York the benediction.

In the evening over 200,000 people gathered in and about the exposition grounds to witness the most elaborate display of fireworks ever made. An immense grand stand had been erected in front of the Administration Building, and from this, 30,000 persons viewed the spectacle. Extensive preparations had been made for the firing of hundreds of pieces simultaneously by electricity, and the sky was filled with colored fire for hours. The most striking piece of the evening was a full-size representation of the cascades and festival hall, the terrace of the statues and buildings being outlined in white, while the torrents of water flowing down the incline were extremely realistic, as were the fountains at the foot.

The Administration Building was strikingly illuminated by 6,000 incandescent lamps, in red, white, blue and yellow. The lines of the beautiful towers were marked with white lights, while the space between was occupied by a gigantic American flag, suspended from a cable, and swaying in the breeze. This illumination was operated every evening of the dedication period.

Friday was Diplomats' Day, and on Saturday, Governors' Day, Governor Dockery was the central figure. On Friday evening another display of fireworks attracted thousands to the exposition grounds. The chief feature of the evening was the "Salute of the Nations," in which an American flag, 600 feet long, was supported in the air at a height of several hundred feet, while other balloons, bearing flags of other nations, fired salutes to "Old Glory," the whole being operated by electricity.

The transportation problem that has been agitating the St. Louis officials was apparently settled during the dedication period, when it was demonstrated that the existing lines could handle almost any crowd that is liable to congregate during the exposition. Cars were run on all the lines entering the exposition territory at 15-second intervals, and the service was very satisfactory. Electric automobiles of the Interstate Transit Company were operated on Lindell Boulevard and were well patronized. Many men prominent in electrical circles were in attendance, and arrangements were made for several large exhibits in the Electricity Building.

Yerkes Underground Railway Plans Opposed.

London newspapers are opposing the Yerkes-Speyer plans for the consolidation of all the underground tube railways of that city, and are urging Parliament not to submit thereto. The parliamentary committee, in its report to the London County Council, will insist upon a further iinvestigation of the consolidation scheme, which the committee contends will raise fares and otherwise operate to the disadvantage of the traveling public.

In connection with the formal organization of the company, to be known as the Underground Electric Railways, it is stated that a loan of $30,000,000 on 10-year five per cent. notes has been arranged at once to meet construction and other expenses. Of the total amount $15,000,000 will be underwritten in London by the syndicate managed by Speyer Brothers, and $15,000,000 will be underwritten in this country by a syndicate organized by Speyer & Co. and the Old Colony Trust Company of Boston.

Preparations for the Electric-light Convention.

President L. A. Ferguson has given out the list of papers to be read at the Chicago convention of the National Electric Light Association on May 26th, 27th and 28th. Wisely, the list is not too long, but it contains an excellent variety of subjects, and the writers are among the best authorities in the country. President Ferguson is certainly to be congratulated on the results of his discriminating judgment and persuasive eloquence. The list of papers follows:

"Fuel Losses in Furnaces and Boilers and How to Lessen Them," by A. Bement, consulting expert of Chicago; "Salt as a By-product," by Alex Dow, Detroit Edison Company, Detroit, Mich.; "Advantages Derived from the Use of One System of Generation and Transmission of Electrical Energy from All Power Stations in One Locality," by C. L. Edgar, Edison Electric Illuminating Company of Boston, Mass.; "Tactful Relations with Customers," by J. W. Ferguson, Chicago Edison Company of Chicago; "Relative Advantages of Electrical and Mechanical Methods at Variable Speeds for General Power Service," by William Cooper, consulting engineer of Cincinnati, Ohio; "First-aid Appliances," by Dr. J. D. McGowan, Chicago Edison Company, Chicago; "Standard Ratios for Transformers," by John S. Peck, Westinghouse Electric and Manufacturing Company, Pittsburg; "Steam Turbines," by Professor William Lispenard Robb of Rensselaer Polytechnic Institute; "The Application of Four-ampere Series Arc Lamps for Street Lighting," by J. Henry Hallberg, General Incandescent Arc Light Company, New York city; "Some Fundamentals of Photometry," by Professor H. E. Clifford, associate professor of electrical engineering, Massachusetts Institute of Technology, Boston; "Exhibition and Description of the Matthews Integrating Photometer," by Professor Charles P. Matthews, Purdue University; "Attitude of Employer Toward Benevolent, Insurance and Educational Associations Among Employes," by Arthur Williams. New York Edison Company, New York city; "District Heating," by John W. Glidden, superintendent DeKalb-Sycamore Electric Company, DeKalb, Ill.; "The Young Engineer and the Electric-lighting Plant," by Charles F. Scott, president American Institute of Electrical Engineers; (subject to be announced) by Professor Elihu Thomson of Swampscott, Mass.

In addition to the above-named papers, there will be the following committee reports: "Report of Editor of Progress," by T. C. Martin of New York; "Decorative and Sign Lighting," by Arthur Williams of New York; "Unaccounted-for Current," by L. G. Van Ness of Denver; "Theft of Current," by R. L. Elliott of Chicago; "Office Methods and Accounting," by W. M. Anthony of Chicago; "Photometric Committee," by H. L. Doherty of Denver; "Committee on Analysis of Flue Gases," by H. L. Doherty of Denver. The last two reports are from standing committees, but the other five will be quite elaborate and more in the nature of papers, special attention having been paid by the editor of each department to make his report comprehensive and valuable. By no means the least part of the convention proceedings will be the questions and answers of the question box, which will be edited by H. T. Hartman of Philadelphia.

At a meeting of local electrical men held at the Union League Club on May 1st preliminary arrangements were made for the local entertainment of the delegates and guests who will be in attendance at the convention. President L. A. Ferguson called the meeting, and among the other gentlemen present were B. E. Sunny of the General Electric Company, W. R. Pinckard of the Westinghouse Electric and Manufacturing Company, A. L. Tucker of the Western Electric Company and W. W. Low of the Electric Appliance Company. Several plans were talked over, and it was decided to have a general reception from 8:30 to 10:30 p. m. at the Auditorium on Monday evening, May 25th, the day preceding the opening of the convention. The rest of the entertainment will be solely for the ladies and will include a carriage ride on Tuesday to one of the neighboring golf clubs where luncheon will be served, and a theater party on Wednesday afternoon. This will leave Thursday open for shopping and sight-seeing. James Wolff, Chicago manager of the New York Insulated Wire Company, will act as chairman of the local entertainment and reception committee and Mr. Sunny will serve as chairman of the local finance committee.

American Institute to Publish Graduating Students' Theses.

At a recent meeting of the board of directors of the American Institute of Electrical Engineers it was decided to request the head of the electrical-engineering department in each of the universities and technical schools in which local Institute meetings have been held during each year to select from the theses of each year's graduating class the one which in his judgment is of superior merit and a valuable contribution to electrical-engineering work. These theses will be received by a committee of the Institute, and those which are of superior excellence will be chosen and printed in full or in abstract in the Transactions of the Institute.

NEW ELECTRICAL APPARATUS IN FRANCE.

ANNUAL EXHIBITION OF THE SOCIETE DE PHYSIQUE.

By A. De Courcy.

Paris, April 23.—The annual exhibition of the Société de Physique, which is held at Paris, always brings out quite a number of novelties, among which electrical devices occupy a prominent place. The exhibition was held on the 18th of April, in the large building of the society, and the different rooms contained a great variety of exhibits, some of which promise to be of great interest.

Arc Lamps with Impregnated Carbons.

One feature which attracted considerable attention was the new arc lamps of the Société Française

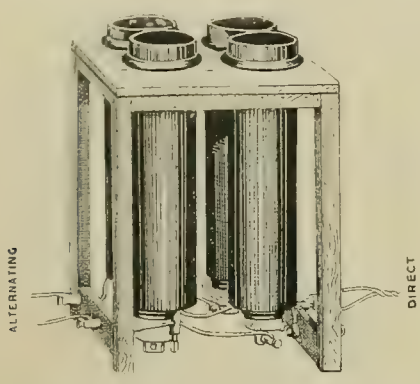


FIG. 1. NODON ELECTRIC VALVE.

d'Incandescence. Two of these arcs were mounted outside the building and several in the interior; they give a remarkably brilliant light, which is of a yellowish hue and consequently more agreeable than the ordinary arc. Carbons are used which are impregnated with mineral matter. The new process of treatment is claimed to give a great economy, and the company states that its normal type of lamp, which takes but 3.3 amperes, gives 50 per cent. more light than an ordinary 10-ampere lamp. In the former cases where carbons were impregnated with mineral matter one great difficulty lay in the formation of scoriæ on the surface. This is now overcome by impregnating the inner layers of the carbon only, leaving the outside pure. In this way there is no spreading of the arc or formation of waste matter. The carbons are placed upright, as usual, with a refractory disk fitted over the upper carbon just over the arc. This disk acts as a reflector and keeps the arc from mounting; it also keeps the temperature of the upper carbon sufficiently high to prevent the formation of liquid scoriæ. With ordinary carbons the light falls off quickly with the current below seven amperes, which prevents the

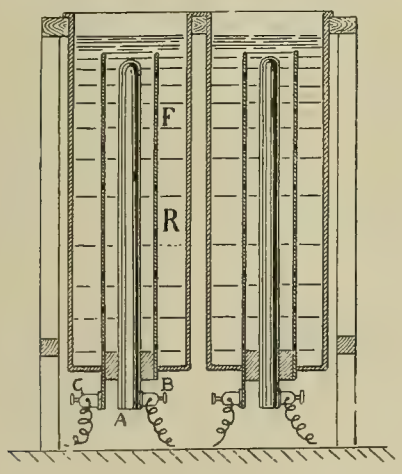


FIG. 2. SECTION OF ELECTRIC VALVE.

use of small arcs. In the present case an arc as low as 3.3 amperes can be used. The company also showed a 10-ampere lamp, which is claimed to have seven times the efficiency of an ordinary 10-ampere arc.

Nodon "Electric Valve."

Among the novelties is an electrolytic device for transforming alternating into direct current, or "electric valve" (Fig. 1), which has been invented by Mr. Nodon of the Paris University, and has proved successful in practice. In principle it consists of an iron tube (F), Fig. 2, which is perforated and provided with a binding post. In the lower part is fixed an insulating stopper, through which passes a cylinder (A), formed of an alloy of aluminum and zinc. The cylinder is concentric with the tube and has also a binding post. The whole is introduced into a cylindrical vessel (R) which contains a saturated solution of ammonium phosphate. The operation is as follows: When the current comes in the positive sense from (A) to (F) a thin film is formed upon the surface of (A) by electrolytic action. This film is composed of phosphate of aluminum and zinc, alumina, and oxide of zinc; it offers a very high resistance to the passage of the current. On the contrary, if the current takes a positive direction from (F) to (A), the film is reduced and the current passes freely. The formation and reduction of the film take place almost instantly. With only one electrolytic cell, however, only half a phase of the current would be used, the other half being suppressed and the valve would act as a rectifying interrupter. In order to use the two half phases and form a current which can be utilized, the valve, as now used, has four cells of the form described, which are grouped as shown in Fig. 3, where (EEEE) are the four cells, (A) the positive pole and (B) the negative. Between (A) and (B) is placed the apparatus to use direct current (batteries, motor, etc.). In this case the two half-phases of the alternating current arrive in the same sense in the work circuit, giving a rectified current.

This instrument has been tested at the laboratory of the university by Professor Hospitalier and found to give an efficiency of 75 to 80 per cent. The loss is due to the formation of heat within the cell, which

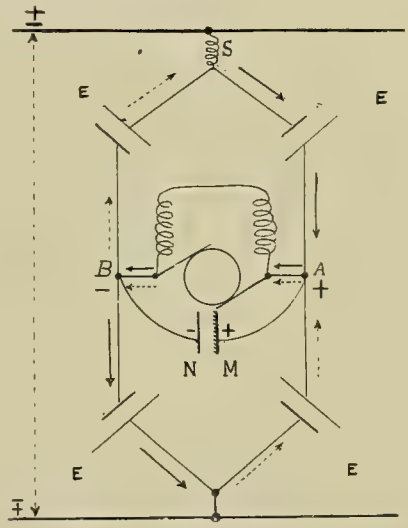


FIG. 3. DIAGRAM OF ELECTRIC VALVE.

heats up under the action of the current, the temperature becoming stationary at about 40 degrees C. The test was made with a five-ampere type, using a frequency of 42 reversals from the city mains and charging a battery of accumulators (42 cells in series) with the rectified current. The curves obtained with Mr. Hospitalier's new "ondograph" are shown in Fig. 4, where No. 1 is the voltage given to the valve on the alternating-current side and No. 2 the corresponding current. Curve 3 shows the rectified current furnished by the valve to the batteries and 4 the difference of potential. The current can also be used to run a small motor or arc lamps, and the writer has had occasion to observe the workings of the valve at Mr. Nodon's shops, where he is now commencing to manufacture it. A small five-horsepower motor is run without difficulty, as well as a number of direct-current arc lamps, which light the shops; the alternating current for the valve is taken from the city mains. It is expected that the valve will be especially useful in charging the batteries of an electric automobile from city mains, and the outfit required for this purpose is compact and inexpensive.

Hot-wire and Other Measuring Instruments.

The Richard Company showed a number of new measuring instruments, among which is a new hot-wire voltmeter. In the former types of hot-wire instrument the disposition which has been adopted for the active wire usually makes the apparatus bulky and of difficult construction, or in cases where a short wire is used the means which is employed for amplifying the effect of the wire is of a delicate nature and difficult to regulate. It sometimes happens that the compensation for exterior temperature is so imperfect that the needle does not come back to the zero point. The present instruments are said to be an improvement over the existing types. The wire which is traversed by the current is formed of an alloy whose electric resistance is practically constant, in spite of the variations of temperature. It is fixed by one of its ends to a compensator, which has the effect of rendering the indications independent of the outer temperature. After passing over grooved pulleys, the wire ends at the extremity of the short arm of a lever. To the long arm of this lever is attached a wire, which, after making a turn around the drum carrying the indicating needle, is attached at the extremity of a spring which keeps the wire constantly stretched. The active wire is mounted in series with a resistance composed of

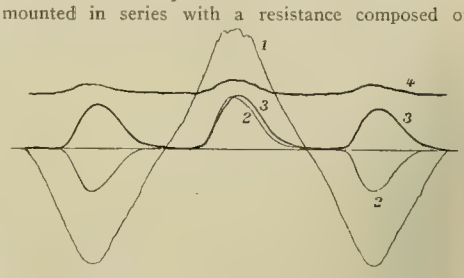


FIG. 4. CURVES OF ELECTRIC VALVE.

the same kind of wire and coiled so as to have no self-induction. The length of wire in the resistance coil depends on the maximum voltage for which the instrument is built. In the case of very high voltages the resistance in series is replaced by a small transformer which reduces the tension in a certain ratio. The compensator for temperature is formed of a system of two metals which have a very different expansion, zinc and a form of nickel steel known as Guillaume steel. It is regulated by a small screw, which serves to set the needle at zero, if it should become displaced owing to a shock or other cause. These voltmeters can be used for alternating or direct current without changing the regulation; they are made in nine different sizes, ranging from 60 to 3,000 volts. In the registering type the shaft of the drum carries an aluminum needle ending in a pen which traces the diagram of voltage on a registering cylinder of horizontal axis; the cylinder makes one turn per day. The latter form is made in four types, ranging from 150 to 600 volts.

The same company also showed a new type of portable voltmeters and ammeters, one of which is seen in Fig. 5, which represents a small voltmeter three inches in diameter used especially for batteries and accumulators, being well adapted for the igniting batteries of automobiles. It is graduated to three or five volts with a large scale. The new type is characterized by the use of a permanent magnet about 20 times stronger than is needed to give the desired effect. An armature of soft iron unites the poles and gives a direct passage for 95 per cent. of the flux. It is well known that a magnet having an armature will hold its magnetism almost indefinitely, while without it shocks and vibrations, and even the influence of time cause it to weaken considerably. In measuring apparatus with permanent

FIG. 5. TINY VOLTMETER.

magnet the demagnetizing effect of the current to be measured is also to be added to the above causes, and it may happen that a voltmeter or ammeter, after long use, will give an eight or 10 per cent. error. In the present instrument the same causes of loss are only brought to bear on the five per cent. of the flux which traverses the coil carrying the current; an error of 10 per cent. on this quantity makes only a difference of 0.5 per cent. on the total flux and consequently on the readings. Where an ordinary permanent-magnet instrument would lose 20 per cent. of its flux, in the new form only one per cent. is lost under the same circumstances, which comes within the limits of error. In such case the readings may be corrected by slightly shifting the armature.

Petrol Sets with Electric Regulator.

The De Dion Company showed a direct-coupled set, consisting of a petrol motor and a small dynamo. This group is light and compact and can be used

for a number of purposes, being especially applicable to accumulator charging, notably the batteries of automobiles. When mounted on a rolling truck, it forms a convenient portable set, as shown in Fig. 6. The motor is of the standard De Dion pattern as built for the gasoline automobiles. The motor body is attached to the bed-plate by an iron bracket. The dynamo has its lower field and bearings cast with the bed-plate. An electric regulator for governing the motor speed is one of the novelties of this group. The motor turns at a speed of 1,500 revolutions. The dynamo is of the Manchester type, with drum armature and shunt field. The field coils are here directly connected with the brushes, and there is no extra rheostat, the dynamo having been specially designed for this application. The dynamo has oil-ring bearings and carbon brushes.

The electric regulator (Fig. 7) is composed of a solenoid (S) which contains an iron core (N) of conical form, guided in its course by an outer tube. To utilize the field to better advantage and diminish the energy needed for the regulator, the magnetic circuit of the solenoid is closed by an external part formed by two end pieces (FF') united by the tube (T). This arrangement, besides, protects the regulator from the influence of exterior magnetic fields in the vicinity. The upper end of the core is attached by a chain (C) to a small pulley (P), mounted upon the cylinder of the valve (B) fixed on the carburetter; the opening (O) of the valve admits the explosive mixture of air and gas coming from the carburetter to the motor, and the rotation of the pulley (P) thus opens or closes the valve and regulates the gas supply. A spiral spring (R), mounted at the outer end of the valve, is fixed at its free end to a cap (D) which may be turned and fixed by the set screw (V). The tension of the spring can thus be regulated to vary the sensitiveness of the apparatus. The solenoid is of very fine wire and has 2,000 ohms resistance for a dynamo

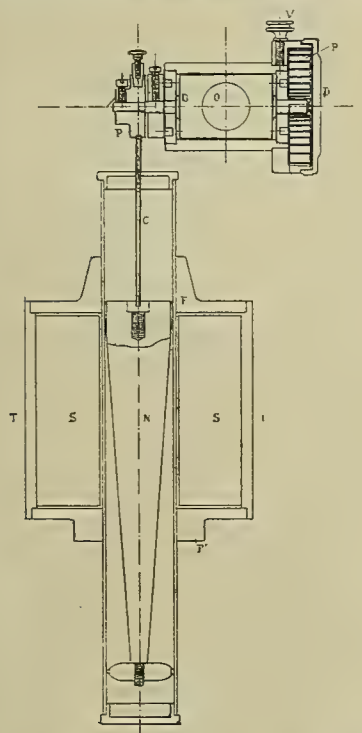


FIG. 7. DETAILS OF ELECTRIC REGULATOR.

of 110 volts. As shown in Fig. 6, the regulator is connected directly with the dynamo terminals. On starting, the dynamo becomes excited and the voltage takes its normal value. When there is no load on the dynamo the motor tends to race, but when the normal voltage is exceeded the core of the regulator is drawn into the solenoid, and by acting on the pulley it partly closes the gas-supply valve, reducing the force of the motor, and in consequence its speed, down to the point where the voltage takes its normal value.

When the load is thrown on the dynamo the speed of the motor tends to slow down; the voltage lowers and the core of the solenoid rises, allowing the valve to open by the action of the spring. The regulator is sensitive and follows all the variations of load, and the voltage of the dynamo is always kept constant. Besides, its action is so rapid that the regulation is effected in less than five seconds when passing suddenly from full load to no load, or the contrary. It takes but five watts. In the set shown in Fig. 6 the bed-plate is mounted on a spring support, so as to diminish the vibration. On the dynamo is placed the water tank for cooling the motor, and the tank is elevated to a sufficient height to cause a water circulation by the action of gravity. Such a group may not only be used for arc and incandescent lighting, for which it is especially suited by its steady running, but the motor may be used to drive various machines directly by means of a coupling

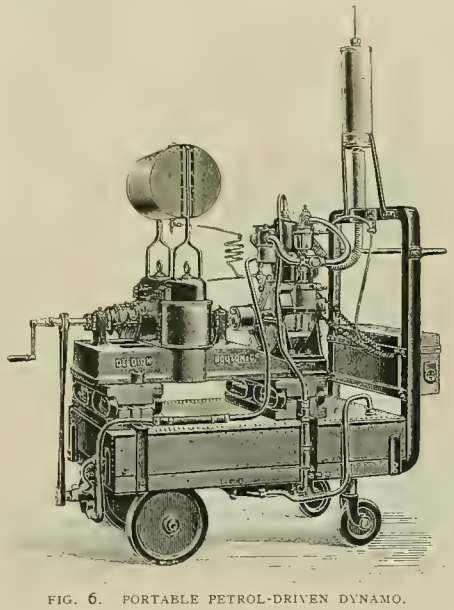


FIG. 6. PORTABLE PETROL-DRIVEN DYNAMO.

pulley. In this case the dynamo runs empty, but still operates the regulator, which keeps the speed constant.

Car Wiring as a Fire Hazard.

Many of the fire underwriters appear to think that the standard of wiring for electric cars is not up to that of stationary plants. William T. Benallack, electrical inspector of the Michigan Inspection Bureau, in a paper on the fire hazard in electric car houses, summarizes the fires in such risks which he has investigated during the past eight years, most of them having occurred within the last four years. He says that of 61 fires in electric cars 42 were due to electrical causes, while of 20 fires in car houses 12 were electrical. Mr. Benallack adds: "The statistics clearly indicate that the greater part of the hazard exists in the cars, where 75 per cent. of the fires listed have started, and the general electrical equipment is responsible for more fires than all the other causes combined, 65 per cent. having originated from electrical source. In the wiring in cars, car houses and repair shops, I find that, with few exceotions, the 500-volt grounded street-railway current is installed mechanically and electrically far below the standard found to exist in ordinary commercial wiring, where the usual voltage is 125. I have recently visited the works of some of the representative car builders and have seen the latest types of cars. I found the lighting and motor wires run in grooves in the framework, fastened in place with nails and metal staples; in contact with the electric-bell wiring of inferior insulation; no insulating tubes of any kind through the woodwork, floors or vestibules of the cars and the general conditions indicating an absolute disregard of the fire hazard."

Electrical Operation of Gas-plant Auxiliaries.

The Milwaukee Gas Light Company of Milwaukee, Wis., is erecting a large new gas works, and a gas-engine-driven electrical plant will be employed for furnishing motive power to the various auxiliaries throughout the works, all of which will be operated by electric motors. A large machine shop will also be operated by electric motors. Coal will be unloaded from boats and elevated to the storage bins by electrical hoists and conveyers, the retorts will be charged and drawn by electrical appliances, and the final disposition of the coke will be accomplished by means of electric power apparatus. The entire electrical distribution system will operate at 250 volts direct current from a central power generating plant, employing gas engines connected directly to the gas mains. The present equipment comprises one 250-horsepower Westinghouse horizontal double-acting gas engine, driving a 150-kilowatt generator, and three 125-horsepower vertical engines, belted to 75-kilowatt generators. Provision has been made for future extensions of the equipment with a second power unit of the former type.

The Northwestern Elevated Railway management has decided on the route for the proposed Ravenswood extension and surveys have been made. It is understood that an ordinance covering the proposed right-of-way is being prepared and will shortly be presented to the Chicago City Council.

New Western Members of the Institute

At the last regular monthly meeting of the directors of the American Institute of Electrical Engineers, held in New York city, on April 24th, 211 new names were added to the list of associate members. For want of space the entire list is not here given, but the following are the names of those admitted from that part of the United States lying south and west of Pennsylvania and the Virginias and from foreign countries:

Ames, Iowa.—George W. Bissell, Iowa State College of Agricultural and Mechanical Arts.

Bellevue, Ky.—Walter H. Underwood and Arthur J. Underwood, Triumph Electric Company, Cincinnati, Ohio.

Berkeley, Cal.—Charles W. Clark, General Electric Company.

Cincinnati, Ohio.—Walter Laile, Triumph Electric Company; Clarence Mellshope, Stern, Heidman & Mellshope; John M. Barnay, Bullock Electric Manufacturing Company.

Clarksburg, Mo.—Henry C. Don Carlos, Telluride Power Transmission Company, Ames, Colo.

Chicago, Ill.—Robert Steck, Western Electric Company; William T. Dean, Illinois Steel Company; Myron M. Fowler, Western Electric Company; Stephen Gardner, Chicago Edison Company; Edward N. Lake, Chicago Edison Company; Herman M. Biebel, Western Electric Company; William A. Blanck, Arnold Electric Power Station Company; James A. Brett, Electrical Installation Company; Harry M. Hope, Chicago Edison Company; Charles G. Y. King, Chicago Edison Company; Walter J. Warder, Jr., Western Electric Company; Ezra J. Pietczker, Standard Underground Cable Company; Rudolph F. Schuchardt, Chicago Edison Company; Frederick S. Hickok, Western Electric Company; Edwin H. Smythe, Western Electric Company.

Cleveland, Ohio.—Martin Schreiber, Cleveland Electric Railway Company; Harry Gillett, H. W. Johns-Manville Company.

Colorado Springs, Colo.—George B. Tripp, Colorado Springs Electric Co.

Columbus, Ohio.—Robert R. Dunlop, Jeffrey Manufacturing Company; Curtis Claypoole, Electric Supply and Construction Company; Perry Okey, Columbus Municipal Electric Light Plant.

Conneaut, Ohio.—Robert C. Reed, Carnegie Steel Company.

Denver, Colo.—Alvin M. Ballou, Denver City Tramway Company; Dwight E. Webster, Mountain Electric Company.

Detroit, Mich.—Ernest McCleary, McCleary & Colquitt Company.

Duluth, Minn.—Eugene C. Bacot, Highland Canal and Power Company.

Goldstream, B. C.—Otto Bergen, British Columbia Electric Railway Company.

Hunthill, Coatbridge, Scotland.—Neil Taylor, Neil Taylor Company.

Indianapolis, Ind.—Harrison A. Smith, General Electric Company.

Kent, Wash.—Berrett Merrill, Puget Sound Electric Railway.

Leeds, England.—Henry J. Fuller, John Fuller & Co.

Liverpool, Ohio. Ralph F. Thompson, United Power Company.

Logan, Utah.—Robert P. Fairbanks, Logan Power Company.

London, S. W., England.—Bernard M. Drake, Drake & Gorham, Ltd.

Madisonville, Ohio.—William A. Hall, Hall Electrical Supply Company, Cincinnati.

Melbourne, Victoria.—George G. Jobbins, Electric Light and Power Company of Australia.

Milwaukee, Wis.—Walter F. Carr, The Falk Company.

Montreal, Quebec.—La Monte J. Belnap, Bullock Electric Manufacturing Company; Geo. C. Rough, Packard Electric Company, Ltd.

Norris, Mont.—James R. Broughton, The Power Company.

Pasadena, Cal.—James E. Barker, Pacific Electric Railway Company, Los Angeles.

Peterborough, Ont.—James C. Hyde, Canadian General Electric Company, Ltd.

Rugby, England.—Siegfried von Ammon, British Thomson-Houston Company, Ltd.

Salt Lake City, Utah.—Robert F. Hayward, Utah Light and Power Company; Elias H. Beckstrand, University of Utah.

San Francisco, Cal.—Herbert W. Crozier, San Francisco Department of Electricity.

Seattle, Wash.—Alvin A. Miller, Westinghouse Electric and Manufacturing Company.

Shreveport, La.—Albert Uhl, Uhl & Elliott.

Spokane, Wash.—John B. Fisken, Washington Water Power Company.

Springfield, Ohio.—Egbert Douglas, General Electric Company, Schenectady, N. Y.; Fred J. Green, Springfield, Troy and Piqua Railway Company.

St. Louis, Mo.—Julien J. Crawshaw, Bell Telephone Company of Missouri; William S. Merkle, Ewing-Merkle Electric Company; Herbert I. Finch, Emerson Electric Manufacturing Company; James Harrison, Kinloch Telephone Company; Clarence E. Delafield, Wagner-Bullock Company; William Hand, General Electric Company; Ernest Ruebel, Ruebel, Schwettman & Wells; Frederick R. Mott, Bell Telephone Company of Missouri; Andrew J. O'Reilly, City Lighting Room; Howard F. Smith, World's Fair Electrical Department; W. O. Garrison, Columbia Incandescent Arc Lamp Company.

Toronto, Canada.—James Lynoch, Canadian General Electric Company.

Vancouver, B. C.—William T. Woodroofe, British Columbia Electric Railway Company.

Victoria, B. C.—Charles E. Stephens, British Columbia Electric Railway Company.

National Electrical Contractors' Convention and Exhibition in Detroit.

In connection with the third annual convention of the National Electrical Contractors' Association in Detroit on July 14th, 15th and 16th, there will be held an electrical exhibition of apparatus and supplies. The exhibition will be held at the Light Guard Armory on the same days as the convention. It will include standard and special supplies and apparatus used for electric house work, lighting, power work and general electrical construction. The association membership includes the leading electrical contractors of 15 states, who purchase annually between five and ten million dollars' worth of material and supplies, and a large majority of the members expect to attend the convention. Frank J. Miner, 207 Jefferson Avenue, Detroit, is chairman of the exhibition committee.

DEVELOPMENT OF THE TELEPHONE FIELD.

Chicago Electrical Association Discusses Telephonic Subjects.

The last meeting for the season of the Chicago Electrical Association was held at the Albion Cafe, Pullman Building, on the evening of May 1st and partook of a semi-social nature, similar to the two previous meetings at that place. Professor P. B. Woodworth, president of the association, presided and helped to make the evening's programme pass off smoothly and with interest. There were about 70 people in attendance at the dinner and during the evening.

The address of the evening was given by H. P. Clausen, chief engineer of the American Electric Telephone Company, his subject being "Recent Developments in Party-line Telephony." Mr. Clausen dealt with party-line systems as they may be applied to magneto-call telephones, that is, local-battery subscribers' stations and central-office equipments in which the divided-circuit arrangements were referred to, as well as the plus and minus selective signaling systems, and several other appliances in which condensers do not form a part of the signaling circuit. Then he treated the matter of applying the existing systems to the conditions imposed by the advances in the central-office operation in respect to common-battery service. A demonstration was made of the operation of the existing party-line systems, and the workings of the old party-line systems when applied on the common-battery switchboard service were gone into. Mr. Clausen demonstrated, by experiments, the different effects observed in actual practice and made his address interesting as well as practical.

C. H. Roth led the discussion with an explanation of how the double-frequency currents were secured from one of the Roth machines. M. W. Babel spoke of the limits in double-frequency work and stated that a 20-cycle system would work up to a frequency of 30, and a 60-cycle system would work at 50, but as neither would operate between 30 and 50, it left quite a range. Mr. Zradolph mentioned the difficulties of the plus and minus system, while further discussion was taken part in by Mr. Krisz, Mr. Libbey and other practical telephone men who were present.

The next meeting of the Chicago Electrical Association will be held on October 2d at the Albion Cafe and dinner will be served at 6 p. m., as at the last meeting. The subject of the address for that evening will be announced later.

Telephone System of the Lackawanna Railroad.

One of the first of the large steam-railroad corporations to adopt the telephone for general railroad work was the Delaware, Lackawanna and Western. This railroad has now in use 10 private branch exchanges and about 600 miles of metallic-circuit telephone lines, with 700 stations. For several years the telephone has been used by the mining department of the railroad, superseding the telegraph altogether. All yards, roundhouses and shops are placed in communication with each other, and 50 per cent. of all messages are handled by telephone, reducing by this amount the messages sent over telegraph wires.

The system used is simple and is operated in the same manner as the regular long-distance service of telephone companies. A through trunk line runs from New York city to Buffalo and lines radiating in all directions furnish service to branch roads, local stations and mines. The line to Elmira, N. Y., is 357 miles and that from New York to Buffalo 410 miles long. The telephone wires are placed on the telegraph poles, and the noise which would otherwise result is almost entirely eliminated by a system of transposition. Connection is made in each city with the local Bell public exchange.

The system is made practically self-sustaining from outside business through the establishment of several pay stations. The telephone is used largely by the traffic and mining departments and is often of great value in securing and controlling shipments. Its advantage is evident, as messages can be handled more quickly and instantaneous replies received. Dependence upon the Morse operator is lessened and the communication is direct.

It is stated that the Lackawanna ultimately aims to operate trains by the telephone, and it is believed by many that the telegraph eventually will be entirely superseded. This will not be the result of a sudden change, but the outcome of a gradual expansion of the system now extended over the entire road. The number of messages that can be handled with 600 miles of telephone line would require 3,000 miles of telegraph lines and a larger number of operators. The Lackawanna's telephone system is in charge of L. B. Foley, superintendent of telegraph.

New Officers of the Chicago Telephone and Central Union Telephone Companies.

The resignation of John I. Sabin as president of the Chicago Telephone Company and the Central Union Telephone Company necessitated special meetings of the directors of the two companies, which were held in Chicago on April 29th, at which time Mr. Sabin's resignation was accepted and new men were elected to take his place. The directors of the two companies met at the same time. Arthur Dana Wheeler was elected president of the Chicago company and L. G. Richardson of the Central Union. A. S. Hibbard, general manager of the Chicago company, was elected second vice-president to succeed Mr. Wheeler.

ARTHUR D. WHEELER.

Arthur Dana Wheeler, the newly elected president of the Chicago Telephone Company, is a prominent Chicago lawyer, a member of the firm of Holt, Wheeler & Sidley. He is prominently connected with telephone and telegraph interests, being at present chairman of the board of directors of the Central Union Telephone Company and also first vice-president of the company. Previous to the recent election he was second vice-president of the Chicago company. He is also a director and member of the executive committee of the Western Electric Company and has been the attorney for the company and also for the Western Union Telegraph Company. Mr. Wheeler was born in Kenosha, Wis., in 1851. In that city he studied law in the office of United States Senator J. V. Quarles and came to Chicago in 1882, where he entered the law office of Williams & Thompson. He is a graduate of Lake Forest University and of the Union College of Law. Mr. Wheeler assumed the duties of his new office on May 1st.

L. G. Richardson, who was elected president of the Central Union Telephone Company, has been general counsel for that company for about nine years. He has also been connected with the Chicago company in a legal capacity for some time. Mr. Richardson was born in Cambridge, Mass., in 1859, where he studied law and was admitted to the bar. He came to Chicago in 1894 and was soon after engaged as counsel for the Central Union company, which position he has since filled. He has assumed his duties as president and his offices will, for the present, be in the Chicago Telephone Building. Mr. Richardson has appointed Horace F. Hill to be general manager of the company.

L. G. RICHARDSON

Angus S. Hibbard, who succeeds Mr. Wheeler as second vice-president of the Chicago Telephone Company, is a prominent figure in the telephone field. He is a native of Wisconsin, having been born in Milwaukee in 1860. While in Wisconsin he was general superintendent of the Northwestern Telegraph Company and superintendent of the Wisconsin Telephone Company. In 1886 he became the first general superintendent of the American Telephone and Telegraph Company, which position took him to New York, where he remained for seven years. Coming to Chicago in 1893, Mr. Hibbard became general manager of the Chicago Telephone Company, which position he has successfully held to the present time, and will continue to fill in connection with his duties as vice-president. During his connection with the company the business has been greatly extended, and the system has grown from 8,000 to 85,000 telephones. Mr. Hibbard is recognized as one of the most progressive telephone men in the country. He is an inventor of note and well versed in the technique of the art, while at the same time possessing executive ability of a high order. He is also interested in engineering advancement generally, being the author of an ingenious scheme to increase the useful carrying capacity of the Chicago River and its branches. He is a member of the American Institute of Electrical Engineers and has served as vice-president of that body. Indeed, his versatility is a marked characteristic, as he is one of the best amateur musicians in the West, an enthusiastic golfer and not unknown as a writer of verse.

ANGUS S. HIBBARD.

Mr. Sabin, although he has resigned the presidency of the two companies operating in and from Chicago, will remain on the board of directors. He left for his home in San Francisco, Cal., last week, where he will look after the interests of the Pacific States Telephone and Telegraph Company, of which company he is president and manager.

New York Stock Exchange Telephone System.

In the handsome new building of the New York Stock Exchange, which has just been completed, is installed one of the largest private telephone systems in the world. Occupying fully one-third of the large floor space are the stalls or booths for 588 telephones, each firm owning a seat in the exchange having a telephone which is connected by a private wire with its main office, even if it be a mile or more distant. The telephone sets were specially constructed for this work and consist of a hard-rubber containing box, receiver, transmitter, ringer and a button for signaling. There is also a small manual-restored drop, which falls when a call comes to the telephone. The attendant, who is constantly at the telephone, when a call comes, presses a button at the side of the telephone. This displays the broker's number on large electrically controlled annunciators or call boards at the ends of the hall and he knows instantly that he is wanted at the telephone or that instructions to buy or sell await him in his attendant's hands.

In addition to the private instruments an intercommunicating system of De Veau telephones is installed with instruments at the entrances, at the telegraph stations and in the gallery. An operator in the gallery has a bank of buttons, which, like the buttons in the telephone booths, may be used to display the number of any broker. Different-colored disks are used to indicate the entrance where the broker is wanted or if a telegram awaits him.

An equipment of 13 local and four long-distance telephones is provided in the main entrance hall for communication with the New York telephone system. All the private and outside telephone work was done by the local Bell company.

A 650-kilowatt isolated generating plant, with a storage battery, is installed in the basement of the building, and current is supplied to 6,000 incandescent and 75 arc lamps, and to 25 motors used for the heating, ventilating and auxiliary services. Power is also supplied for the small batteries, motor-generators, telephones, signals, etc. No expense has been spared in equipping the building with the best electrical service possible.

The Evansville Situation.

The stockholders of the Municipal Telephone Company of Evansville held a meeting on April 29th, and elected James W. Lauer president, R. K. Dunkerson treasurer, and F. M. Petersheim, secretary. The company has employed F. E. Eversole as construction engineer for the municipal plant. Mr. Eversole has just completed the construction of a plant at Dayton, Ohio.

Preparation is being made for the hearing of the suit against the Cumberland company. Attorneys Gilchrist, Cunningham and Funkhouser were at Nashville last week when depositions were taken from Leland Hume, general manager of the Cumberland company, and a Mr. Brown of Illinois, who was the local manager of the company when the city officials cut down the poles several years ago. Mr. Hume stated the mileage covered by the company, the number of telephones in operation and the average cost of maintenance. Mr. Hume said if the poles were cut down at the present time in Evansville, the damage would amount to $1,000,000. He declined, however, to state what was the physical value of the company's plant in Evansville.

The attorneys for the Cumberland company saw Mayor Covert, Chief of Police Heuke and other city officials, and asked each of them if he had stock in the municipal telephone company. The attorneys were informed by each of the officials that he held stock in the company. The object of the inquiry is not known. There is nothing in the city charter preventing city officials holding stock in a corporation.

Indiana Telephone Items.

Harry B. Gates, J. S. Shaf, E. I. Fisher of Indianapolis and George W. Beers of Fort Wayne are seeking an Independent telephone franchise in Cincinnati. Mr. Gates was formerly secretary of the New Telephone Company of Indianapolis and has had large experience in constructing local and long-distance lines, and Mr. Beers is one of the most aggressive and successful telephone men in northern Illinois. The Indiana men assert that Cincinnati offers an attractive field for the Independent telephone, and claim to have received encouragement. Telephone charges in Cincinnati are $72 and $125, against $24 and $40 in Indianapolis.

Postmaster-general Payne has assured Senator Fairbanks that he will recommend a small appropriation to carry out his suggestion that arrangements be made for telephoning urgent rural messages by the local postmaster.

The commissioners of Jefferson County have granted to Captain William Kirk & Co. of Madison a franchise to erect telephone lines and exchanges all over the county, making outside connections. This is regarded an important step toward great telephone development in this county.

All of the lines of the Clinton Township Mutual Telephone Company are now operated from a newly established and modern exchange office in Millersburg, Elkhart County. J. A. Judy is manager, and the patrons have both day and night service.

The girls employed by the Bell Telephone Company as operators in Shelbyville went out on a strike because the manager frosted the windows, to prevent them from looking out. The manager promised to remove the obstruction if they would return to their posts, but they declined to do so until after he had made his promise good. The service was at a standstill for several days until new operators could be secured.

The patrons of the Morgantown Telephone Company at Nashville petitioned the company to give them free service with Columbus, a few miles distant, and, upon refusal, the patrons called a meeting and unanimously voted to order their telephones taken out. This will be done, and the Bell company will at once install a new exchange and give the citizens free service to Columbus.

The following new companies filed articles of incorporation with the secretary of state during the week. The name and address of the company, amount of capital stock, territory to be served, and name of one director are given:

Fairview Telephone Company, Sugar Branch, $1 600; Sugar Branch, and in Switzerland, Ohio, Jefferson, Ripley, Dearborn and Jennings Counties; J. K. Cunningham.

Number Eight Telephone Company, Owensville, $1,000; Owensville, and in Gibson County; Thomas J. Boren.

Twelve Mile Telephone Company, Twelve Mile, $5,000; Twelve Mile, and in Cass and Miami Counties; L. C. Miller.

Fairbanks Mutual Telephone Company, Fairbanks; $5,100; Fairbanks, and in Sullivan County; Levi Drake.

F.

Ohio Telephone Notes.

James B. Hill, the well-known New York corporation attorney, was in Cleveland last week in consultation with the officers of the Federal Telephone Company as to the best methods of refinancing the corporation. A meeting was held at the Hollenden Hotel, and the matter was very thoroughly discussed in all its phases, but no definite plans were decided upon, other than what have already been announced.

The North Electric Company of Cleveland, manufacturer of telephone boxes and other telephone apparatus, has filed notice with the secretary of state of an increase of capital stock from $200,000 to $250,000. C. H. North is the president of the company, which has within the last few years developed a large business.

The Dillonvale Telephone Company, Dillonvale, has been incorporated with a capital stock of $10,000 by T. C. Millard, E. G. Pinney, C. W. Dill, A. Carrubine and W. H. Wold. O. M. C.

Southern Telephone Developments.

The Interstate Telephone Company of Durham, N. C., has contracted for a $12,500 switchboard, to be installed by June 1st.

The vanguard of the clerical force of the Southern Bell Telephone Company, more recently of New York, has reached Atlanta, Ga., in pursuance of the plan of the company to move its headquarters to Atlanta.

Work has been started on the new buildings of the Sumter (S. C.) Telephone Manufacturing Company. The present buildings will be duplicated.

It is announced that the American Telephone and Telegraph Company will build a long-distance line from Morristown, Tenn., to Asheville, N. C., and thence to Spartanburg, S. C.

The Columbus (Ga.) Automatic Telephone Company has been organized at Columbus with a capital stock of $1,000,000. The Southern Telephone Construction Company will build the system. John T. Norman of Columbus has been elected president of the new company. Conduits are being laid for underground wires.

It is reported that the American Telephone and Telegraph Company has purchased the property and franchise of the Greensboro Telephone Exchange.

The Bell Telephone Company has bought out the Southern Telephone Company of Waycross, Ga. Several thousand dollars worth of improvements are being installed.

Dr. W. A. Hargis has organized a company to build a telephone line from Granville to Bagdad, Tenn., the line to be eventually extended into Kentucky.

The Roaring Springs Telephone Company of Greene County, Tenn., has been incorporated by H. A. Simpson and others with $500 capital.

The Interstate Telephone Company is connecting Raleigh, N. C., with a number of outside points. Over $50,000 will be expended.

The Southern Bell Telephone Company is considering the erection of a long-distance line from Jacksonville, Fla., to Lake City and other towns. L.

Telephone News from the Northwest

Several township telephone companies in the vicinity of Lake Crystal, Minn., have consolidated as the Minnesota Farmers' Mutual Telephone Company. They plan on having a line 100 miles long at the start, and will connect with the local exchanges at Lake Crystal and at Mankato.

The Annandale Telephone Company of Annandale, Minn., has declared a dividend of 15 per cent.

The Wisconsin Telephone Company will extend its long-distance wires east from Fond du Lac, Wis., to Plymouth and the Sheboygan county lines.

The Stevens Point (Wis.) Mutual Telephone Company has been incorporated with $25,000 capital stock.

The Grant County Telephone Company has been incorporated at Elbow Lake, Minn., with a capital stock of $100,000.

The Madelia (Minn.) Telephone Company has been incorporated with a capital stock of $10,000.

Harry B. Brookins of Mankato, has opened an office in Minneapolis, to conduct a clearing house for the toll-line business of the Independent telephone lines of the state.

Darius F. Morgan, general counsel for the Northwestern Telephone Exchange Company, died at his home in Minneapolis, of heart disease, aged 49. Mr. Morgan has been counsel for the company for nine years.

The Johnson County Telephone Company of Iowa City, Iowa, has begun suit against the Union Electric Telephone and Telegraph Company to restrain the defendant from cutting the plaintiff's wire or refusing to accept messages for delivery over its lines. Plaintiff claims to have entered into a 10-year contract for connection and service, but defendant threatens to discontinue the arrangement.

A trolley feeder in Marinette, Wis., was crossed on a telephone wire, resulting in about 100 instruments being burned out. The crossing was made while a house was being moved under the wires.

The council of Sault Ste. Marie, Mich., has concluded to test the validity of the ordinance fixing telephone rates at $24 and $12. The telephone company maintains its rates at $36 and $24, and refuses to consider any less figures. The city attorney will be instructed to bring proceedings to compel the reduction to the figures of the ordinance. R.

Old Bell-Western Union Suit Argued.

The suit of the Western Union Telegraph Company, the American Speaking Telephone Company, the Gold and Stock Telegraph Company and the Harmonic Telegraph Company against the American Bell Telephone Company, brought 20 years ago, to recover about $7,000,000 which the plaintiffs claim they are entitled to recover from the defendant upon an accounting under a contract made by them with the National Bell Telephone Company on November 10, 1879, was argued in Boston before Judges Putnam, Aldrich and Brown in the United States Circuit Court of Appeals last week, upon the appeal from the decree of the Circuit Court, dismissing the plaintiffs' bill and confirming the report of the master who had heard the case.

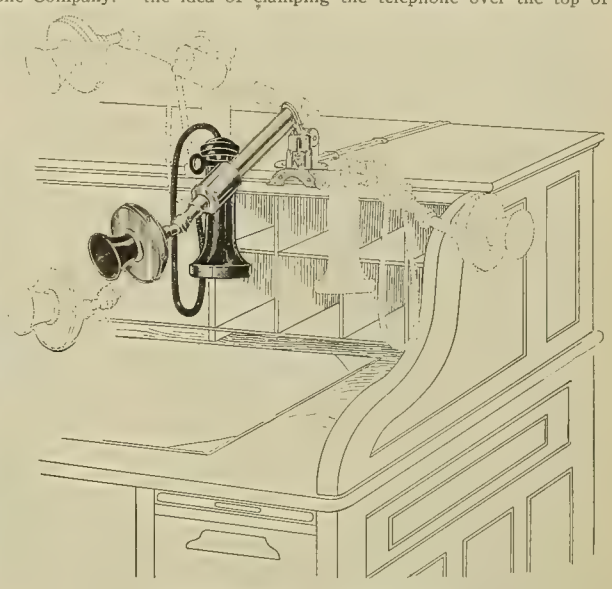
This is a suit growing out of the contract dated November 10, 1879, by which the American Bell Telephone Company, which was then known as the National Bell Telephone Company, agreed to pay the Western Union company and the other plaintiffs 20 per cent. of all rentals or royalties received from licenses for telephones in the United States. The Bell company issued licenses to certain corporations and, in addition to the annual rentals for telephones, received 35 per cent. of the capital stock of these corporations. The Western Union Telegraph Company claims that this stock was "rentals and royalties" within the meaning of the contract, and that it is entitled to 20 per cent. of the stock in question, together with the dividends declared thereon.

The Bell company contends that the "rentals or royalties" mentioned in the contract are the standard annual rentals (less commissions), and nothing more: that under the contract it had the exclusive right to carry on the exchange business, and to receive the profits, or to license another corporation to carry it on, receiving from such licensee a share of the profits. Its claim, in other words, is that this stock merely represents the outcome of the mode adopted for realizing its share of the profits of the exchange business. The case was referred to a master, who found for the American Bell company.

Counsel were Rush Taggart and J. H. Benton, Jr., for the plaintiffs, and Richard Olney, J. C. Gray and C. H. Swan for the American Bell Telephone Company.

Warren Adjustable Desk Telephone.

The accompanying illustration shows a new type of adjustable desk telephone which is put on the market by the Warren Ball Bearing Fixture Company of 377 Broadway, New York city. In this apparatus are combined a telephone and an adjustable bracket for telephones, so it is not to be classed with the ordinary telephone holders, as it is a distinct instrument by itself. However, instead of being made in the manner in which most of the instruments are that are now in use, the manufacturer has applied the idea of clamping the telephone over the top of the desk, to take the place of the portable styles of instruments.



WARREN ADJUSTABLE DESK TELEPHONE.

There are two ball-bearing joints, which permit swinging the telephone to any position within a four-foot arc, and a telescoping extendable arm which can be drawn to or pushed from the operator at will. One of the ball joints is directly behind the transmitter, which allows that to be moved at will, and the other ball joint is at the end of the arm, which gives movement to the entire bracket.

The receiver hangs on a swivel joint, and, regardless of the position the arm is placed in, the receiver will always hang in an upright position. The diameter of the ball at the end of the arm is one inch, and through it there is a thumb screw. This telephone bracket is also made in another style with a plate instead of the clamp, so that the bracket can be screwed onto any flat surface, as a wall. The Warren company furnishes either of these brackets, equipped with any make of telephone desired, or it will furnish the bracket without telephone parts. The brackets are durable and handsome in appearance, being made of polished nickel, brushed brass or oxidized copper. They are fully covered by patents.

GENERAL TELEPHONE NEWS.

An increase in capital from $2,500 to $5,000 has been made by the Farmington Citizens' Mutual Telephone Company of Farmington, Ill.

The Grayson County Telephone Company, with headquarters at Sherman, Texas, has increased its capital stock from $170,000 to $340,000.

In Germany last year it is said that the telephone was used 757,500,000 times, making an average of nearly eight calls a day by each subscriber.

The Beaumont Northeastern Telephone Company, with $1,000 capital stock, has recently been incorporated to operate a telephone system in Beaumont, Texas and vicinity. J. M. Smith of Beaumont is one of the incorporators.

E. J. Hall, vice-president and general manager of the New York Telephone Company; George W. Cummings, formerly vice-president of the Erie Railroad; General Thomas Sherwin, president of the New England Telephone Company, and J. C. French, general manager of the American Bell Telephone Company, have been elected vice-presidents of the American Telephone and Telegraph Company. They will retain their respective positions with the subcompanies of the American. With the exception of Mr. Cummings, all have been identified with the telephone industry for many years.

The town of Zamora, Michoacan, Mexico, is arranging for the construction of an electric traction system.

On Electrons.[1]

By Sir Oliver Lodge, F. R. S.

We must consider the properties of the ancient and long-known phenomenon called an electrified body. Two substances placed in contact and separated are in general united more or less permanently by lines of force, the region between them being in a state of tension along the lines and of pressure at right angles. These lines have direction; they begin at one body and end at another; they map out a field of electrostatic force, and their terminations on one or other of the bodies constitute what we call an electric charge. Electric charges are of two kinds, one corresponding to the beginning of the lines, the other to their ends. To one class of bodies called insulators the lines appear rigidly attached, whereas in another class they slip easily along and are transferred from one such conducting body to another in contact with it with great ease.

The tension in the lines tends to bring the ends together as near as possible, giving rise to what is observed as electrical attractions and repulsions. In empty space it is probable that the only way of destroying such a field of force is to allow the two bodies to approach each other, and thus shorten up the lines to nothing, though, even so, it is not probable that the charges are destroyed, but only approach so close that they have no external effect at any moderate distance.

When matter is present, however, it may be able to assist this collapse of the lines in various ways, giving rise to the various phenomena of conduction and of disruptive discharge.

Now, consider how far this field of force belongs to the body and how far it belongs to space—that is, to the ether surrounding the body. The body is the nucleus whence the lines radiate, but the lines themselves, the state of tension and other properties which they represent and map out, do not belong to the body at all; at each point of space there is an electric potential, and this potential represents something occurring in the ether, and in the ether alone.

A Charged Sphere.

Picture in the mind's eye such a charged body, say a charged sphere, and let it change its position; how are we to regard the effect of the displacement on its field of force? Nothing in physics is more certain than this—that when a body moves the ether in its neighborhood does not move. The ether, in fact, is stationary; it is susceptible to strain, but not to motion; it is the receptacle of potential, not of locomotive kinetic energy. The effect of the motion of the body, then, is to relieve the strain of the ether at one place and to generate it at another; the state of strain travels with the body, but through the ether.

At any point of space there are now three directions to consider: (1) There is the original direction of the electrostatic field—the original electric line of force; (2) there is the direction of the motion—that is, a direction parallel to the movement of the charged sphere; and (3) there is the direction at right angles to these two, this last being the direction of the magnetic lines of force—the direction of the magnetic field.

Just as there is no electrostatic field save that extending from one charged body to another, so there is no electric current except the motion of such a charged body, and no magnetic field except that which surrounds the path of this motion.

The locomotion of an electric charge is an electric current, and the magnetic phenomena surrounding that current are believed to be the only magnetic phenomena in existence. If any other variety is possible, the burden of proof rests on those who make the positive assertion. One more statement: While the charge is stationary everything is steady, and we have an electric field only.

While the charge is moving at constant speed the current is steady, and we have a steady magnetic field superposed upon a steadily moving electric field, and a certain conveyance of energy in the direction of the motion.

We get the phenomenon of induction—the generation of an induced electromotive force of value at any point equal to the rate of charge of the lines of magnetic force there. There being no conductor, this electromotive force will propel no current, but it will represent an electric force which was not there before, and in a new direction, perpendicular to the direction in which the growing magnetic lines are moving, which is outward from the charge. Consequently, the new or induced electromotive force points in the direction of motion, though in the sense opposed to it; and the effect of its superposition upon the magnetic field is to cause a certain small transmission of energy in a radial direction out and away from the accelerated charge. Some energy, therefore, flashes away with the speed of light, though in ordinary cases an exceedingly small amount.

It is from an electric charge during its epochs of acceleration or retardation that we get the phenomenon called radiation; it is this, andthis alone, which excites ethereal waves and gives us the different varieties of light.

Thus, or, rather by means of a very extensive development of these fundamental ideas, are all the phenomena of electricity and optics summarized, and, so to speak, accounted for.

Electric Inertia.

Whatever a charge may be, and whatever the hydrodynamic constitution of the ether, it must be able to maintain electric lines and magnetic lines, and to transmit energy wherever both sets of lines cross at right angles. Considered from the point of view of a current constituted by a moving charge, this corresponds to a mass acceleration. And the electrical acceleration is opposed by the electromotive force, just as the acceleration of matter is opposed by its mechanical inertia. The coefficient of the electric acceleration represents, therefore, an inertia term, and is properly called electric inertia.

By Lenz's law the effect of induction is always to oppose the cause which produced it. In the present case the cause is the acceleration or retardation of the moving charge, and so in each case this is opposed by the reaction of the magnetic lines generated by it. Motion is opposed while it is increasing in speed, and it is assisted while it is decreasng in speed—an effort precisely analogous to ordinary mechanical inertia—and, therefore, force is necessary, and work must be done either to start or to stop the motion of a charged body. An extra force, that is, by reason of its charge. Whatever the inertia the body may have, considered as a piece of matter, it has a trifle more by reason of its being charged.

Now, any appreciable quantity of matter, even a milligramme, moving with the speed of light, has a prodigious amount of energy—namely, for the mass of one milligramme, 15 million foot-tons. Or, as Sir William Crookes has expressed it, a gramme of 15 grains of matter moving with the speed of light would have energy enough to lift the British navy to the top of Ben Nevis. Consequently, the inertia of any ordinary quantity of electric charge must be exceedingly minute. Notwithstanding this, it is quite doubtful whether or not there really exists any other kind of inertia. The question whether there does or not is at present, strictly speaking, an open one; though to my mind it is practically closed.

The only way of conferring upon a given electric charge any appreciable mass is to make its potential exceedingly high—that is, to concentrate it on a very small sphere. A coulomb at the potential of a volt has an electrostatic energy of half a joule, that is $\frac{1}{2} \times 10^7$ ergs. The mass equivalent to this would be

$$\frac{2}{3} \frac{10^7}{9 \times 10^{20}} = \frac{2}{27} \cdot 10^{-13} \text{ gramme} = 10^{-8} \text{ milligramme.}$$

Raise the potential to 1,000,000 volts, and the mass equivalent to a coulomb at that potential would be $\frac{1}{100}$ milligramme; still barely appreciable therefore.

The charge on an atom as observed in electrolysis is known to be 10^{-10} electrostatic units. If this were distributed uniformly on a sphere the nominal size of an atom—viz., one 10^{-8} centimeter in radius, its potential would be $\frac{1}{100}$ electrostatic unit, or about three volts. The energy of such a charge would be 10^{-12} erg, and the inertia of a body which would possess this energy if moving at the speed of light would be 10^{-33} gramme. But this is incomparably smaller than the mass of a hydrogen atom, which is approximately 10^{-25} gramme. Consequently, the ionic charge distributed uniformly over an atom would add no appreciable fraction to its apparent mass. If, however, the atomic charge were concentrated into a sphere of dimension 10^{-13} centimeter, its potential would be 1,000 electrostatic units, or 300,000 volts, its energy would be 10^{-7} erg, and its inertia 18^{-28} gramme, or about $\frac{1}{100}$ of the mass of a hydrogen atom.

Discovery of the Atom of Electricity.

Quoting from Clerk Maxwell's "Electricity," we find on page 312, in the chapter on electrolyisis, the following sentence: "Suppose, however, that we leap over this difficulty by simply asserting the fact of the constant value of the molecular charge, and that we call this constant molecular charge, for convenience in description, one molecule of electricity." Thus, some idea of the conception of the atomic nature of electricity was forced upon men of genius by the facts of electrolysis and a knowledge of Faraday's laws.

The unit electric charge, the charge of a monad atom in electrolysis, whatever else it is, is a natural unit of electricity, of which we can have multiples, but of which, so far as we know at present, it is impossible to have fractions.

The atom with its charge is called an ion. The charge considered alone, without its atom, was called by Dr. Johnstone Stoney an electron or natural electrical unit. What we learn with great accuracy from electrolysis is the ratio of the charge to the mass of substance with which it is associated. It matters nothing how much substance is chosen, whether 100 atoms or one, whether an atom or a gramme or a ton, the amount of electricity associated with it in electrolysis, and liberated when the substance is decomposed, increases in the same proportion; the ratio is constant, and if determined for one substance is known for all. This is the ratio which is technically known as the electrochemical equivalent of the substance. In the light of Faraday's laws, if this quantity is measured for one substance it is known for all, because the charge is the same for every kind of atom up to a simple multiple; and hence in specifying electrochemical equivalents there is nothing to consider but the atomic weight or combining proportion of the substance. Thus the electrochemical equivalent of oxygen is eight times that of hydrogen, that of zinc is 32½ times, and that of silver 108 times that of hydrogen.

The substance chosen for a determination of the electrochemical equivalent may be the one which can be most accurately experimented on, and Lord Rayleigh has shown that such a substance is nitrate of silver, and has ascertained that if a current of one ampere is passed from a silver anode to a platinum cathode through a nitrate of silver solution, the cathode gains in weight by 4.025 grammes every hour. Hence the electrochemical equivalent of silver is 4.025 grammes/one ampere-hour, the electrochemical equivalent of hydrogen, being 1/108 of this quantity,

$$\text{is } \frac{4.025 \text{ grammes}}{108 \text{ ampere-hours}} = \frac{4.025}{108 \times 360} \text{ C.G.S.} = 0.0001035$$

$$\text{C.G.S.} = \frac{1}{96600} \text{ gramme per coulomb.}$$

Hence the ratio of an atom of electricity to an atom of hydrogen is $9{,}660\,\mu^{-\frac{1}{2}}$ C.G.S. units, or approximately $10^4 \sqrt{(\text{centimeters}/\mu\,\text{grammes})}$; the unknown constant μ necessarily making its appearance because we are comparing quantities measured in different ways—viz., electricity and matter. The numerical part of this quantity is known with comparative exactitude—that is to say, up to the limits of error of experiment.

To proceed further we must make an estimate of the mass of an atom; that can be done, and has been done, in many ways, and we have been taught both by Dr. Johnstone Stoney and by Loschmidt, and notably by Lord Kelvin, that the mass of an atom of water is approximately 10^{-24} of a gramme, wherefore an atom of hydrogen will be approximately 10^{-25} gramme; whence the unit of electric charge is 10^{-21} C.G.S. magnetic unit, or 10^{-10} of an electrostatic unit, or 10^{-20} of a coulomb.

Cathode Rays.

Cathode rays have a remarkable penetrating power; for Hertz found that a thin metal diaphragm, especially if it were of aluminum, was powerless to stop their passage completely, as could be demonstrated by the phosphorescence and other effects appearing in the further half of the tube beyond the diaphragm. The position of the anode in such experiments is of small consequence. There must be one somewhere, and the easiest plan is to make it a cylinder through which the cathode-ray bombardment goes. The bombarding particles fly in straight lines and decline to turn a corner, taking no apparent notice of the position of the anode, and exhausting themselves by bombarding the side of the glass opposed to them if the tube is bent into a V shape, for instance. Lenard extended Hertz's discovery in a remarkable way by skilfully constructing a tube with its outer wall of very thin aluminum, so arranged as to be able to stand the atmospheric pressure outside. He then directed the cathode-ray bombardment on to this window or aluminum film, and showed that the rays can penetrate it and actually come outside into the ordinary atmosphere, where they are called Lenard rays, in honor of this indefatigable investigator, a friend and disciple of Hertz.

These Lenard rays make the air phosphoresce and produce the other effects which cathode rays can produce, but they are stopped within a moderate range by the immense obstruction they meet with from a substance of the density of ordinary air. The rays can also affect photographic plates, and, indeed, do nearly all the things, though on a smaller scale and with much less penetrating power, that the later-discovered Roentgen rays can do. The Lenard rays are clearly cathode rays emerged from the tube, and it was the custom at the date of their discovery to think of them as flying charged particles of matter; though the extraordinary distance they could travel through common air, a distance comparable to an inch, was a manifest difficulty to such a hypothesis, seeing that things as big as atoms of matter cannot travel so much as $\frac{1}{1000}$ inch in ordinary air without many collisions. Lenard accordingly adhered to the view that they were not material, but ethereal; and, although in the sense he probably intended this is not a tenable view, for they are not ethereal waves or anything of the nature of radiation, yet, as we shall see, neither are they ordinary material particles, any more than the cathode rays are. But that is just what we are now considering, and we will return to them as observed by Crookes in 1879.

Nature of the Cathode Rays.

Let us summarize the evidence for the view that the cathode rays are at any rate charged particles of some kind in extremely rapid motion. That they are in motion must be granted from the facts of their bombardment—driving mills, heating platinum, and the like; and in order to show that they are charged, the most direct plan is to catch them in a hollow vessel connected with an electroscope, as Perrin did; but another plan is to show that they have the properties of an electric current. If they are charged while in motion they constitute a current on Maxwell's theory, and therefore should be able either to deflect a magnet or to be deflected by it; and here comes one of the most simple and important experiments in physics at the present time. A definite form of old experiments by Goldstein and many other vacuum-tube observers was arranged by Crookes in 1879, when he made the track of the rays visibly luminous by passing a selection of them through a

1. Portions of a paper read before the British Institution of Electrical Engineers, November 27, 1902.

slit and letting them graze along the surface of a film of mica covered with phosphorescent powder, and when he then brought near them a common horseshoe magnet. When this is done the track of the rays is at once seen to be curved, showing that it is not a beam of light we are looking at, but a torrent of charged particles behaving like an electric current and deflected by a magnet. It is really the very same phenomenon as can be observed with difficulty when a current flows through metals, which was discovered by E. H. Hall, and known as the Hall effect. The fact that the particles are thrown off the cathode, being evidently vigorously repelled by it, is sufficient to suggest that they must be negatively charged; the direction of the curvature caused by a magnetic field enables us to verify at once that the flying particles are negatively charged, and no comparable rush of positive particles in the opposite direction or in any direction has been observed. In that respect evidently the magnetic curvature of cathode rays in gases differs from the magnetic curvature of a current in metals—viz., that whereas in metals it is sometimes the negative and sometimes the positive current which is acted upon, according to the nature of the metal, and is always small, in gases it is the negative alone that appears to be acted upon, and the action is always large. It seems, therefore, that for some reason or other the negatively charged bodies in a vacuum tube are much more mobile than the positive, and that the mobility of the negatively charged bodies is extreme.

All the experiments that had been made in electrostatics had been made on charged matter, the surface or boundary of the matter acting as the locality for an electric charge. The facts of electrolysis had suggested or proved that the atoms themselves could carry charges, and hence, that if a liquid were electrified, what was really happening was that a number of the atoms on its surface turned their similarly charged poles outward; and the same might, for all we knew, be true for metals also, and thus every charge seemed associated with matter. Yet at the same time the occurrences at an electrode, where an ion gave up its charge and escaped without it, indicated the possibility that perhaps the electric charge could exist alone; at any rate, that it could be handed from one atom to another, and thus might conceivably exist alone for an instant. During this momentary isolation some might, in the freedom of a rarefied gas discharge, possibly escape, and wander about free. To such hypothetical isolated charges, the unit charge or charge of a monad atom, the name "electron" has been given, and when I speak of an "electron" I mean to signify the at present purely hypothetical isolated electric charge. Whereas by the term "ion" I always signify the atom and its charge together. Now, if the flying particles which constitute the cathode rays were electrons rather than ions—if they were detached charges, leaving the atoms behind them (probably leaving the atoms from which they were detached positively charged), their extreme mobility and diffusiveness and high speed would be perfectly natural, and although they would not be matter in the ordinary sense, yet no difficulty need be felt at their possessing some of the properties of matter; at any rate, such properties as appertain to matter by reason of its having inertia, because, as we have seen, an electric charge itself does possess a certain kind of imitation inertia. Hence, these electrons in movement would possess momentum, and might, therefore, propel windmills; they would possess kinetic energy, and, therefore, might heat a piece of platinum, and if suddenly stopped by a massive target when traveling at a high speed they might readily give rise to phosphorescent appearances, and even to the sudden pulse of radiation known as X-rays. But the existence of this last property ought to be capable of clear deduction on electrical principles if the matter is further gone into.

Increase of Inertia Due to Very Rapid Motion.

It will be observed that when a charge moves it generates circular magnetic lines of force. Now these magnetic lines are not stationary, but are themselves moving at the same rate as the body, hence they generate fresh electrostatic lines—i. e., cause an electric displacement away from the axis, which displacement is superposed upon the original radial displacement (away from or toward the center) due to the charge.

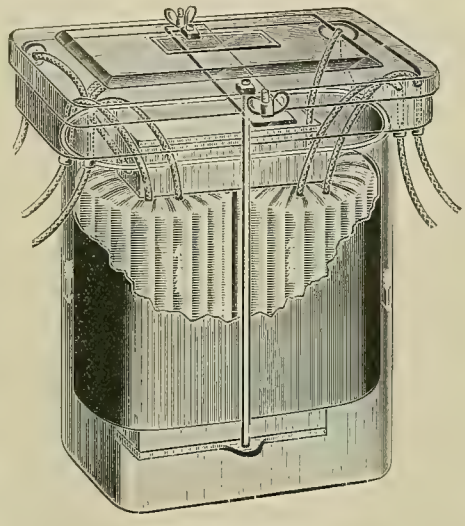
At ordinary, or even violent, speeds, this second-order electric effect is insignificant, but it is there all the time, and must not be ignored when the speed becomes extravagantly high. It rapidly rises into prominence when the speed approaches the velocity of light, but at any speed much smaller than this such a second-order effect is vanishingly small. Its effect will be, as Mr. Heaviside showed, to alter the distribution of the charge, making it move away from the poles and concentrate toward the equator of the charged sphere, when the speed is very great, ultimately becoming wholly concentrated upon the equator, all the rest of the sphere being denuded, when the speed attains that of light. And the electric lines of force will then be opened out into a fan or equatorial plane, like the spokes of a wheel which is rushing furiously along an elongated axle, the circumference of the wheel representing the direction of the magnetic field. The magnetic force due to motion can be shown to depend on the ratio of the speed of the motion to the velocity of light, u/v. The secondary electrostatic force due to the motion of this magnetic field likewise depends on the same ratio. Hence the second-order disturbance of the original uniform electrostatic field will be of the order u^2/v^2, and whenever we can afford to neglect quantities of this order the distribution, and, therefore, the inertia of the moving charge continue practically constant. But when its speed of motion begins to approach the velocity of light, say, even no more than one-tenth of that speed, then a disturbance of one per cent. is to be expected, and something like a one per cent. increase of inertia must occur.

Kuhlman Transformer.

The Kuhlman transformer, which is illustrated herewith, is of the well-known core type. To obtain the full benefits of this construction, which are large radiating surface per unit of heat generated and low magnetic leakage, the transformers are made extremely long in the direction of the magnetic circuit. The case, which serves simply to hold the oil about the coils, is made of galvanized sheet iron, the weight of the transformer proper being carried by the cast-iron rim at the top. A light case is thus obtained, one which will not imprison the heat generated and which is practically non-magnetic in character. The use of oil is recommended, and to assist its natural circulation, a fiber sheet is wound around the transformer proper, separating the rising and descending currents of oil.

All the standard transformers of this type have four primary and four secondary terminals, thus giving two primary and two secondary voltages.

The standard lighting transformers are designed so



KUHLMAN TRANSFORMER

that their maximum efficiency comes at three-fourths load, and the temperature elevation above the surrounding atmosphere does not exceed 40° C. after the period corresponding to the term of full load. The power transformers are designed so that their maximum efficiency comes at full load, with the same temperature limits under continuous operation as the lighting transformers after their normal period running under full load. This enables the regulation to be considerably improved over that of the lighting transformer.

In addition to the usual line of single-phase power transformers, the Kuhlman company is building a polyphase type, combining the separate transformers for each phase in one case. The magnetic circuits are combined, as are the wires in a polyphase circuit.

The Kuhlman Electric Company of Elkhart, Ind., which makes these transformers, though primarily a static-transformer specialist, has on the market a full line of stationary induction apparatus. Its line of static transformers includes lighting transformers for high or low-frequency circuits, power transformers, single or polyphase, step-up transformers for series arc-lighting service, and transformers for multiple arc lighting. Besides these standard types, which are carried in stock, the company is prepared to build transformers special in any particular.

Electric Locomotive for Pennsylvania Company's New York Tunnel.

The committee of experts appointed by President A. J. Cassatt, of the Pennsylvania Railroad Company to act as an advisory board and assist in the work of constructing the New York $50,000,000 tunnel, has already decided to adopt for use in the tunnel an electrical locomotive so arranged that it will only be necessary to increase the number of trucks to obtain increased power.

The following-named gentlemen are the appointees on the committee: Theodore N. Ely, chief of motive power of the Pennsylvania Railroad, chairman; W. H. Baldwin, president of the Long Island Railroad; S. D. Newhall, purchasing agent for the Pennsylvania, and A. W. Gibbs and A. S. Vogt, general superintendent of motive power and chief mechanical engineer for the Pennsylvania Railroad.

Progress in Electrochemistry.[1]

By Joseph W. Richards.

The German-speaking countries count up alone at their universities and technical schools 15 chairs of electrochemistry and 12 electrochemical laboratories. These, we all know it, have been the source of the greater part of the advance of electrochemical science in the last 10 years. The whole industrial electrochemical world is debtor to the European electrochemical laboratories and their workers, and how can that debt be requited? Surely not by selfishly using all the facts and holding fast all the material benefits. Not only common gratitude, but also self-interest, unite in recommending to the captains of electrochemical industry that more such laboratories be built and more such chairs endowed; money thus spent will be seed which will return manifold its value to the industry. America has boasted that it is "the electrochemical center of the world." It may be so, in the development of electrochemical industries, in the amount of power used and material products turned out; but is it not a fair question to ask, "Where are the professors of electrochemistry at our universities and how many electrochemical laboratories are at their command?" Are we not out of comparison with Germany in that respect? But I trust not hopelessly so. Our present flourishing condition is largely due to our foreign-trained electrochemists and our imported literature. Shall we not, through shame at contributing so little ourselves to that literature, soon begin to establish chairs of electrochemistry and build well-equipped laboratories to go with them? Then our boast might begin to be more than the empty boast of a successful moneymaker; then we may begin to be an illuminating center radiating knowledge to the rest of the world.

In place of professors and professional laboratories, however, America is blessed with another class of investigators who are no less industrious in acquiring facts, and to whom a large part of our commercial success is directly ascribable. I refer to the small army of patient investigators in the laboratories of our industrial plants, who are searching over ground not yet explored and accumulating facts of value in their special industrial lines. The expense of such work is borne by the corporation for which they labor, and the work itself is in reality an investment made in the hope of yielding financial reward. One great hindrance to scientific progress is the common human weakness of becoming partisans of a theory. The pitfall is particularly dangerous to the young and ardent investigator. Believing almost implicitly in the rectitude and ability of his instructor, he takes to his professor's hobby with enthusiasm, and spurs it on to feats which make more careful scientists shudder. He rattles off glibly the shibboleth of the pet theory, talks of its hypotheses as if they were facts proved beyond all question, smiles superciliously at anyone who questions the accuracy of his statements, and often gets irritated at the most friendly and unavoidable criticism. Thus the warmest friends of a theory are often its worst enemies, and by their blind partisanship lay obstacles in the path of scientific progress instead of being the leaders which they might be.

To make a specific application of these remarks, who has not felt that the most effective blows dealt the present theory of electrolytic dissociation have come from the excessive zeal of its warmest adherents? Out of their camp has proceeded half-fledged treatises on the theory, such as inaugural dissertations of would-be doctors of philosophy or textbooks compiled by privat-docents, in which the theory was simply done to death and made a laughing stock. Have we not met writers or lecturers on this theory who shunned a fair debate on their written or spoken statements, because, forsooth, they were themselves conscious that they had surpassed the safe bounds of reasonableness in those statements? Such an attitude, and such results are the consequence of holding a theory too tenaciously, and not "subject to revision." There are scientific zealots as well as religious bigots, and the one does as much harm to the progress of true science as the other does to the development of pure religion.

The fundamental conceptions of any and every theory must always be open to correction and revision, and thus progress will be rendered easy. If new facts appear which contradict our theories, let us welcome them, like loyal lovers of the truth should. The theory of electrolytic dissociation is being saved by being modified and revised; it is being transformed into a more perfect mirror of the truth as we now conceive it, and thus only is it retaining its usefulness and aiding in scientific progress.

Niagara Falls is the most accessible of our great waterpowers, and has therefore drawn into its fold the majority of our electrochemical industries. But another source of surplus power is distributed over a large part of our country, in a condition at present as undeveloped as was Niagara power when Columbus touched our shores. I refer to the surplus power from blast furnaces, obtainable by using gas engines. Every blast furnace burns its gases to heat its blast and to raise steam for its power. The two-thirds of its gases used for the latter purpose generate just about the power needed for the blowing engines,

1. Extracts from the presidential address delivered at the third general meeting of the American Electrochemical Society in New York city on April 18, 1903.

pumps, hoists, etc., an amount equal on an average to 2,500 horsepower for a furnace making 500 tons of iron per day. If the gas thus used was used in gas engines, there would be an average surplus power, over and above all the requirements of the furnace itself, of 10,000 horsepower. The gas-engine plant needed to produce this power does not cost over $50 per horsepower investment, which compares favorably with the cost of developing waterpowers, which vary from $25 to $100 per horsepower. It is thus deducible, that there are scattered over the United States, in some of our most flourishing industrial centers, undeveloped powers which aggregate over 1,000,000 horsepower, which can be developed at no more cost than the average waterpower, can be generated just at the spots where they can be most favorably utilized, and without any more drain on our natural resources than the harnessing of a new waterpower—for not a pound of coal more would have to be burnt than is used at present.

Other possible sources of power are the waste surplus gases from by-product coking ovens, and the utilization of gas producers, using cheap, almost waste, coal, in connection with gas engines. Power, therefore, is available in immense quantities in places and in countries not blessed with Niagaras, and the industrial development of such sources will be one of the most marked industrial movements of the next 10 years.

The factors which promote increasing applications of electrochemistry are cheap and accessible power, experimentation on a semi-industrial scale, men with heads full of ideas and inventiveness in applying them to the industrial needs of the country, more research companies and a further cultivation of the beneficent results of our society meetings.

By thus doing, cheap raw materials will be converted by the electrochemists into valuable products with constantly increasing ease and constantly decreasing cost, and thus electrochemistry will achieve its great raison d'être, by increasingly ministering to the needs, the comforts and the pleasures of life, and thus it will become an increasingly important factor in social progress.

If we ask the student of electrochemistry why he chooses this for his lifework, he will possibly reply that he has been advised by counselors in whose judgment he relies, that this is a most promising field for his activities; more probably he will answer that by reading himself some of the literature of electrochemistry he became attracted by the novelty of what was being achieved, and wished to take part in a science with such a promising future. In either case, the knowledge of what is and the vision of what may be, in this almost virgin field of human endeavor, is the magnet which draws recruits and adds to the working forces in our ranks.

If we ask the enthusiastic worker in his laboratory, what is the principal force keeping him at his work, which ever incites to fresh activity and lightens labors which might otherwise easily become tedious, the ready reply is that there is so much to do, so much to find out, so much promise of achieving great things, that he would be made of very dull stuff indeed who would not be enthused thereby. The ever-widening vision of an ever-widening field is the reward and inspiration of every honest worker, and is the mainspring of the mechanism whose working means progress to our science.

In every field of human endeavor, for the teacher in his classroom, the writer at his table, the editor at his desk, the workman at his labor, the investigator at his task, the chief incentive to happy, productive work is the vision and the promise of what may be attained. Without that vision, life would be dull indeed.

If there is, therefore, one thing which an electrochemical society such as ours achieves of more superlative worth than any other thing, it is the resultant enlargement of vision which comes to each of its members, mainly and chiefly from the interchange of thought, the sharing of ideas, the communication of insights into the possibilities of the science, resulting from our semi-annual meetings. Does not each one of us go away from these meetings feeling that he has been sharing in the visions of all his electrochemical brethren, and with his mind often so overloaded with suggestions, thoughts and ideas of what may, can and will be done in the near future, that he wishes he had half a dozen lifetimes at his command, in order to work out to realization this plenitude of ideas? Such is the zeal and ardor which our meetings engender in a high degree, resulting from listening to papers and discussions, by conversations, by simple handshakes and seeing our friends, and by breathing the invigorating atmosphere of our assemblies.

To Play Ball by Electric Light.

Charles D. Jenney, president of the Jenney Electric Manufacturing Company of Indianapolis, Ind., has perfected plans to light a baseball park by electricity, so that baseball may be played at night. Several years ago Mr. Jenney tried an experiment with strong reflectors, but the reflectors made a shadow, and the players could not judge a ball when in the air. Mr. Jenney's new invention is far superior to the former one, he says, and with it he can cause a diffused illumination all over the grounds, making it almost as light as day, and with no annoying shadows.

CORRESPONDENCE.

London Letter.

London, April 21.—The daily service of wireless-telegraph news which the Times announced as having been arranged with the Marconi company from America has not fulfilled expectations from the public point of view, and that portion of the technical press on this side which is not altogether favorable to Marconi has not failed to comment upon the matter. The messages from New York to London have been of a somewhat spasmodic character, the average over about three weeks being something over one per week. As, however, certain defects or breakdowns at the American station of the Marconi company have been encountered, criticism of the capabilities of the system in such a venture as supplying daily news should be withheld for the present.

The opening of the London County Council's tramways in the south of London has been fixed for May 15th, when the Prince of Wales will perform the opening ceremony. Everything is in complete readiness for this, and trials are being given to the motormen every night, in order to accustom them to the new conditions. Power will be supplied from a temporary power house, pending the erection of the permanent one at Greenwich. The lines to be opened on May 15th will include 15 miles of route, and it is anticipated that another 19 miles will be opened before the end of the year. Halfpenny (one-cent) fares will be continued, as heretofore, as, with horse haulage, the London County Council carries no less than 60,000,000 passengers per annum at this fare. A system of "never wet" seats has been adopted. A school of instruction has been run for some time in order to initiate the horse drivers into the mysteries of electric traction. Very little difficulty has been experienced in this, however.

Quite the event of the week has been the decision of the Willesden Urban District Council (a local body quite near London) to sell its half-completed electricity works to the North Metropolitan Electric Power Distribution Company, one of the large power supply undertakings of which so much has been heard from time to time. The company in question, which has parliamentary powers to supply electricity for all purposes over an enormous area around Willesden, has not, as a matter of fact, commenced the erection of any of its permanent stations, but the acquisition of the one which has been started by the Willesden Urban District Council will fairly launch it upon its career. The offer of the company, which has been accepted, was to pay the council the entire expenditure incurred up to date upon the scheme and to supply current to it at certain prices, thus leaving the municipality the full scope of the powers granted in its provisional order in respect of distribution. The price per unit will, in the opinion of the council's electrical engineer, compare more than favorably with what the council itself would have had to charge, with the additional advantage of relieving it from all financial responsibility. In fact, the engineers' estimates for the municipal scheme anticipated a loss upon the first one or two years' working, and inasmuch as the charges proposed by the company are independent of the total units sold (they vary with the load factor or number of units sold per kilowatt of the maximum demand) the council has felt bound, in the interests of the ratepayers, to accept the proposal. Of course, Parliament has yet to consent to this transfer, but no doubt is entertained in this direction, as the arrangement is evidently so mutually advantageous. In order to safeguard itself against the creation of any monopoly on the part of the company, the council contemplates the purchase of a site upon which to erect another works of its own should future circumstances warrant it. This it is empowered to do under its provisional order, which it has not surrendered.

The visit of the Institution of Electrical Engineers to Italy finished with the Easter holidays, and the usual beneficial time appears to have been spent, both educationally, and from the health point of view. Among the more important electrical works visited was the now famous Valtellina railway, which is equipped by Ganz & Co upon the high-pressure system which it was proposed to introduce upon the Inner Circle and which was the subject of the prolonged arbitration; the Paderno and Vezzola waterpower transmission schemes, the Royal Technical Institute, Milan, the direct-current railway system of the Mediterranean Railway Company equipped by the British Thomson-Houston Company, and a large number of electrically driven factories.

The National Telephone Company has just reconstructed its Glasgow system, despite the refusal of the Glasgow corporation to allow it to place its wires underground. The area covered by the company around about Glasgow is over 140 miles, with 25 exchanges and some 12,000 subscribers already connected up. The call-wire system has been abandoned, and more up-to-date methods adopted, which should render competition with the corporation much more effective than formerly, although the company cannot be said to have suffered much in this direction.

Apropos of the purchase of the Willesden Urban District Council's electricity undertaking mentioned above, another large power company, viz., the Kent Power Company, has offered to take over the Gravesend corporation's electrical undertaking upon a similar basis. W.

New York Notes.

New York, May 2.—The contractor on the rapid-transit subway is able to announce that he will have trains running as far north as One-hundred-and-fifty-fourth Street by the end of the present year. While the prospect of an early completion of the subway and tracks is good, the contractor must not fail to consider the erection of a power house and sufficient plant to operate this portion of the line. The total length of the subway, including the deep-level tunnels and elevated structure, is about 20 miles, of which about 11 miles has involved the opening up of the streets; about 3½ miles is deep tunnel work that has been carried on without any considerable obstruction of the surface; and about 5½ miles consists of elevated structure. Out of 10.8 miles of the subway constructed by the cut-and-cover method, 6.35 miles has been completed, that is to say, the tunnel has been excavated, the steel framework erected, the concrete roof and brick or terra cotta sidewalls built, the excavation filled in, and the street surface paved or asphalted as the case may be. There are three sections of deep-level tunnel being excavated through solid rock. Of these the most important section, that extending from Thirty-fourth to Forty-second Street, and the one which caused considerable annoyance on account of the faulty quality of rock which resulted in the collapse of several houses, has been completed. The first portion of the line to be opened will be from City Hall Park to the great underground storage yards at One-hundred-and-forty-fifth Street, and the question of opening the main line at the end of the year is a question of the completion of the work at certain points where it has been delayed by legal obstruction or the backwardness of contractors. The most important subway stations on the whole line are the loop station, situated just below City Hall Park, and Columbus Circle station at Sixtieth Street. They are representative of two different types of construction, the City Hall Park station being formed of arched concrete construction, while the roof of the Circle station is carried on steel columns and girders with concrete roofing turned in between the girders. In both cases the stations are well lighted by overhead sidewalk vault lights, assisted by a liberal use of incandescent electric lights. The finish of the walls will be in glazed tiling, the colors being chiefly white, green and Venetian red. The names of the stations will be shown in large glazed tile letters set in the panels of the wall, and they will be clearly distinguishable by the passengers.

The special franchise tax law was unanimously sustained by the Court of Appeals at Albany in a decision handed down on April 28th, which reverses the decision of the Appellate division of the Supreme Court at the January term. The decision sustains the provision for the assessment of the special franchises by the state board of tax commissioners. The court holds that the Legislature, in creating a new system of taxation, embracing a new kind of property, never taxed before, had the right to intrust to state officers the power of making the assessment, and that tangible property, such as rails and poles, which had been formerly taxed by local assessors, is merely incidental to the special franchises, and, hence, that there was no infringement upon local self-government. The total amount of taxes to be paid New York city by the various corporations under the decision for the years 1900, 1901 and 1902 will be $14,944,146.

Magistrate Barlow in the Center Street police court to-day dismissed the complaint of William N. Amory, charging H. H. Vreeland, president of the Metropolitan Traction Company, with criminal libel. Magistrate Barlow said: "I have heard testimony on both sides at the greatest length and with the utmost attention. I have read and reread all the records, and as I find there seems no sufficient cause to believe Herbert H. Vreeland is guilty of the offense as charged, I order him to be discharged and the complaint dismissed."

Announcement has been made here that the Hudson Valley Railway Company has acquired the property and franchises of the North River Railway Company, which was organized to build an electric railway from Saratoga to Glens Falls.

A report was current again yesterday that the Interborough Rapid Transit Company had, or would, acquire the Brooklyn Rapid Transit Company. August Belmont, president of the Interborough company denied the report, however. O.

New England News.

Boston, May 1.—The annual report of the Electric Company of America shows the following: Net earnings, $366,576; interest on loans and deposits, $24,034; other income, $2,932; total receipts, $393,542; direct charges sub-companies, $8,432; expenses, $32,632; dividends, $203,979; total expenditures, $245,043; surplus, $148,499; surplus January 1, 1902, $916,194; total surplus, $1,064,693; extra dividend in June, 1902, $610,917; balance December 31, 1902, $153,776.

The Connecticut legislative committee on railroads has favorably reported a bill providing that if any person shall take into his enclosure any part of land belonging to a railroad company, within the limits of which an electric railway has been built, or shall erect any building upon such land, he shall not, by adverse possession, acquire any title to the land so enclosed or built upon.

Theodore Hoague, trustee of the Thomson European Electric Welding Company, reports a balance of $7,800, which is sufficient for a dividend of 52 cents per share, and all interested persons are requested to appear before the Maine Supreme Court, at Portland, Maine, on May 14th, to show cause why such dividend should not be paid to the stockholders.

The Oakland (Maine) Electric Company has reorganized, increased its capital from $10,000 to $200,000, and purchased the Messalonskee Electric Company's property in Oakland, including valuable waterpower privileges which the latter company could not develop, owing to inability to obtain the necessary charter rights. The officers of the Oakland company are as follows: President, Harvey D. Eaton; vice-president, John N. Webber; treasurer, William T. Haines; clerk, Edward L. Meader; directors, Harvey D. Eaton, John N. Webber, G. F. Terry and W. S. Wyman of Waterville, Maine, and W. M. Ayer of Oakland.

The New York, New Haven and Hartford Railroad Company has obtained control of the Rockville Railroad Company, which owns the road between Rockville and Vernon, Conn. The former company has operated the Rockville road under lease for some time, and it proposes to establish a third-rail electric system between Rockville and Hartford. The Hartford, Manchester and Rockville Tramway Company has proved a formidable competitor to the railroad company.

The directors of the Louisiana Purchase Exposition are negotiating for the loan of the high-potential transformer designed and built by Professor H. B. Smith of the Worcester Polytechnic Institute.

A number of the students at the Worcester Polytechnic Institute have joined the American Institute of Electrical Engineers and are contemplating the formation of a branch of that association.

The Connecticut Railway and Lighting Company has begun the work of building a large power house in Plainville, Conn., on 6½ acres of land it recently purchased. The electricity will be supplied by the New Milford Power Company, and will be generated from power derived from the company's water privilege on the Housatonic River in the town of Kent. The current will be transmitted 40 miles through large cables. The power from the new Plainville station will be used to move cars on the New Britain division, covering New Britain, Plainville, Southington and Bristol. Power from the station will also be used for New Britain electric lights.

The Massachusetts Legislature has passed a bill making it a misdemeanor for any railroad, street-railway, electric-light, gas, telegraph, telephone, water or steamboat company to appoint, promote, reinstate, suspend, or discharge any person employed or seeking employment at the request of the governor, lieutenant-governor, member of the Executive Council or Legislature, judge of any court or any other state, county, city or town official; or for any public official or official-elect to use his influence in obtaining a position for any person from a public-service corporation. Notaries public and justices of the peace are exempt from the provisions of this law. B.

From the Buckeye State.

Cleveland, Ohio, May 2.—The Cleveland and Southwestern, the Mandelbaum-Pomeroy road, has been breaking some speed records lately, and on Tuesday two cars made exactly the same time over the line from Norwalk to Cleveland, a distance of 57 miles, in two hours to the minute, thus clipping 33 minutes from the best previous record. The schedule time is three hours and a half. The detail of the run is as follows: Norwalk to Oberlin, 25 miles, 46 minutes; Oberlin to Elyria, nine miles, 16 minutes; Elyria to Cleveland, 20 miles, 37 minutes. The remainder of the time and distance is represented in the run from the western city limits to the Public Square.

The Canton and New Philadelphia Railway Company of Canton has filed a mortgage made to the American Loan and Trust Company of Boston, for $1,000,000, to secure the issue of the same amount of bonds. The papers indicate that in the execution of the mortgage $585,000 of the bonds will be issued at once.

The Perry Electric Light and Power Company of New Lexington has been incorporated with a capital stock of $100,000 by Albert Bringardner, W. E. Finch, C. A. Donahue, William S. Bartlett and M. H. Donahue.

B. F. Bellows, a machinist of Cleveland, has invented an electric typesetting machine which he claims will be of great advantage in the mechanical department of newspapers. It is said that a company is being formed to manufacture the machine.

President W. Kelsey Schoepf of the Cincinnati Traction Company, denies the reports that an attempt has been made to form a merger of the roads in and about the cities of Cincinnati and Columbus and the lines between the two cities. He says nothing was done in regard to it and that the reports sent out were untrue.

The DeForest wireless-telegraph station, near Cleveland, has been completed, and it is thought will be in operation, connecting with Buffalo and other points, in a few days.

The Superior Court at Cincinnati has rendered a decision in which the curative act passed at the special session of the Legislature last winter, attempting to make good certain franchises of the Cincinnati Street Railway Company, is unconstitutional. As the case now stands, the John Street, Seventh Street, Third and Fifth Street, Elm and McMickin Avenue, Vine and McMickin Avenue, Vine and Clifton and Sixth Street lines have no franchises. Others whose franchises will expire between 1905 and 1911 are Eighth Street, Crosstown, Clark Street, Clifton and Elm Street, Zoo-Eden Park, Colerain Avenue, Gilbert Avenue and Sycamore cable lines. The Warsaw Avenue line expires this year. The street-railway attorneys say that they do not fear the result of appealing the case to the Supreme Court, as there has never been a case decided in which innocent investors were allowed to lose money through an unconstitutional act passed by the Legislature. O. M. C.

Information from Indiana.

Indianapolis, May 4.—Ground was broken and the work of constructing two new interurban lines was begun last week. A large force of men in the employ of the Richmond and Northwestern Traction Company began grading its Richmond-Newcastle line at the latter place, and the Union Traction Company, with a force of 60 men, under direction of Chief Engineer Bloss, began at Middletown to construct the Anderson-Middletown line. Both lines are to be completed before the summer ends.

The Fort Wayne and Northeastern Traction Company has filed articles of incorporation. The capital stock is $100,000. The company will build street and interurban lines in Fort Wayne and Allen County, through to the villages of Hicksville and Bryan in the state of Ohio. C. S. Karoly and R. S. Robertson of Fort Wayne are chief among the incorporators.

The Eastern Indiana Traction Company obtained a renewal of its franchises in Portland and Red Key. The company gave bond to begin the work at once on its line from Hamilton, Ohio, to Portland, by way of Richmond and Muncie. Peter Schwab is president.

A settlement has been effected by which the suit to prevent the consolidation of the Indianapolis Northern Traction Company with the Union Traction Company has been dismissed. This action permits the consolidation of the two traction-line interests. The construction of the Indianapolis Northern has been delayed somewhat on account of the pending suit.

The report of the purchase by the Union Traction interests of the two interurban lines connecting Peru and Wabash and Wabash and Logansport has been verified by Mr. McCulloch. The consideration is understood to be $800,000.

The Kokomo, Marion and Western Interurban Company placed a contract last week with the Cambria Steel Company of Johnstown, Pa., for 3,200 tons of 70-pound rails. Work on this line is to begin soon and the eastern branch completed by November 1st.

W. C. Heckman, a postal-department agent, is in Indianapolis arranging with the interurban lines for special pouch mail service over them. Two such services have been established, and others will be arranged this week.

Much interest is manifested in the coming to Indianapolis of M. C. Huyette of Chicago, an expert on the use of "coal as a factor in power production," who will lecture before the engineers of the electric-light, the steam and water, the electric-railway power and other plants in this city, on May 12th. The question is one of much interest and concern, and the attendance promises to be large. F.

Michigan.

Detroit, May 2.—The differences of the Jackson and Battle Creek Traction Company and the city of Marshall have been settled. The traction company must sell 12 workingmen's tickets between Marshall and Battle Creek for $1.

The village of River Rouge will hold a special election on May 18th to vote on the proposition to bond the village for $28,850 for an electric-light plant.

A public demonstration of the De Forest wireless-telegraph system will probably be given in Detroit soon. A station is being built at Grosse Isle, and it is nearly completed.

It is officially announced that the Detroit and Toledo Short Line will enter Detroit, via Wyandotte, Trenton and Rockwood, paralleling the Lake Shore and Michigan Southern Railroad and coming into Detroit by way of Fort Street. Mr. Tarkington, the new general manager, has assumed his duties. The Hannan syndicate has control.

The railroad commissioner, Atwood, who, it was understood, would carry out former Commissioner Osborn's policy of permitting no grade crossings of electric with steam roads, has granted permission to the Michigan Traction Company to cross the Michigan Central Railroad at Augusta at grade by installing a half interlocker. Commissioner Osborn had ordered a separation of grades at this point, but instead of making it, the traction company has been transferring its passengers. The steam line crossed is not the main line of the Michigan Central, but only a branch running to Allegan.

A bill has been introduced in the Michigan Legislature to provide for the exchange of freight by electric and steam roads. This bill is particularly in the interests of several communities of Michigan which have electric-railway facilities, but no direct steam-railroad communication. The steam roads will not recognize the electric lines in the interchange of freight business or in the handling of passengers or baggage on the same basis as with steam roads; hence the legislation to compel them to do so. If the electric lines would reincorporate under the general railroad laws, and assume the same obligations as steam roads, no legislation would be necessary.

The Toledo and Michigan electric railway now constructing a line from Adrian to Coldwater, has secured right-of-way clear through to Sturgis. The road is now in operation between Toledo and Adrian. Dr. Duket of Toledo is president of the company. The line, when completed, will be one of the longest in the state, and will run through well-settled farming country. C. G. W.

Southern Developments.

Charlotte, N. C., April 30.—R. E. and E. R. Briggs of Amesbury, Mass., J. Elwood Cox of High Point, and others, are interested in a $75,000 concern, to be started up at High Point, N. C., for the manufacture of electric cars. Over 100 skilled mechanics will be employed. The Messrs. Briggs have been in the car manufacturing business for 12 years.

It is reported that capitalists are interested in a proposed electric line from Sparta, Tenn., to Cookeville. A fine waterpower at Burgess Falls is being examined with a view to developing for power.

An election will be held at Griffin, Ga., on June 10th on the question of issuing $100,000 bonds for sewerage, water and electric-light improvements.

A bill has passed the lower house of the Virginia Legislature, requiring street cars to be provided with vestibules between November 1st and April 30th of each year.

A new electric-light plant is now being completed at Lewisburg, Tenn.

A bill has been introduced in the Virginia Legislature conferring upon street-car conductors the power to designate seats for passengers. This is designed to supply the alleged need for a "Jim Crow" street-car law in Virginia. L.

Northwestern Notations.

Minneapolis, May 2.—It is reported that options have been secured on street railways at Ottumwa, Des Moines and Cedar Rapids, Iowa, by representatives of eastern capital, with a view to establishing a power station on the Des Moines or Cedar River and running both interurban railways and lighting plants from a centralized power station.

The State Orphans' Home at Twin Bridges, Mont., is to be equipped with an electric-light plant.

Guthrie Center, Iowa, has voted to grant a franchise for an electric-light plant.

The promoters of the electric interurban line from Kaukauna to Fond du Lac, Wis., via the east shore of Lake Winnebago, have about completed their right-of-way between those cities.

The Great Falls Electric Light and Power Company secured the contract to furnish the electric fixtures for the new courthouse at Great Falls, Mont., at $3,000.

The Electrical Engineering Company of Minneapolis is erecting new poles and rewiring the electric-light plant of the Foley-Bean Lumber Company at Milaca, Minn.

P. T. Hanscom, assistant engineer of the power and mining department of the General Electric Company, Schenectady, N. Y., has been in Duluth and the Iron Range, north of Duluth, inspecting the territory which the Great Northern Power Company proposes to furnish with power, after completing the development of its system. Mr. Hanscom is quoted as saying that the St. Louis River waterpower proposition would furnish immense power, and its transmission to the Iron Range would be a simple matter. The Duluth Heights proposition he also regarded as a simple matter of engineering, although a project of immense magnitude.

Samuel V. Gilbert of Duluth attempted to turn on an electric light with one hand and a water tap with the other. He received the full charge of the light wire and was killed. Investigation showed that the primary and secondary wires, which were parallel and supposed to be separated by 16 inches, had lapped and worn off the insulation. Death was almost instantaneous.

Capitalists of Burlington, Iowa, propose to form a company to be known as the Burlington and Keosauqua Railway and Power Company, to build a line to Keosauqua. Three routes have been surveyed. Power is to be secured from the river at Keosauqua.

The city electrician of Thief River Falls, Minn., estimates the cost of improvements needed to the municipal light plant to bring it to a modern basis, at $3,290 for additional waterpower, or $5,845 for additional steam power, in connection with the present waterpower.

The Marquette City and Presque Isle Street Railway Company of Marquette, Mich., has decided upon improvements to its street-railway system. The power plant will be increased in capacity by the installation of a 250-horsepower generator. A new feed wire will be strung, with frequent connections to the trolley, giving an equalized current at all points on the system. Six new cars have been ordered, to give sufficient rolling stock for any emergency.

The inside wiremen of the Minneapolis General Electric Company have gone out on a strike because a workman was directed to make repairs at a resi-

[illegible] there a non-union paperhanger at [illegible] to make the repairs, but was [illegible] work by the company. Upon his [illegible] work, he was discharged. The [illegible] called out all the union men.

Peter T. Hoyer has engaged in the electrical sup- [illegible] Rochester, Minn. R.

Among the Rockies.

Great Falls, Mont., April 27.—By a vote of 383 to 72 the taxpayers of Great Falls, Mont., on April 25th, authorized the City Council to grant to M. Ryan of Butte and the Daly estate and their associates a 25-year street-railway and electric-light franchise.

The Montana Water and Electric Power Company of Philipsburg has filed with the secretary of state at Helena its annual financial statement. The capital stock of the company is given as $500,000. Of this there has been paid in money $3,000, and the balance in property of various kinds. The assets of the company are given as $500,000 and the liabilities $300,000.

It is the intention of the residents of Glasgow, Mont., to install an electric-light plant this summer. Representative citizens have been busy getting estimates on the cost of a plant, and there is no doubt that work will be commenced soon. H.

On the Pacific Slope.

Seattle, Wash., April 30.—The Moran Brothers Company has begun the construction, at Seattle, Wash., of a power plant which will be installed at a cost of over $125,000. The new plant will have a capacity of 2,400 horsepower.

Application has been made to the City Council at Northport, Wash., for a 30-year franchise to put in an electric-light system and power plant. The power will be generated at Kettle Falls, on the Columbia River.

The power plant at Eagle Falls, Ore., which will cost a total of about $200,000, will generate, when completed, from 6,000 to 10,000 horsepower for transmission to the mines and towns in eastern Oregon.

A large electric-light plant, costing over $18,000, will probably be installed 15 miles south of Heppner, Ore., this summer, deriving power from Willow Creek. A. M. Slocum, a milling man, who owns a plant at Willow Creek, is planning the enterprise.

Mayor Bennett of Whatcom, Wash., signed the ordinance granting a franchise over several streets to the Lynden Electric Railway and Improvement Company, for the construction and operation of a street railway.

The Franklin County (Wash.) commissioners have granted a 25-year franchise to furnish water, electric lights, electric power and telephone systems at Connell to the Connell Land and Improvement Company. A similar franchise for a period of 20 years was granted to J. W. Harris of Mesa, Wash.

Articles of incorporation have been filed by the Whatcom-Skagit Interurban Railway Company. The trustees are George G. Shelton, Thomas Tyler, B. F. Shifter, A. H. Wright and E. M. Day.

The Lynden Mill and Light Company of Lynden, Wash., has filed articles of incorporation with authorized capital stock of $26,000. G.

PERSONAL.

Patrick J. Kennedy has been reappointed wire commissioner of the city of Boston for the ensuing three years.

Joseph B. Hall has severed his connection with the General Electric Company as sales representative and is now chief engineer of the McGuire Manufacturing Company of Chicago.

The board of directors of the Lake Shore Traction Company (electric) has returned the resignation of President Barney Mahler, having refused to accept it. Mr. Mahler will, therefore, remain in office.

P. O. Anderson, who has been with the Gas and Electric Light Company of Stillwater, Minn., for 18 years, has gone to Benson, Minn., where he becomes manager of the electric-light and water company's plant.

Professor G. W. Bissell of Iowa State College, Ames, Iowa, has been retained by the Guthrie Center Electric Light Company, Guthrie Center, Iowa, to prepare plans and specifications for an electric-light plant to be installed by that company.

Dennis J. Hern, for many years engaged in the telegraph business in Boston and recently general manager of the Boston Mutual District Messenger Company, has been appointed member of the Boston Board of Health for a term of three years.

David Young, general manager of the North Jersey Street Railway, has severed his connection with the trolley company and will go to California in the interest of Brown Brothers of New York, who control a number of street-railway systems in the United States.

Edward Tremlett Carter, the late editor of the London Electrician, whose death was very briefly noted in the Western Electrician last week, was not quite 37 years of age. Death was due to consumption. Mr. Carter was a graduate of Bristol University College and was the author of "Motive Power and Gearing for Electrical Machinery," a well-known book. He was a member of several scientific societies and was highly esteemed by his associates.

J. G. White & Co. of New York have been appointed consulting electrical engineers for the New York and New Jersey Railroad Company, for which Charles M. Jacobs is chief engineer. Their work will cover the electrical equipment of the company's tunnels, terminals and rolling stock.

A. Eastman has been appointed division superintendent of the Fort Street and Wyandotte line of the Detroit United Railway in the place of Robert Johnson, assigned to other duties. Mr. Eastman came from Utica, N. Y., a few months ago. He was passenger and express agent of the Utica and Suburban lines.

Robert Ives, formerly of Chicago, has resigned the position of division superintendent of the Haverhill (Mass.) and Southern New Hampshire, the Hudson, Pelham and Salem, the Lawrence and Methuen, and the Lowell and Pelham Street Railways and has been succeeded by Robert Dunbar, promoted from the position of starter at Amesbury, Mass.

D. W. Roper, formerly superintendent of electrical equipment with the Missouri Edison Electric Company of St. Louis, Mo., and more recently engaged in consulting-engineering practice, has accepted a position with the Chicago Edison Company of this city. Mr. Roper's new duties will have to do principally with the electrical-engineering work of the Edison and Commonwealth companies.

H. H. Cutler, vice-president and chief engineer of the Cutler-Hammer Manufacturing Company of Milwaukee, says that the experiments being made by the Navy Department to propel machinery on warships by electricity is proving a gratifying success. Mr. Cutler was at Norfolk and witnessed the launching of the new cruiser West Virginia, which is to be fitted with electrical appliances.

Miss Mary A. Henry, eldest daughter of the late Joseph Henry, the first head of the Smithsonian Institution, died suddenly on April 10th, at Seville, Spain. Miss Henry was very familiar with her father's work and for several years she had been engaged in collecting his scientific, literary and personal papers in order to strengthen his claim to the discovery of the fundamental principles of telegraphy. She is survived by two sisters.

Francis E. Drake, who has long been identified, in this country and Europe, with prominent electrical enterprises, has entered a new pathway by accepting the presidency of the Lanyon Zinc Company of New York and St. Louis, with works in Iola, La Harpe and Pittsburg, Kan. This company is the largest producer of spelter in the United States. Mr. Drake will make his headquarters in St. Louis and will be followed by the hearty good wishes of a host of friends in the electrical field.

Daniel C. Shaw, a well-known telegrapher, died in Bath, Maine, on April 22d. For many years he was night manager for the Western Union Telegraph Company at Portland, Maine, but some 20 years ago he was made manager of that company's office at Bath, Maine. Of late years poor health caused him to abandon work. He was about 60 years old at the time of his death. Telegraph men of a generation ago will remember him as the "Oney Gagin" who contributed many bright letters to The Operator, the telegraph paper of that period.

ELECTRIC LIGHTING.

The Merchants' Co-operative Lighting Company, capitalized at $5,000, has been incorporated and will furnish light, heat and power at Centralia, Ill. William B. Smith is interested.

The Edison Electric Company is preparing to erect a new office building and power station on Fourth Street, near Main, in Los Angeles, Cal. Bids are now being taken for the construction of the new building by the architect, John Parkinson.

The Kittanning Electric Light, Heat and Power Company of Kittanning, Pa., has assigned to the Armstrong County Trust Company, with assets $80,000, and liabilities $30,000. Many of the prominent business men are directors in the company.

The Norborne Electric Light and Power Company has been granted a charter to furnish light and power at Norborne, Mo. The company has a capital stock of $10,000. J. L. Wilson and Ella M., W. A. and J. W. Cunningham are the incorporators.

A comparatively new boiler in the electric-light plant at Normal, Ill., exploded early in the morning on May 3d, fatally injuring one man and wrecking the building, causing a damage estimated at $15,000. There is no positive theory as to the cause of the explosion. The plant is operated by a stock company in which Mrs. Dr. Sweeney of Chicago is one of the principal owners.

J. Harkness Brown has recently closed a contract with the Nernst Lamp Company of Pittsburg, Pa., for over 1,500 Nernst lamps, which are to be used for lighting his large department store on Euclid Avenue, Cleveland, Ohio. The Nernst lamp is especially advocated for illuminating dry-goods stores, not only for the reason that 90 per cent. of the light is thrown to the counters and floors, but also on account of the daylight quality of the light.

ELECTRIC RAILWAYS.

Senator Fred T. Dubois is the chief promoter in a company which proposes to operate a street-railway system at Lewiston, Idaho, and to install a power plant near that city on the Waha Lake.

Work has commenced on the new electric railway to connect Rockford and Madison, Ill. The preliminary survey through Durand, Broadhead, Albany and other small towns is in charge of County Surveyor Baldwin. Warren Stearns, the promoter of the new road, proposes to do both a passenger and freight business.

The stockholders of the Omaha, Decatur and Northern Electric Railway, at a recent meeting at Tekamah, Neb., formulated plans for the construction of the proposed new road, which is to be built at once. P. B. Gordon of Decatur, Neb., was elected president; A. M. Anderson, Tekamah, secretary, and F. W. Bennett, Tekamah, general manager.

The City Council of Los Angeles on May 4th sold a street-railway franchise covering slightly over two miles on Sixth Street in that city at public auction. G. C. Johnson, presumably representing the Clark-Harriman syndicate, was the purchaser, paying $110,000. The franchise is considered a very valuable one and will probably be the nucleus of a new system.

A charter has been granted to the Oklahoma Electric Company, with Oklahoma City, Okla. Ter., as the principal place of business. The object of the company is to build a 100-mile electric railway, connecting Oklahoma City, Norman, Shawnee and El Reno. The capital is $1,000,000. F. R. Zigley and W. T. Young of Oklahoma City are among the directors.

SOCIETIES AND SCHOOLS.

Bion J. Arnold of Chicago, on the evening of April 28th, delivered a lecture before the New York Electrical Society at 19 West Forty-fourth Street on the subject of "Transportation Problems in Chicago and Other Great Cities." Mr. Arnold based his address, which was illustrated by maps and pictures, on his recent voluminous report as traction expert of the city of Chicago.

A well-attended meeting of the Chicago chapter of the American Institute of Electrical Engineers was held on the evening of May 5th in the assembly hall of the Western Society of Engineers. Local Honorary Secretary Junkersfeld presided, and the three papers bearing on "Tendencies of Central-station Development" recently presented at the New York meeting were read in abstract and briefly discussed.

PUBLICATIONS.

Science and Industry of Scranton, Pa., a monthly magazine issued in conjunction with the International Correspondence Schools of that city, has been absorbed by Power of New York and will be discontinued as a separate publication.

Two recent bulletins, distributed by the Stanley Instrument Company of Great Barrington, Mass., illustrate and explain the company's wattmeters. One shows the Stanley glass enclosed wattmeter, which is used for switchboard work and which makes a very neat instrument when mounted on a board. The meter is used for alternating-current circuits on primary or secondary service. The other bulletin describes the Stanley alternating recording wattmeter in metal enclosed case. Special attention is called to the fact that flotation in air of the rotating parts is accomplished by magnetic suspension.

SPACE TELEGRAPHY.

On Friday evening, May 1st, at the Masonic Temple, Detroit, Thomas E. Clark, president of the Thomas E. Clark Wireless Telegraph-Telephone Company, delivered a lecture on wireless telegraphy, and gave practical demonstrations. The occasion was a most interesting one, from the fact that Mr. Clark has already become known as a manufacturer of practical space-telegraph outfits. The Thomas E. Clark Wireless Telegraph-Telephone Company started in business about a year ago; and under Mr. Clark's guidance has been steadily developing a number of types of apparatus that will apply to conditions where it is desired to replace wires with wireless apparatus. Mr. Clark introduced into his lecture a number of striking and novel demonstrations. For instance he showed in the dark the luminous wave caused by the oscillation in two antennæ. This was shown on the stage in the Masonic Temple; likewise a street car was wirelessly started; a bomb exploded; lamps were lighted; bells were rung; motors started in operation; in fact, it was shown to what an extent the wireless system may be used in practical, everyday situations.

TRADE NEWS.

It is reported that the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., is about to issue a portion of its $7,000,000 treasury stock.

On account of its large increase in business the Illinois Electric Specialty Company has been compelled to seek larger quarters, and is now to be

found in its new factory at 171 and 173 South Canal Street, Chicago.

In a statement filed by the Stanley Electric Manufacturing Company with the commissioner of corporations of Massachusetts, the assets of the company are shown to be $5,175,016. To balance this the liabilities include capital stock of $3,000,000, debts of $1,935,472 and profit and loss of $239,544.

To meet the demands of constantly increasing business, the Western Electric Company has remodeled its store and city sales department located at 254 South Clinton Street, Chicago. The improvement will allow the prompt handling of all orders, whether by telephone, mail or actual visit.

Recent consular reports from Germany show a slight falling off in the profits of some of the more important branches of industry in that country. The average dividend paid by stock companies in the manufacture of electrical machinery and appliances in 1901 was 5.92 per cent., while in 1902 it was only 4.13 per cent. Most of the other industries show a corresponding decrease for 1902 as compared with 1901.

Sealed proposals will be received until June 3d for the construction, including plumbing, heating apparatus, electric wiring and conduits, of the United States courthouse, postoffice, etc., extension at Springfield, Ill., in accordance with drawings and specifications, copies of which may be had at the office of the custodian at Springfield, Ill., or by addressing the supervising architect, James Knox Taylor, Treasury Department, Washington, D. C.

Field, Hinchman & Smith, engineers and architects, with offices at 708, 709 and 710 Washington Arcade, Detroit, Mich., have succeeded to the business of Field & Hinchman, consulting engineers, and Mortimer L. Smith & Son, architects, of the same city. H. G. Field and T. H. Hinchman, Jr., who are well-known Detroit engineers, are the senior members of the new firm, Fred L. Smith and Ralph Collamore comprising the other members.

The electrical contractors of Hartford, Conn., have formed an association to be known as the Hartford Electrical Contractors' Association. Charles N. Knox was elected president and E. M. Baldwin, secretary. The objects of the association are to protect the members from trade losses and to place them in a better position regarding terms and credit from the manufacturers. The association becomes a member of the National Electrical Contractors' Association.

The Chicago offices of the Simplex Electrical Company have been removed to more commodious quarters at 1144-1146 Monadnock Block, a few doors from the old location. The warehouse is now at the northwest corner of Dearborn and Harrison Streets, in the basement. Deliveries of wires and cables, etc., will hereafter be made direct from the warehouse to city customers with written orders. H. R. Hixson is the well-known western selling agent of the Simplex company.

The Gregory Electric Company, the well-known dealer in second-hand electrical machinery, announces that it has purchased the large manufacturing property located at the corner of Sixteenth and Lincoln Streets, Chicago. This is adjacent to the Chicago, Burlington and Quincy Railroad and occupies an entire block. The plant is a modern one, constructed of steel, with truss-roof buildings, electric power transmission, electric traveling cranes, etc. Railroad tracks run into the building, which will greatly facilitate the handling of machinery. At this new location the Gregory company will handle, overhaul and repair the larger size dynamos and motors exclusively, having outgrown the capacity of its works on Clinton Street. To save the expense of moving its large machines to the new warehouse the company is selling them off cheaply. The general offices remain at 54-62 South Clinton Street, Chicago.

The Empire Wire Company, which was organized about one year ago and took over the business of C. M. Garrison, the Spargo Wire Works and the Empire Insulated Wire Company, all of 100 William Street, New York city, the latter two having factories at Rome, N. Y., has found it necessary to increase its capacity for the manufacture of magnet wire, in order to handle its rapidly growing trade. To do this it has taken over the mill of the Granite State Electrical Works at Lisbon, N. H., which has been thoroughly remodeled and equipped with new and modern machinery. It is now turning out from this mill wire equal in quality to that which the company has heretofore made at its old factories. To look after the requirements of its western trade, the company has opened an office and stock room at 60 West Van Buren Street, Chicago, in charge of Mr. A. D. Forney. On May 1, 1903, the general offices of the company were moved to 92 William Street, New York city.

BUSINESS.

The Thornton Electric Company of Hickory, N. C., is installing induced-draft apparatus furnished by the American Blower Company of Detroit, Mich.

J. F. Butterfield, electrical engineer and contractor, 113 Adams Street, Chicago, recently closed a contract for the reconstruction of the Posey County Telephone Company's plant in Mount Vernon, Ind.

The Ohio Electric Works, Cleveland, Ohio, have placed on the market a line of efficient battery fan motors, with either wet or dry batteries. The sizes are from five to 12-inch fans. The motor with the nine-inch fan takes only three-quarters of an ampere at seven volts and runs the fan at 1,600 revolutions per minute. A new catalogue with discount sheet describes these goods.

The Electric Appliance Company, Chicago, has served notice on all alternating-current electric-lighting plants that it has instituted a vigorous campaign against them on the subject of Gutmann wattmeters It is a case, it is said, where the companies must surrender in order to win. If there is an alternating-current plant in the United States not receiving this meter literature, it is an oversight, which will be promptly corrected if notification is sent in.

The use of storage batteries for lighting private yachts is rapidly increasing. The great advantage of a battery lies in the fact that it enables the lights to be used throughout the night while the machinery is shut down, thus avoiding the vibration from the running of a generator, which is especially noticeable in a yacht while lying at anchor. The Electric Storage Battery Company has recently contracted for the installation of five yacht-lighting plants on boats now under construction at Morris Heights, N. Y.

The E. J. Noblett Company of Chicago, manufacturer of cable boxes for telephone companies, and fuse boxes for use in lighting circuits, reports a most satisfactory business. This progressive company supplies many of the leading concerns in the country, and its product is said to be so satisfactory that when it once secures a customer it invariably holds his trade continuously. The company also makes electrical woodwork of all kinds, as well as cross-arms, pins and brackets. One of its specialties is insulator pins for high-voltage transmission lines.

The White Mountain Paper Company has recently purchased from the Westinghouse Electric and Manufacturing Company three 1,000-kilowatt and one 300-kilowatt, three-phase, engine-type alternators, which are complete with exciters, and are to be direct-connected to Hamilton-Corliss engines installed in its paper mills at Portsmouth, N. H. The various machines in this mill will be operated by Westinghouse, type-C, induction motors, aggregating 5,500 horsepower. When this apparatus is in operation it will comprise the largest individual electrical installation in a paper mill in the world.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) April 28, 1903.

726,241. Electrical Cooking Apparatus. James I. Ayer, Malden, Mass., assignor to the Simplex Electrical Company, Boston, Mass. Application filed September 10, 1900.

The apparatus comprises a cooking utensil and an electric-heating device, provided respectively with heat-transmitting surfaces adapted to contact at every point throughout their adjacent areas.

726,254. Lock. Henry G. Carleton, New York, N. Y. Application filed February 20, 1902. Renewed March 4, 1903.

An electric lock is described.

726,269. Electric Track Circuit and Method of Insulating Same. Edward A. Everett, Detroit, Mich. Application filed February 10, 1902.

The process consists in interposing substantially throughout the length of the circuit oil between the section of railroad rails forming part of such circuit and the underlying ties and road-bed, by applying oil to the web and base of the railroad rails.

726,272. Storage Battery. Fritz A. Feldkamp, Newark, N. J. Application filed July 8, 1902.

A compound electrode for storage batteries is described. It comprises a thin metal plate, and a porous fabric, an active material applied directly upon the outer surface of the fabric, the fabric being arranged in close contact with a surface of the plate.

726,274. Secondary Battery. Pietro Figuccia, Boston, Mass., assignor to Louis Melano Rossi, Boston, Mass. Application filed May 22, 1902.

In the battery are a grid or frame comprising a series of juxtaposed and laterally separated bars, each having a channel in its opposite, outer faces, and masses of active material retained in the channels of the bars, the spaces between the latter being left open and unobstructed.

726,292. Burglar-alarm System. Edwin T. Holmes, New York, N. Y. Application filed July 18, 1900.

The system comprising a line between a protected structure and a central office is combined with a local circuit at the guarded structure, a primary signal device in circuit with the line and controlled by a device in the local circuit, and a repeating signal device also in circuit with the line and adapted to be put in operation by the primary signal device and to repeat its signal as often as desired at predetermined intervals.

726,293. Exhausting Lamps. John W. Howell, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 9, 1897.

The method of exhausting bulbs to form a high vacuum consists in pumping off the air from the bulb, closing the connection between the pump and bulb without the aid of heat, volatilizing the chemical within the bulb to absorb the remnant gases, and then sealing off the bulb.

726,301. Electric Recording System. Joseph C. Huss and George W. Schilling, Philadelphia, Pa. Application filed December 18, 1902.

Means are provided for automatically causing a continuous series of electric impulses in frequent succession to be produced in the local circuits, the impulses producing a series of successive records during each closing of the switch to indicate the time the switch is closed or open.

726,302. Electrical Control of Elevators. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed April 11, 1902.

High and low-potential controlling circuits are so connected that control of the elevator motor is excluded from the stations after the car has come to rest.

726,303. Motor-controlling Apparatus. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed May 5, 1902.

In apparatus for controlling induction motors there are combined with the primary of the motor a three-phase secondary, fixed and variable resistances in the secondary circuit, and means for short-circuiting the variable resistances without varying the fixed resistance as the motor starts.

726,307. Automatic Control System for Elevators. Benjamin N. Jones, East Orange, N. J. Application filed January 13, 1903.

Means are provided for making the control circuit independent of the operating circuit while a car is moving, and an auxiliary circuit co-operates to make the control circuit independent of the operating circuit after the car has come to rest.

726,308. Railway-crossing Gate. Burton A. Karr, Council Bluffs, Iowa, assignor to the Electric Gate and Signal Company. Application filed April 7, 1902.

The mechanism comprises track circuits, a vibrator circuit, motor-controlling circuits, means operated by the vibrator circuit to close the motor-controlling circuits, a motor and motor circuit.

726,327. Switch Regulator. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 21, 1902.

A switch having its neutral position between two operative positions is combined with means for preventing the movement of the switch into one of the operative positions without first being moved into the other operative position.

726,328. Fixture for Vacuum-tube Lighting. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed April 15, 1898.

A fixture for tubular electric lamps consists of a bracket fixed to the wall, an insulated support attached thereto and from which the lamp is readily removable, a circuit terminal plate attached to the bracket to which the lamp terminal may be connected, and a removable shield for hiding and protecting the support and plate. (See cut on next page.)

726,331. Electric Cut-out. Lewis J. Mulvaney, Kingsbridge, N. Y. Application filed September 8, 1902.

An improved cut-out is described.

726,347. Fastening Field Magnets to Spiders. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 18, 1901.

Means for fastening a laminated pole-piece to a support comprise a base-plate, means engaging the lower ends of laminations and clamping them to the base-plate, and means for fastening the base-plate to the support.

726,360. Microphone or Microphone Transmitter for Electrical Sound Transmission. Friedrich W. Senkbeil, Offenbach-on-the-Main, Germany. Application filed January 11, 1902.

In a granular microphone a funnel-shaped granule carrier is provided with a central partition of the shape of a flat bar having the outer edge adjacent and parallel to the diaphragm, and the inner edge at a slight distance from the rear of the carrier, the inner edge being curved so as to leave a passage for the granules from one side of the bar or partition to the other side.

726,361. Electrical Switch Lock. Christopher A. Shea, Philadelphia, Pa., assignor to the Automatic Train Controller Company of New Jersey. Application filed February 12, 1902.

An electrical circuit is opened and closed by a contact on the train, whereby the switch-lock and its lock is operated.

726,364. Electric Furnace. Ernst Sjöstedt, Sault Ste. Marie, Canada, assignor to the Lake Superior Power Company, Sault Ste. Marie, Canada. Application filed September 30, 1901.

The electric smelting furnace described has a cover of refractory material with feed and vent holes and opening for the electrode, an upper electrode held adjustably suspended within the opening of the cover and a bottom electrode embedded in the bottom lining and its ends in contact with the metallic frame of the bottom and wires connecting the upper electrode and the bottom frame to a suitable electric generator.

726,366. Door-bell Attachment and Burglar Alarm. Elbert Snedeker, Brooklyn, N. Y., assignor to the Marvel Patents Company. Application filed March 26, 1902.

Combined in the alarm are a spring-latch, an electric circuit for operating the alarm, and make-and-break device on the door-jamb adapted to be operated by the spring-latch, and contacts for intermittent and for constan ringing.

726,368. Electrical Distribution and Selective Distribution. John S. Stone, Boston, Mass., assignor to the American Bell Telephone Com-

pany, Boston, Mass. Application filed April 4, 1894.

The method of producing and impressing upon a main or signaling circuit electric-current impulses of a harmonically vibratory character, consists in abruptly changing the supply of current furnished to suitably proportioned electric circuits or loops associated with the main circuit, thereby producing oscillatory currents of the desired frequencies in the loops.

726,370. Safety Device for Electric Elevators. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed September 12, 1902.

A main circuit containing the motor-armature, an auxiliary circuit controlling a brake, and switches for operating the circuits are combined with a manually operated switch to open both of the circuits together.

Means for Varying Delta-connected Voltages. Albert H. Armstrong and Jonathan E. Woodbridge, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed December 16, 1901.

Combined with a number of translating devices connected in delta are interior taps from the devices, and a number of conductors constituting a multiphase system of distribution connected to the taps.

726,413. Transmitting and Receiving Apparatus for Hertzian Waves. Eugene Ducretet, Paris, France. Application filed November 1, 1901.

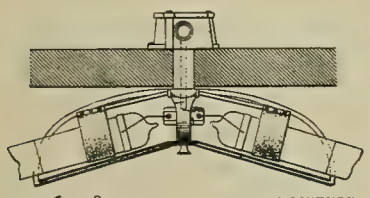
The device comprises a solenoid for regulating the relation of discharge and induction currents in transmitting and receiving Hertzian waves, sliding contacts for the solenoid, supporting means therefor, adjusting means for the contacts, whereby their relation to one another may be varied, and the number of spirals in circuit may be altered, and receiving and discharging circuits connected to the sliding contacts.

726,445. Means for Connecting Multiphase Windings. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 3, 1902.

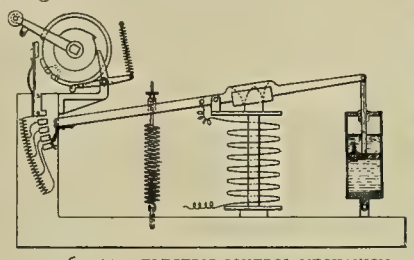
Combined with a number of multiphase windings are means for connecting the windings in delta with a portion only of each of the different windings included in the delta connection.

726,468. Process of Forming Accumulator Electrodes. Gordon J. Scott, Philadelphia, Pa., assignor to Charles H. Graham and George D. Bonton, Philadelphia, Pa. Application filed February 28, 1903.

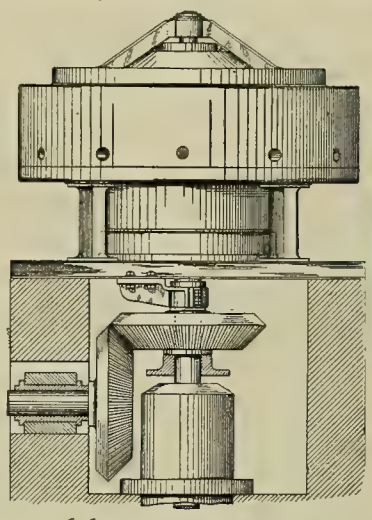
The process of forming an accumulator electrode consists in separating it from the opposed electrode during the forming operation by a current-conducting baffle.



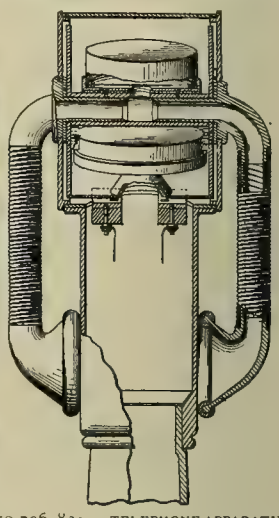
NO. 726, 328.—VACUUM-TUBE LAMP FIXTURE.



NO. 726, 593.—ELECTRIC CONTROL MECHANISM



NO. 726, 659.—ELECTROLYTIC APPARATUS.



NO. 726, 835.—TELEPHONE APPARATUS.

726,476. Electrical Distribution and Selective Distribution. John S. Stone, Cambridge, Mass., assignor to the American Bell Telephone Company. Original application filed April 4, 1894. Divided and this application filed March 12, 1903.

A sonorous circuit of definitely proportioned resistance, capacity and inductance is associated with the main circuit and means are provided for abruptly varying the electrical condition or disturbing the electrical equilibrium of the sonorous circuit, thereby producing in the circuit a vibratory current of definite frequency.

726,479. Mechanism for Controlling Electric Circuits. George A. Tate, Chicago, Ill., assignor of one-half to Frederick E. Newbery, St. Louis, Mo. Application filed November 29, 1901.

Means are arranged whereby the shunt-circuit controlling the main circuit-breaking mechanism is controlled by a movable part.

726,485. Insulating Material. Willis R. Whitney, Boston, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 24, 1902.

The material is formed of very thin sheets or films of an artificial vitreous substance cemented or held together in the desired shape by means of a suitable binder.

726,497. Carbon-holder for Electric Arc Lamps. Harry P. Bayley, Chicago, Ill., assignor to the Pyle National Electric Headlight Company, Chicago, Ill. Application filed January 5, 1903.

In the holder are a stationary bar having a vertical concave carbon-guiding face, a carbon-guiding sleeve on the bar, a carbon-engaging contact spring in the sleeve, and a carbon-guiding ring at the lower end of the bar.

726,512. Railway Signaling Device. Edwin M. Cutting, Oakland, Cal., assignor of one-half to W. W. Slater, San Francisco, Cal., and H. C. Barnes, Oakland, Cal. Application filed August 19, 1902.

Electrical means are provided for moving opaque blinders.

726,529. Searchlight. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 17, 1900.

Mechanical means for manipulating a search-light projector are described.

726,536. Mechanism for Driving Shafts at Variable Speeds by Means of Alternating-current Motors. Otto Holz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 15, 1902.

Combined with a power shaft and a shaft to be driven are intermediate connecting mechanism comprising two independently rotatable members, a closed winding on one of the members, a primary winding on the other of the members, a direct-current exciter for the primary winding driven by the power-shaft, and means for connecting one member to the power-shaft and the other to the driven shaft.

726,548. Charging Device for Storage Batteries. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 20, 1901.

A charging station for electrically propelled vehicles is provided with terminal contacts connected with an electromagnetic control device adapted for actuation by a residual battery charge in the vehicle.

726,566. Printing-telegraph System. William P. Phelps, Merchantsville, N. J., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed March 6, 1902.

Type-member-actuating mechanism comprising a power-storing motor member, a magnet, and means operated thereby for storing power in the motor member is combined with electrically controlled mechanism for governing the position of two type members, the mechanisms being in different circuits, shifting mechanism and press mechanism, both comprising magnets, one of which is in circuit with the magnet of the type-member-actuating mechanism, the other magnet being in circuit with the mechanism determining the position of the type members. The shifting mechanism is adapted to permit impressions to be taken from either of the two type members at will.

726,587. Trolley Wheel. Charles S. Stanton, Hartwick, N. Y. Application filed August 20, 1902.

Combined with fork-arms are bearing disks rigidly secured to the fork arms and having annular grooves for the reception of a lubricant, and a trolley wheel having recesses in its opposite sides for the reception of the disks.

726,593. Electric-control Mechanism. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 29, 1900.

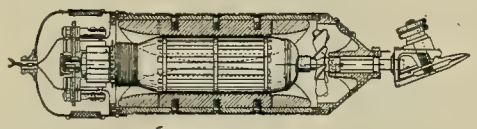
In a system of motor control, there are a number of electric motors, manually actuated means for connecting the motors in series and in parallel, resistances adapted to be connected in circuit with the motors, and means independent of manual control for slowly cutting out the resistances. (See cut.)

726,599. Third-rail Support for Underrunning Third-rail Electric Railways. Leonard Wheeler, Wheaton, and John T. Murphy, Chicago, Ill. Application filed February 24, 1903.

See page 363.

726,600. Rail-contact Shoe and Support Therefor. Leonard Wheeler, Wheaton, and John T. Murphy, Chicago, Ill. Application filed February 24, 1903.

See page 363.



NO. 726, 795.—CLIPPING MACHINE.

726,651. Electric-wire Support. Beauregard Cullen, New Albany, Ind. Application filed July 14, 1902.

An improved metal-pin support is described.

726,659. Apparatus for the Generation and Direct Electrolytic Application of Electric Currents. Francis E. Elmore, London, England. Application filed January 10, 1902.

In the structure are an electrolytic cell and a unipolar dynamo-electric machine, the armature of the latter being in direct electrical connection with the anodes or cathodes of the former. (See cut.)

726,687. Magneto. Charles W. Holtzer, Brookline, Mass. Application filed February 26, 1903.

Mechanical details are described.

726,693. Telegraph System. Charles K. Jones, Tuscumbia, Ala. Application filed May 24, 1902.

Parts of the system are an electromagnet arranged in a relay-controlled circuit, an armature arranged within the field of the force of the electromagnet and having a synchronal movement with the striking lever of the sounder, and means under the control of the armature for cutting out the local key and closing the main line when the magnet is de-energized for a predetermined period of time.

726,721. Third-rail Guard for Electric Railways. Jacob Martin, New York, N. Y. Application filed January 23, 1903.

A third rail for electric railways is provided with a flexible guard or protector which is secured at one side thereof and is adapted to rest in a horizontal position thereover, and the free edge of which is provided with a flexible metal reinforcement or protector. A motor car is provided with a contact-arm having a contact shoe adapted to bear on the rail. The contact-arm is provided with a plow for raising the guard or protector.

726,734. Electric Circuit. Edwin F. Northrup, Baltimore, Md., assignor to the Rowland Telegraphic Company, Baltimore, Md. Application filed September 27, 1901.

An electric circuit for the prevention of mutual magnetic induction between the same and a neighboring conductor comprises a number of sections in which current in one section flows in an opposite direction from that in an adjacent section, whereby the mutual magnetic effect on an adjacent conductor, of one section, is neutralized by that of an adjacent section, and a source of periodically varying electric current connected to the circuit.

726,735. Synchronous-code Telegraphy. Edwin F. Northrup, Philadelphia, Pa. Application filed October 10, 1902.

The system consists in impressing upon a circuit a succession of periodic electrical impulses, and forming the elements of the characters of a code by changing the phase of a number of impulses for each element, the characters of the code being independent of a preselected number of impulses, but dependent upon the relation between the number of impulses modified to form one element and those modified to form another element.

726,736. Synchronous-code Telegraphy. Edwin F. Northrup, Philadelphia, Pa. Original application filed October 10, 1902. Divided and this application filed January 2, 1903.

Parts of the system are a main line, sources of two simultaneous periodic electromotive forces of different phase, means for normally transmitting to line impulses of the current produced by one of the electromotive forces, and transmitting the characters of a code by substituting for the normal impulses on the line impulses from the source of the second electromotive force.

726,750. Means for Producing Synchronous Motion. Louis M. Potts, Baltimore, Md., assignor to the Rowland Telegraphic Company, Baltimore, Md. Application filed December 10, 1901.

Combined with an electric motor are a body with which the motor is to be synchronized, a shunt-circuit, and means for exerting a continuous synchronizing effect upon the motor by intermittently closing the shunt-circuit around the armature of the motor.

726,773. Support for Street Lamps. Peter W. Shute, Ypsilanti, Mich. Application filed October 11, 1902.

A suspending device for street lamps is described.

726,795. Electric Clipping Machine. Jean Cornu, Lyons, France, assignor to Société Francaise des Tondeuses Electriques, Lyons, France. Application filed August 4, 1902.

The machine has a casing, an electric motor therein, a cutting blade coupled directly to the motor and a fan within the casing interposed between the motor and the cutting blade. (See cut.)

726,831. Method of Connecting Multiphase Windings. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed February 3, 1902. Divided and this application filed April 26, 1902.

The method of obtaining voltages differing from the voltages across the terminals of a number of multiphase windings consists in completing a delta connection including a portion only of each of the windings.

726,835. Telephonic Apparatus. Frank W. Wood, Newport News, Va., assignor to Charles Cory & Son, New York, N. Y. Application filed August 1, 1902.

The apparatus consists of a transmitter and receiver, a casing inclosing the same and having an opening, ear tubes communicating with the receiver and a movable closure for the opening located entirely within the casing. (See cut.)

726,836. Telephonic Apparatus. Frank W. Wood, Newport News, Va., assignor to Charles Cory & Son, New York, N. Y. Application filed August 7, 1902.

In the apparatus are a stationary receiver, movable ear tubes communicating therewith, a movable transmitter, and means actuated by one of the ear tubes for moving the transmitter.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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Lowell Laboratories of Electrical Engineering at the Massachusetts Institute of Technology.

Through the generosity of five children of the late Augustus Lowell, George A. Gardner, Mrs. Walter Scott Fitz and C. C. Jackson, the Massachusetts Institute of Technology now has one of the most convenient electrical laboratories to be found in any of the educational institutions in the world. Owing to the manufacturers' slowness in filling orders, all of the equipment has not been installed, but, barring accidents, the opening of the next school year will find everything in place and the students enjoying the facilities afforded by the most completely equipped educational electrical laboratories in this country or Europe.

In recognition of Mr. Lowell's services to the Institute, the building containing these laboratories has been named the Lowell Building, and the electrical portion is known as the Augustus Lowell Laboratories of Electrical Engineering. Of the money available for the erection and equipment of the building, $50,000 came from Mr. Lowell's children, including Professor A. Lawrence Lowell of Harvard University and Percival Lowell, the astronomer, both members of the Technology corporation; $10,000 was given by Mr. Gardner, also a member of the corporation; Mrs. Fitz gave $2,000, and Mr. Jackson, who is vice-president of the Boston Stock Exchange, contributed $3,000.

The building, as shown in Fig. 2, on the next page, is a brick structure, one story high and covering 45,000 square feet of ground. It contains two lecture rooms, professors' rooms, a library, a standardizing laboratory, a laboratory of dynamo-electric machinery, and rooms for photometric measurements and special research. The plan is shown in Fig. 3. The building is lighted through skylights, which open toward the north. Ventilation and warmth are obtained by forcing air from outdoors over a heating coil and through false ceilings. Fans draw the exhausted air through openings in the skylights.

The principal room is the laboratory (or "power house"), devoted to electrical appliances and machinery and the accompanying engines and boilers. This laboratory is 40 by 270 feet, occupying the entire width of the west end of the building. This is equipped with a complete electric-lighting and power plant and an extensive collection of alternating and direct-current machinery, testing instruments, induction motors, etc. It also contains a traveling crane, electrically driven, with a capacity of 12½ tons. This crane travels the long way of the room, and it is so arranged that it can pick up a piece of machinery at the outer door and deliver it in any part of the room or to movable tables, by which it can be transported to the large lecture room. Fig. 4 is a view in the main laboratory, showing the crane carrying an engine. It gives no idea of the length of the room, however.

On the west side of this laboratory, and opening into it, is a fully equipped machine shop to which machinery can be delivered direct by the crane. Near the center of this laboratory a flat concrete bed, 30 by 12½ feet, has been laid in the floor. Flush with the top of this bed are anchor-bolted steel rails to which any description of heavy machinery can be fastened by iron fingers which clasp the rails through grooves in the surrounding cement.

The boiler room adjoins the laboratory on the north and contains two 250-horsepower Babcock & Wilcox boilers, with space for 50 per cent. increase. The engines are in the north end of the laboratory, there being five of them. There is a Russell horizontal cross-compound engine driving a 480-kilowatt double-current generator, with a direct-current output of 2,000 amperes at 230 volts and connected, on the alternating-current side, with the six-phase primary winding of 25-cycle transformers which deliver a three-phase current at 2,300 volts; a tandem-compound McEwen engine, direct-connected to a General Electric 60-cycle, four-phase generator which delivers current to a five-wire, four-phase system at a pressure of 230 volts; two Westinghouse compound engines, direct-connected to Westinghouse generators and a compound engine and pair of General Electric dynamos for general instruction in various methods of plant testing. A Worthington combined air pump and circulating pump are used in connection with the steam-condensing apparatus. Outdoors there is a large Worthington cooling tower in which warm water from the circulating pump is cooled by rapid evaporation produced by a current of air from a motor-driven fan.

The large lecture room (Fig. 1) seats 300 persons. The seats are placed on an inclined floor at such elevations that every person therein can see the entire front and top of the demonstration table. The room is ventilated by properly heated air blown in through small openings placed under each chair, the air leaving the room at the top. The room can be completely darkened and the electric lights can be controlled from any part of the room by means of switches attached to flexible connecting wires. On either side of the lecture room are preparatory rooms, the one on the east for the chemical demonstration and the one on the west, between the lecture room and the electrical laboratory, for the electrical demonstrator. From the west side of the laboratory, tracks are laid across the laboratory, through the electrical preparatory room, the lecture room, and the chemical preparatory room. Large and strong tables resting on six wheels with vertical pivots so arranged that the wheels can be placed in any position, run on these tracks. These tables can be run under the traveling crane, where an engine, or any heavy machinery can be placed thereon, and taken to the lecture room for the purposes of demonstration. In the electrical preparatory room tracks are laid at right angles to the tracks running into the lecture room, and on these several tables can be prepared for lectures and run thence into the lecture room. This room is large enough and the tracks are so arranged that the tables can be run by each other and taken to the lecture room in any desired order. This system of tracks was devised by Professor William L. Puffer, who has charge of the laboratory of dynamo-electric machinery.

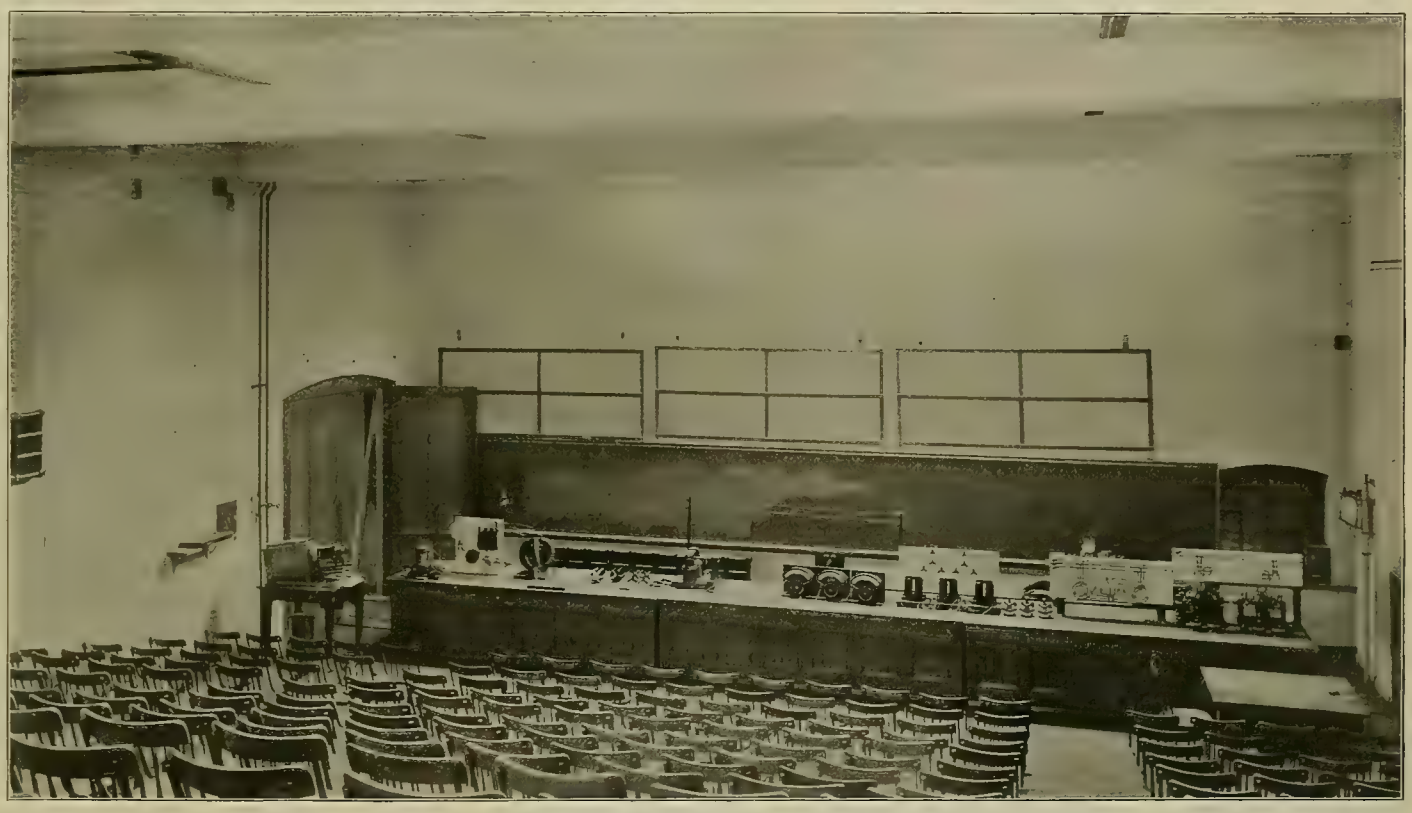


FIG. 1. ELECTRICAL LABORATORIES AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—LECTURE ROOM WITH PLATFORM APPARATUS.

The standardizing laboratory, which is in charge of Professor Frank A. Laws, contains facilities for testing and instruction in measurements in technical work. The equipment permits careful investigation of any proposed scheme of measurement. It is provided with circuits furnishing alternating current at 25 and 60 cycles, both three-phase and quarter-phase, also direct current. There is a storage battery giving 1,000 amperes, a special set of dynamos giving potentials to 3,000 volts, the necessary controlling devices, standard ammeters and voltmeters, and a potentiometer reading to 1,500 volts. By means of special transformers, alternating currents up to 4,000 amperes and potentials to 50,000 volts can be obtained. There are several oscilliographs for the examination of wave forms and all necessary appa-

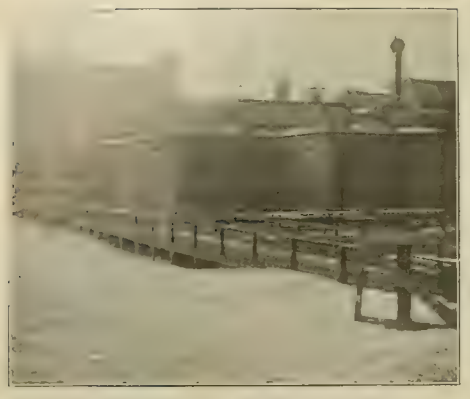


FIG. 2. LOWELL BUILDING AT BOSTON "TECH."

ratus for measuring high and low resistances and for calibrating resistance boxes.

The especial novelty of the building is an arc-light photometer devised by Professor Puffer and set up by Instructor Ralph R. Lawrence. The special features of this instrument are the entire absence of reflecting mirrors and the direct comparison of the arc light, at any desired angle, with a standardized incandescent lamp. The arc lamp hangs by gravity in a stirrup, supported on ball bearings, so that the center of the arc is at the height of the bearings. The arc lamp is placed at one end of a frame that turns on trunnions, over which is placed a fixed screen. The standardized incandescent lamp is placed on the frame back of the screen; that is, with the screen between it and the arc light. The distance between the arc light and the screen is constant—10 feet—while the incandescent lamp can be moved to and from the screen. The observer stands by the trunnions and controls the distance between the screen and the standardized incandescent lamp, this distance being shown on a tape automatically wound on or unwound from a drum, as the position of the incandescent lamp is changed. The frame is turned by a hand wheel, shaft worm and gear, the latter graduated to show the angular distances in a vertical plane, or angles above and below the horizon. At any and all positions of the photometer, the incandescent lamp, the center of the screen and the arc light are in a straight line. The extreme range of the arc light is from 90° above to 90° below the horizon. The arc lamp is pivoted so that it can be continuously rotated by a motor. All the parts are carefully counterbalanced and every movable portion is moved with the greatest ease. Of course, the walls of the room are painted black to prevent the reflection of the light.

The entire department is under the charge of Dr. Louis Duncan, professor of electrical engineering. William L. Puffer is associate professor of electrical engineering; Frank A. Laws is assistant professor of electrical testing; Elihu Thomson is non-resident professor of applied electricity; Harry E. Clifford is associate professor of theoretical electricity; Ralph R. Lawrence and Harrison W. Smith are instructors in electrical engineering, and Harry E. Dart is assistant in electrical engineering.

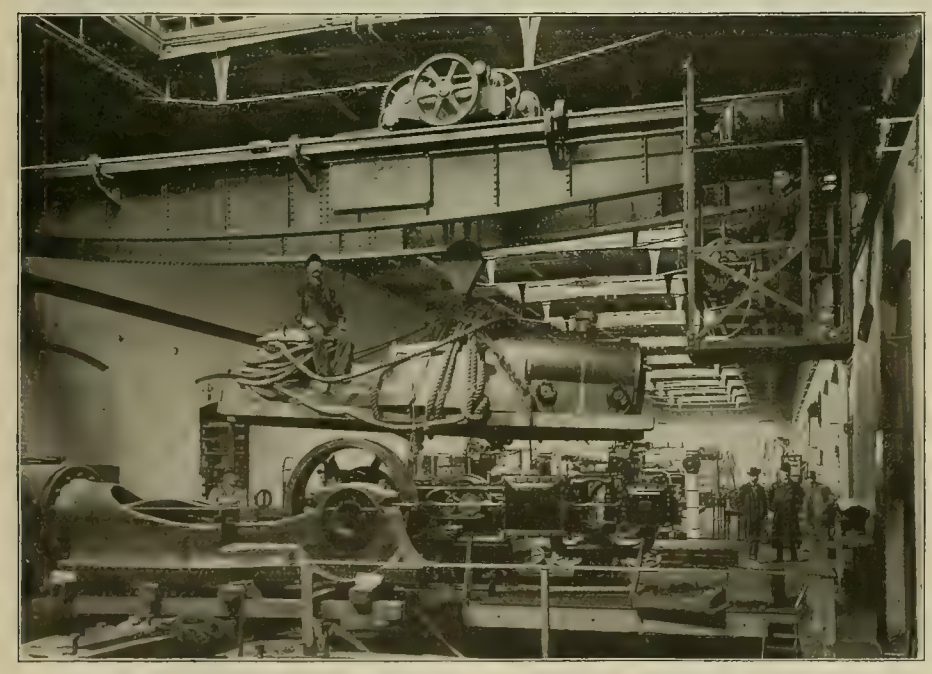


FIG. 4. LOWELL ELECTRICAL LABORATORIES.—VIEW OF MAIN LABORATORY SHOWING OVERHEAD CRANE.

Hongkong Electric Railway.

Operations have commenced on the new power plant of the Electric Tramway Company of Hongkong, China, and the laying of the line will be proceeded with this month. It is hoped that the road will be in working order in 12 months' time.

The generating station and car shed, offices, etc., will be situated on the eastern bank of the Bowrington Canal, bordered on three sides by Canal Street, Russell Street and Sharp Street. The area of this compound is about 1,800 square yards. In the first instance 26 cars will constitute the complement, 10 being for natives. The cars run entirely independent of each other. The European cars are to be of a roofed semi-open pattern (no accommodations on top), with an enclosed center. The enclosure seats will be longitudinal, but those at the open ends cross-bench. Sun blinds will be provided. The native cars are to have cross-bench seats, and open right along. The lines will be laid to the gauge of three feet six inches, and each rail joint will be double-bonded. The overhead work is to be partly side-pole construction. The poles will be of mild steel and the conditions will conform with the rules laid down by the British Board of Trade for the erection of overhead trolley wires.

The line is to be divided into half-mile lengths by means of section insulators. At each of these points a feeder box will be located and the current taken from feeder cables. The cables from the feeder boxes to the line wire will be carried up inside the poles, emerging at the top, and running along the bracket arms, while the feeder cables will be laid in cast-iron troughs, which are to be filled up with bitumen and buried under the surface of the road.

At the generating station the boilers will be of the Babcock & Wilcox type, each to have approximately 3,700 square feet of heating surface, and will each be capable of evaporating with ease under normal conditions and with burning ordinary Japanese engine slack, at least 12,000 pounds of water per hour. The large engines will be of the cross-compound type, the fly-wheel and generator being arranged between the cylinders upon the main shaft of the engine. With a steam pressure of 150 pounds each engine will give 428 brake horsepower while running at a speed of 100 revolutions. The direct-current generators are guaranteed to give at terminals a constant potential of 550 volts. The switchboard, in addition to being fitted with the necessary instruments for distributing the current, is also fitted with special instruments for testing purposes as required by the British Board of Trade. The gradients over the line are not considered of any importance.

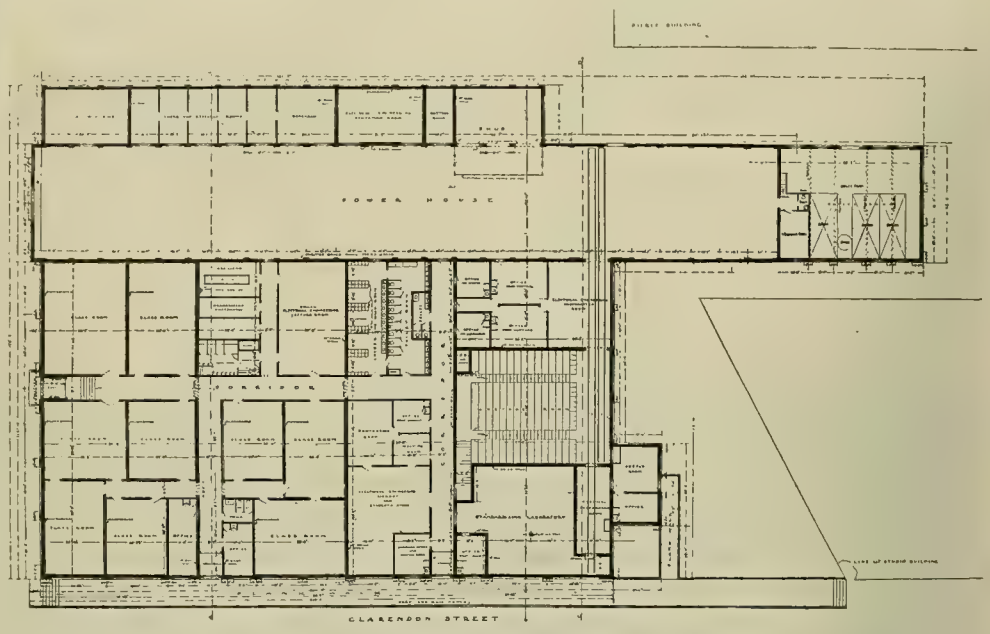


FIG. 3. FLOOR PLAN OF ELECTRICAL LABORATORIES AND POWER HOUSE AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

National Fire Protection Association.

The seventh annual meeting of the National Fire Protection Association will be held in the assembly room of the Chicago Underwriters' Association, 159 LaSalle Street, Chicago, on May 25th to 28th. An interesting programme has been arranged. The objects of the association are to promote the science and improve the methods of fire protection; to obtain and circulate information on this subject, and to secure co-operation in matters of common interest. Only fire-insurance men are eligible to membership. Among other subjects which will be discussed, those of an electrical nature will be presented by committees as follows: "Thermo-electric Fire Alarms," F. E. Cabot, chairman; "Heavy-current Protectors on Wires of Signaling Systems," Ralph Sweetland, chairman; "Electric Fire Pumps," Ralph Sweetland, chairman.

On Thursday the association will visit the Underwriters' Laboratories at 67 East Twenty-first Street, where the work of the Underwriters' National Electric Association will be inspected. Fire-extinguishing devices of various kinds will be on exhibition for the inspection of members. The programme will be concluded by the operation of any testing apparatus which appears of interest.

The association now numbers 35 active members and about 160 associate members. The present officers are: President, C. A. Haximer; vice-president, William A. Anderson; secretary and treasurer, Everett U. Crosby.

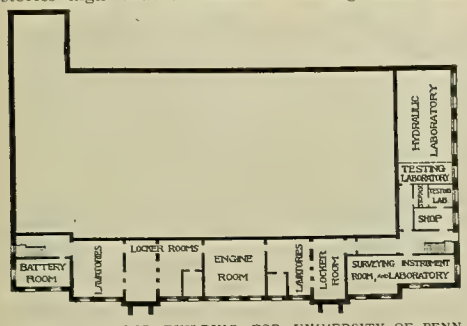
Municipal Lighting Proposed for the Twin Cities.

Congressman Stevens of St. Paul proposes to have the streets of Minneapolis and St. Paul lighted by electricity generated from the government dam in the Mississippi River, between the two cities. The dam was constructed for the purpose of improving navigation, but it is estimated that from 4,000 to 6,000 horsepower is available. It is planned to light the government buildings and the buildings at Fort Snelling, and then let the surplus power be apportioned to the two cities. An act of Congress would be necessary before this could be done, but it is thought that there would be no difficulty in getting such legislation.

A bill requiring street railways to equip their cars with vestibules for the protection of motormen and conductors during the months of November, December, January, February and March was passed at the recent session of the Illinois General Assembly.

New Engineering Building for University of Pennsylvania.

The accompanying drawings represent the floor plans of the new engineering building that is about to be erected at the University of Pennsylvania in Philadelphia. The plans for the building have been completed and the drawings will soon be placed in the bidders' hands for estimate. The building will be located at the corner of Thirty-third and Locust Streets, facing Dental Hall on Locust Street. It will be 300 feet long and 160 feet deep, with a wing 50 feet wide on the west end extending 40 feet further to Chancellor Street in the rear. It is to be three stories high with a basement covering about one-

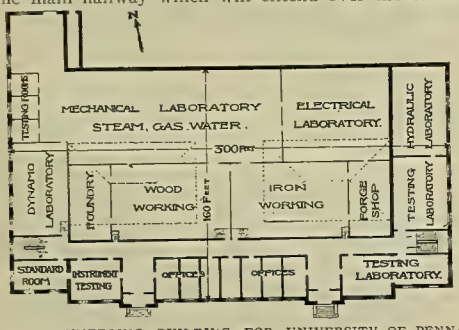


NEW ENGINEERING BUILDING FOR UNIVERSITY OF PENNSYLVANIA.—BASEMENT PLAN.

third of the area. By a suitable scheme of terracing, full advantage will be taken of the natural downward slope of the ground toward the east to convert the basement at that end into practically a first story. The total floor space available in the building will be approximately 128,000 square feet.

The construction will be fireproof throughout. The exterior will be of dark brick with sandstone trimmings, and the general architectural treatment and finish of the building will be in strict keeping with the high standards observed in the more recently constructed university buildings.

There will be two principal entrances leading to the main hallway which will extend over the entire

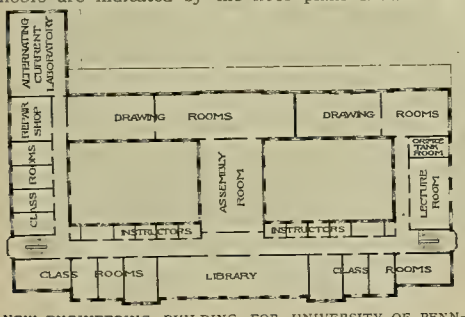


NEW ENGINEERING BUILDING FOR UNIVERSITY OF PENNSYLVANIA.—FIRST-FLOOR PLAN.

length of the building to staircases at both extremities. Two light-wells, about 80 by 50 feet, terminating in skylights over the first floor, will insure an abundance of light throughout the interior of the building.

The basement along the front will be occupied largely by commodious locker-rooms and lavatories and by the necessary engine and machinery equipment for heating and ventilating purposes. A storage-battery room, to be used in connection with the electrical laboratories, will be located at the west end. The remainder of the basement will be occupied as shown on the accompanying plan.

The arrangements of the first, second and third floors are indicated by the floor plans shown. On

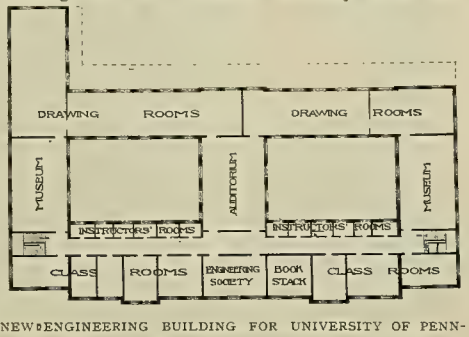


NEW ENGINEERING BUILDING FOR UNIVERSITY OF PENNSYLVANIA. SECOND-FLOOR PLAN.

the first floor, immediately adjacent to the main entrances, will be the offices of the heads of the departments. A spacious laboratory for the testing of cements, mortars and concrete will occupy the southeast corner. The eastern side of this floor will be otherwise occupied by the main physical testing and hydraulic laboratories, both extending partly into the basement. The pumping plant in the hydraulic laboratory will consist of three units independently driven by variable-speed motors, so that they may be operated either separately or combined and at various speeds, thus ensuring a wide range in the rate of supply.

On the west end, opening out of the main hall, will be an instrument testing room for the calibration of indicators, thermometers, calorimetric work with fuels, etc., and beyond that an electrical-standard room for the comparison and correction of electrical testing apparatus of every variety. The remaining mechanical and electrical laboratories will be situated on a floor four feet below the entrance hall. The central space under the skylights, about 200 by 50 feet, will be utilized entirely for workshops. To the west and north of the shops will be the mechanical laboratory and a part of the electrical laboratories. At the western entrance will be a dynamo and motor room in which direct-current work will be carried on. Provision for high-voltage and railway work will be made in the adjacent laboratory. In the mechanical laboratory steam and gas engines will be installed, each installation being complete with its apparatus for doing the special kind of testing for which it is to be used. Adjacent to the mechanical laboratory will be the electrical laboratory, in which all measurements to be made away from the machines will be carried on.

A reference library and reading room will occupy the central space on the front of the second floor. The library and stack at one end have been planned to hold about 20,000 volumes. The library is flanked on either side by a series of recitation and lecture rooms, which are continued along both ends of this floor. Between the light-wells at the center of the building will be a students' assembly room with



NEW ENGINEERING BUILDING FOR UNIVERSITY OF PENNSYLVANIA.—THIRD-FLOOR PLAN.

about 2,500 square feet of floor space. Instructors' rooms will be provided along the south side of the light-wells. The rear portion of this floor for nearly the entire length of the building will be assigned to drawing rooms. The extension on the west side will be utilized for an alternating-current laboratory, with facilities for two and three-phase work and photometric work. An instrument repair shop will be adjacent to this laboratory.

A room intended for the use of the engineering societies, a general supply store and the library stack will occupy the middle of the front of the building on the third floor; the space along the front being otherwise assigned to classrooms and to instructors' rooms along the south of the light-wells. In the east and west wings, spacious rooms will be set aside for engineering museums. The rear of this floor will be devoted entirely to drawing rooms which, like the drawing rooms on the second floor, will have the full advantage of north light through windows of ample dimensions.

The building will be heated by direct steam, the ventilation being provided for by electrically-driven fans, supplying tempered air to the various rooms. The lighting throughout will be by electricity. It is expected that the building will be completed and made ready for occupancy by the fall of 1904.

Chicago Street-railway Situation.

As stated in the last issue of the Western Electrician, the Mueller municipal-ownership bill, in which the traction companies and the people in Chicago in general are specially interested, passed both branches of the Illinois Legislature and was submitted to Governor Yates for signature. The governor has announced that he will probably take the full 10 days allowed him to consider the measure. He has obtained an opinion from the attorney-general, in which the latter says the bill is constitutional, and has also received indorsements of the bill from several Chicago citizens. The new Chicago City Council, at its inaugural meeting on May 11th, passed a resolution requesting Governor Yates to sign the bill.

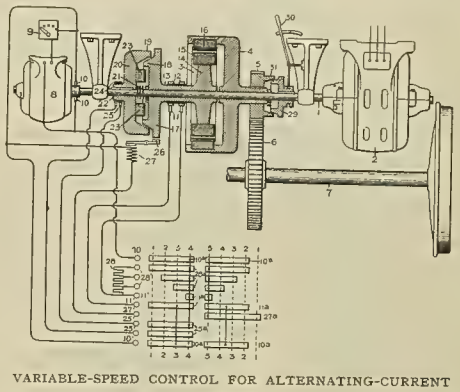
No important developments have come to light in regard to the Union Traction Company's affairs, except that stockholders of the North and West Chicago leased lines have appointed committees to protect their interests. It is believed that the terms under which the Union Traction Company expects to reorganize are gradually being outlined, but no definite information has been made public as yet. Charles T. Yerkes, who holds large bond interests in the Union Traction lines, has arrived in New York city and may possibly come to Chicago to take a hand in the local situation.

The City Council has passed an order directing the corporation counsel to take steps to prohibit the Chicago General Railway Company from using Twenty-second Street, and has referred to committees ordinances for the removal of unused stairways at elevated stations and providing that no traction settlement shall be made unless the companies agree to an eight-hour and six-day working rule.

Variable-speed Control for Alternating-current motors.

A mechanism for driving shafts at variable speed by means of alternating-current motors, has recently been devised by Otto Holz of Schenectady, N. Y. The device is of special value when the motor is an alternating-current motor which runs at a nearly constant speed under a varying load. In many cases, such as that of an electric car, it is necessary to stop and start frequently, with a demand for large starting torque, in order to accelerate speed rapidly.

The invention is illustrated in the drawing and consists in the combination, with a main alternating-current motor (2) and a shaft to be driven thereby, of intermediate mechanism, comprising an auxiliary



VARIABLE-SPEED CONTROL FOR ALTERNATING-CURRENT MOTORS.

induction motor (3) (4), one of whose elements is driven by the main motor, while the other element is connected with the shaft to be driven. The primary winding (15) of the auxiliary motor is excited from a source of direct current (8), and by varying this exciting current the slip of the auxiliary motor is varied, and with it the speed of the driven shaft. In order to stop the driven shaft, the inventor cuts off the exciting current, checks the rotation of the driving member of the auxiliary motor, and then turns on the current again, thereby causing it to exert a retarding drag on the still rotating driven member.

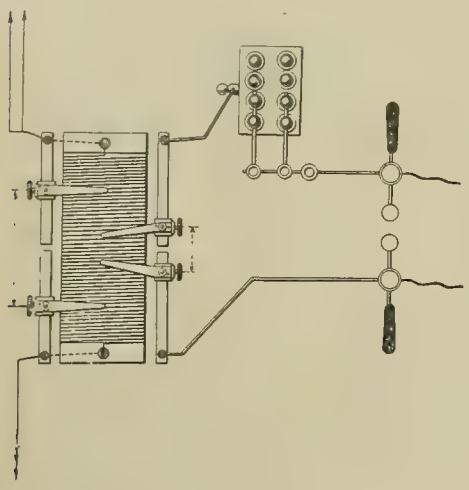
The operation of the device is as follows: Suppose the main motor (2), the power shaft, and the disk (20) of the magnetic clutch to be rotating at full speed, the other parts being at rest, and it is desired to start the load. The left-hand set of segments is brought into contact with the fingers, sending current simultaneously through the primary winding and the clutch magnets. The primary (3) is therefore caused to rotate with the power shaft, while the magnetic flux generated by the primary winding induces current in the secondary winding and sets up a drag thereon, so that the secondary begins to rotate. Its motion is communicated to the shaft (7) through the gears (5) (6). The exciting current is at first rather weak, owing to the resistance (28); but as this is cut out by a further movement of the controller the current becomes stronger, until in the fourth position of the controller all the resistance is cut out and the primary winding generates its full field strength. As the slip between the primary and secondary is very great at starting, the current generated in the secondary is very large, and thus there is obtained a good starting torque. The slip quickly lessens as the speed of the driven shaft increases, until at running speed the slip is only sufficient to cause the generation of the proper magnetizing current in the secondary.

The running speed can be varied at will by shifting the rheostat (9) or cutting in or out the resistance (28), so as to supply more or less current to the primary winding, and thus vary the strength of the field, and consequently the relative speed of the primary and secondary necessary to generate enough current in the secondary to carry the load. When it is desired to stop the driven shaft, the controller is turned backward, gradually cutting off current from the primary winding and finally from the clutch magnets. This leaves the de-energized primary revolving by its own momentum. A continued backward movement of the controller brings the right-hand set of segments into circuit. In the first position the magnet (27) is energized, and applies the brake to the disk (17), which quickly stops the primary. The exciting current is then turned on again by a further backward movement of the controller, energizing the primary more and more strongly until the reaction between the stationary primary and the still revolving secondary exerts a powerful retarding effect on the latter, which is transmitted by the gears to the driven shaft, and rapidly slows it down.

Ducretet Space-telegraph Apparatus.

[illegible] upon currents of great variations [illegible] Tesla, Thomson and Oudin. Eu[illegible] of Paris, France, says he has shown after practical experiments, that it was possible to use these currents for the transmission of Hertzian waves through space, that they increased the carrying power, that applied to aerial radiators and collectors (antennæ), some of these devices permitted the regulation or bringing into agreement of the posts with one another, and that it was very neces[illegible] as shown by Thomson and Tesla in their notes, that the condensers of the discharge circuit, the capacities, and self-induction circuits of the apparatus should be perfectly regulated with one another in order to obtain the greatest effect.

A receiving and transmitting device, invented by Mr. Ducretet, is applicable to the devices of Thomson



DUCRETET SPACE-TELEGRAPH APPARATUS.

and of Tesla, and is believed to constitute an important improvement. The accompanying drawing shows the apparatus applied to a Thomson or Tesla apparatus. The essence of the invention lies in a transformer for induction currents and especially adapted for use in connection with transmitting and receiving devices for Hertzian waves, wherein it has been found necessary to exactly regulate the discharge and induction circuits in relation to one another. The transformer is adapted to enable the relations of the discharge circuits and the inducing circuit to be changed at will and as the needs demand. This device consists, essentially, of a solenoid, the number of whose effective coils may be varied to give different effects upon the introduction of a current thereto, and so regulate the discharge with relation to the inductive effects.

Colorado Power Company Enjoins a Railroad.

The fight which seriously threatens the construction of the Denver, Northwestern and Pacific Railroad—Moffat's new line from Denver to Salt Lake—has developed out of the plans of the New Century Light and Power Company to build a large dam across Gore Canyon, in Grand County, Colorado. The injunction sought by the light and power company restraining the Denver, Northwestern and Pacific from interfering with its plans has been served upon Mr. Moffat.

Some time ago plans were filed with the state engineer by the Hydro-electric Company for a power plant in Grand County, near Kremmling. The company's plans were to conduct the water through pipes to the power plant, which would in no way interfere with the railroad. The New Century Light and Power Company was formed and took over the rights of the Hydro-electric Company. Instead of a pipe line, it filed plans for building a dam which would impound 548,000,000,000 gallons of water, and, it is asserted, form a reservoir one-fourth in size of all the reservoirs in the world. The estimated cost of the dam, plant, tunnel and everything complete was placed at $4,223,548, with an estimated operating expense of $250,000 a year. Land in the vicinity was obtained at $60 an acre under options which, at market value, was not worth more than the government rates. R. G. Munn, W. H. Duval and R. L. Hopper of Denver were named as the officers of the company.

The railroad line is to run through Gore Canyon, and the Denver, Northwestern and Pacific obtained the surveys and rights-of-way of the old Burlington surveys, which were made through the canyon. Proper filings upon the lands were made with the Interior Department by the railroad, and no trouble was anticipated. The light and power company has applied to the district courts for an injunction restraining the railroad from further work and operation. It is thought possible that opposing railroad interests are backing the light and power company in an effort to down the new railroad.

A Chain of Independent Telephone Exchanges in Northern Illinois.

Although it is less than three years since it began business, the record made by the Interstate Independent Telephone and Telegraph Company is one to be proud of. The territory operated by this company includes a belt lying well around the city of Chicago, and extends across the state to Whiteside County and the Mississippi River, and the company is rapidly extending its exchanges and toll lines to other parts of the state. It is capitalized at $3,000,000 under the laws of the state of New Jersey, with principal offices at Jersey City, N. J., and branch offices at Chicago and Aurora, Ill. Its officers are as follows: President, Hon. H. H. Evans, state senator, Aurora, Ill.; vice-president, Edward Dickinson, Chicago, Ill.; secretary and general manager, Edward R. Conklin, Aurora, Ill.; treasurer, Archie B. Conklin, Aurora, Ill.; assistant general manager, E. J. Clapp, Aurora, Ill.

The growth of the Interstate company has been remarkable, over 8,000 telephones being in operation at the present time. The total switchboard capacity at present installed is 12,575, so that new business is taken care of promptly and efficiently. Every exchange operated by the company is showing a healthy growth. From the very first this growth has prevailed, until now it shows an average increase in the larger exchanges of 17 per cent. per quarter. In the smaller exchanges an even larger percentage of increase is shown, or about 20 per cent. per quarter.

Sterling Exchange. Elgin Exchange. Joliet Exchange.

A CHAIN OF INDEPENDENT TELEPHONE EXCHANGES IN NORTHERN ILLINOIS.

The exchanges operated by the company are located at Aurora, Joliet, Elgin, Sterling, Morrison, Batavia, Big Rock, Elburn, Elwood, Frankfort Station, Geneva, Kaneville, Lockport, Mokena, Naperville, Plainfield, Monee, Peotone, Virgil, Plato Center, Coleta, Sugar Grove, Wilmington, Orland, Prophetstown and Penrose. Besides the operation of these different exchanges, the company is thoroughly covering the territory in which it operates with a network of toll lines, over 400 miles of which is already in operation.

The construction of about 2,000 miles of exclusively trunk toll lines has been authorized, and several hundred miles of this construction is near completion.

Probably no cause has contributed to the success of this company to a greater degree than the good service that it gives. Modern first-class methods of construction are responsible for this. Nothing cheap, shoddy, temporary or doubtful is allowed to enter into the construction of any of its plants or lines. In all the larger plants, the heavy business portion of the city, and, in many cases a good portion of the residence territory, is covered by underground construction. This work has been put in with a view to efficiency and permanency, and future requirements have been amply provided for.

An idea of the magnitude of this part of the company's property is given when it is stated that the company has 728,640 feet of conduit, contained in 120,000 feet of trench and reached through 363 manholes. The advantage of having all trunk lines, as well as distributing lines in the congested portion of cities, carried through subways direct to the central exchanges, thus avoiding all trouble from foreign electrical influences, where such trouble is most likely to occur, as well as protection from all atmospheric disturbances, is apparent to any telephone man.

In the aerial construction the same methods are in vogue. Cable distribution is carried to the farthermost parts of the towns, there being at present over 65 miles of cable in service in the larger plants of the company. None but poles of the best quality are used, and wherever possible alley construction has been adopted, so that the general appearance of cities where this company has built is not marred.

In its toll-line properties, the Interstate Independent Telephone and Telegraph Company has observed the same degree of efficiency that marks its other work. For its trunk toll lines it has adopted a standard which is rigidly adhered to. Twenty-five-foot poles not less than seven inches at the top are used for these lines, which are graded up in height from this size as a minimum, to whatever length is required in following the contour of the country. The poles are set not less than 42 to the mile, and carry 10-foot, 10-pin, 3¼-inch by 4¼-inch standard cross-arms, strung with No. 10 copper wire. The company's toll lines give it connection with many other Independent companies reaching over a large terri-

AURORA EXCHANGE.

tory, and these connections are constantly being extended.

In addition to the plants already in operation, the company has at present under construction plants at Springfield and Peoria—new fields which it has entered. In the former city the subway construction is completed, the pole and cable installation is nearing completion and the switchboard will be installed and ready for service by June 1st. In Peoria the underground plant is finished, with the exception of a few subway lines leading to the central exchange, which will be located in the company's own building

POLE LINES ON MAIN STREET IN AURORA.

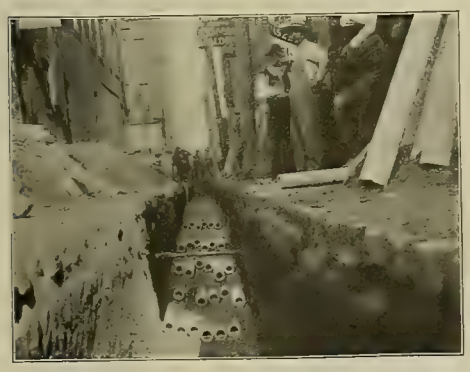
situated on property in the heart of the city, purchased and owned by the company for that purpose. It is the intention to put these two plants in operation at the earliest possible moment. Recently a franchise was secured by this company at Kankakee and construction work is already under way. The switchboard capacity to be installed at Peoria, Springfield and Kankakee aggregates 14,400, which, added to the present capacity of the company, makes a grand total of 26,975.

One of the strong features favorable to this company is the fact that it has established a reputation

SUBWAY WORK IN CAPITAL AVENUE, SPRINGFIELD.

for fairness in dealing with municipalities as well as the general public, that has given it a foothold seldom attained by corporations enjoying privileges granted by cities.

The equipment installed in the various exchanges was selected to meet the requirements of the individual localities. In the smaller exchanges of approximately three or four hundred lines' capacity, generator-call systems are in operation. In the ex-



SUBWAY WORK IN OFFICE ALLEY, SPRINGFIELD.

changes up to approximately 1,000 capacity, central-energy trunking switchboards, with lamp-disconnect signals are used, and in the larger exchanges central-energy multiple switchboards are installed.

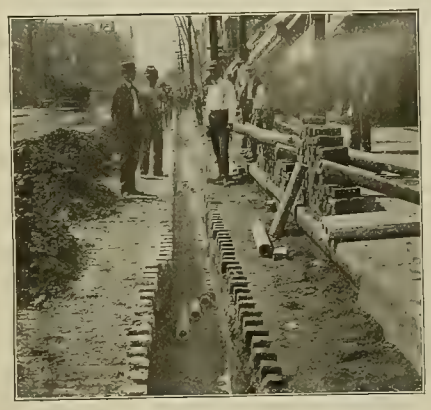
At Sterling, Ill., a typical trunking switchboard is used of the central-energy type, with lamp-line signals, double-lamp supervisory-cord circuits, and lamp disconnect transfers. This switchboard is equipped for both farmer lines and local central-energy lines, the farmer lines being terminated on one position. The present capacity of the switchboard is 100 farmer lines and 840 central-energy lines, distributed in two four-position switchboard sections, assigning 120 central-energy lines for each operator's position, likewise providing a separate set of trunks from each position to every other position, with the exception of the adjoining positions. A separate toll board having a capacity for 48 toll lines is also installed and connected with the local board by means of trunks. A complete 40-volt storage-battery system is installed, providing, with two sets of batteries, power sufficient to operate the exchange. The service from this board is said to be equal to that of a multiple board of this capacity. The service is prompt and the operators have complete supervision over all connections by means of the lamp-supervisory and disconnect system.

At Joliet there is installed a visual-signal, series-multiple, central-energy switchboard, having a capacity for 3,600 subscribers' lines. The cord circuits are equipped with supervisory lamps, and line-call pilot lamps are also used. This type of multiple

POLE LINES ON CHICAGO STREET IN ELGIN.

board has demonstrated itself to be a very economical board to operate, and likewise quick in operation. The position of the visual-line signals is such that the monitors and chief operator can monitor and supervise the operator very readily, and there is thus an additional incentive on the part of the operator to give prompt service. A separate toll board is also provided, and the exchange is fully equipped with complete power and battery plant.

At Aurora the equipment consists of a lamp-line-signal, relay-bridged, multiple, central-energy switchboard of 3,200 lines' capacity, equipped with all



SUBWAY WORK IN FIFTH STREET, SPRINGFIELD.

modern improvements, with full double-lamp supervisory signals and complete pilot-lamp system. This exchange has far outgrown the expectations of the company, requiring the complete installation of a new switchboard and accessory apparatus in more commodious quarters.

At Elgin is installed a central-energy, lamp-line-signal, relay multiple switchboard of 3,200 lines' capacity, and giving the best of service. At Kankakee there is about to be installed a 2,400-capacity, visual-signal, series-multiple switchboard, of the same type as described above for Joliet.

At Springfield there is at present being installed a 4,800-capacity, central-energy, lamp-line-signal, relay multiple switchboard, of the latest design, providing each operator's position with 140 line equipments, 15 pairs of cords, full double lamp-supervisory signals, pilot and operator's equipment. There is likewise being provided a chief operator's desk and wire chief's desk, also a complete battery plant with two sets of storage batteries operating on 40 volts. Provisions are being made for a toll board to handle the heavy toll traffic on the toll lines centering at Springfield. This equipment is to be duplicated for Peoria, with provisions for a greater ultimate capacity.

The telephone equipment, including the sub-station and central-office equipment, has been furnished by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., and Chicago.

Revolt from Municipal Ownership in England.

In a recent article in Harper's Weekly Sydney Brooks says: "I do not think it would be too much to say that the intelligent public spirit of this country [Great Britain] is preparing for a revolt from the extremes of the new municipalism. Ratepayers' defense clubs, property owners' associations, citizens' unions, industrial protective societies, and so on, are multiplying all over the kingdom, and endeavoring to arouse the average respectable citizen, whose apathy is at the root of the mischief, into some active sense of the dangers that lie inevitably ahead."

Mr. Brooks notes a prodigious expansion of municipal indebtedness—it now stands at well over $1,500,000,000—and an increase in local rates almost as great, and adds: "The way in which local authorities plunder manufacturers, industrial companies, well-to-do traders, and property owners, that some fresh municipal enterprise may be undertaken, is almost incredible. The question of local rates is becoming as formidable to British industry as is the question of trade-unionism. Moreover, it is a fact that the new municipalism is the direct outcome of the concerted movement which English trade-unionists, socialists, and labor men have organized for the capture of the local authorities.

"One reason of their irruption into city councils is that the best type of men are ceasing to interest themselves in local affairs; another is that while the range of municipal activity is constantly widening, its efficiency is as steadily deteriorating. At the same time, a bureaucracy of municipal officeholders is being solidly formed, and even the municipal employes are now a sort of trade union on their own account. Add to this the unfairness of a local authority competing with and finally crushing private traders and professional men, add the paralyzing effect on invention and initiative, add further the recklessness with which wildcat schemes are plunged into, and the extravagant inefficiency with which they are usually prosecuted, add finally the suspicion that a municipal balance sheet needs as close a scrutiny as a prospectus from Mr. Whitaker Wright's pen, and you will understand why Englishmen envy America her hundred years' backwardness."

Electric-railway Project for Quebec.

A project for an extensive electric-railway system through the south shore counties and eastern townships of Quebec is now in tangible form. It is understood that two main lines will be commenced this season, one to connect Montreal with St. John's by way of Longueil and Chambly and the other between Montreal and Valleyfield, closely following the river bank and taking in St. Lambert, Laprairie, Chateauguay and Beauharnois. The roads are to be built with heavy tracks and in the most modern way, the cars being 50 odd feet in length, supplied with air brakes and motors capable of running at a speed of between 50 and 60 miles in straight stretches. There will also be parlor coaches for private parties.

This will be one of the largest electric-railway systems in Canada, and it will form part of large plans now being mapped out for an electric road to connect New York with Montreal. It is understood that connections will be made with the important trolley roads in eastern New York, with the Berkshires of Massachusetts and with nearly a dozen systems in Vermont. The scheme is reported to be backed by capitalists from New York, Boston and Chicago. The proposed main line from New York to the Canadian border would pass through much attractive scenery, the shore of Lake Champlain, which it will follow, being particularly beautiful. The Montreal and Southern Counties railway route will also have the scenic advantages of the Richelieu and St. Lawrence Rivers. It will further enable the farmers all along the south shore to reach the markets of Montreal with their products. The company's intention is to make special arrangements for the carrying of all kinds of farm products between midnight and 6 a. m., thereby allowing the farmers to get their stuff into Montreal in good condition for the morning market.

A Strap Hanger Recovers Damages.

In the Salem (Mass.) Superior Court a jury recently awarded full damages to the plaintiff in the suit of Miss M. Louise Kinsella versus the Lowell, Lawrence and Haverhill Street Railway Company. The plaintiff sued for $7,000 for injuries received while standing in a crowded car that ran off the track. She was holding to a strap and her left wrist was so wrenched that physicians say that eventually the arm must be amputated above the elbow.

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DATES AHEAD.

National Electric Light Association, Auditorium Hotel, Chicago. May 26th to 28th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

IF THERE is a strike bacillus or germ or microbe, it is certainly in the air, for American workingmen, and workingwomen, too, for that matter, exhibit nowadays a most remarkable proneness to strike on the slightest pretext, and sometimes without any real grievance at all. Strikes are rushed into with so little deliberation by labor unions that have sprung up almost over night, apparently, that the more conservative and experienced of the labor leaders themselves are beginning to view the situation with some dismay. A strike is a serious matter always and to all concerned. There may be a justifiable strike, but certainly it should not be decided upon until all resources of conference and arbitration are exhausted. It is to public sentiment, and to public sentiment alone, in a country like this, that workingmen must look for the support that will mean any real or lasting advancement for them in labor disputes. The public is for fair play and is willing to concede the just claims of labor, but it is simply irritated by senseless and trivial strikes, of which there are so many at present. By experience the older trades-unionists know that a strike is no light thing to enter upon, even if successful in the end; they know, also, that, for the success of their cause in a large way it is essential to retain public sympathy. Let them, therefore, do their utmost to restrain the ill-considered rashness of the newer organizations that are juggling strike orders and ultimatums with the recklessness of a boy with a hatful of toys.

ENGLISH central-station companies and municipal bodies supplying electric current are greatly interested in the question of free wiring. In London there appears to be a general agreement that the corporation supplying the current, whether municipal or private, shall not do the necessary wiring on the customer's premises itself, but shall, instead, pay a construction contractor to do the work. Recently a conference was held in London between a number of electrical contractors, central-station men and local authorities with a view to evolving a rational system. Mr. W. R. Rawlings, who opened the discussion, said that at present in London 11 electric supply works employed a system of free wiring, three had had such a system but had abandoned it, and 14 others had never entertained the principle. He summed up the methods of free wiring available as follows: (1) By loan to consumer, repayable by installments, contractors carrying out the work; (2) extra price per unit, contractors carrying out work; (3) company carrying out work, either by themselves or with contractors, repayable by arrangement with consumer; (4) absolutely free installation of a small number of lights, carried out by the contractor. He regarded the last mentioned as the most suitable system. He had known instances in which the first lights wired free had been increased to 100 within 12 months, the remainder, of course, being paid for by the consumer. This system was started many years ago by Mr. Bowden of the Brompton and Kensington company, and it had not yet proved a failure. It was a system which would bring to the contractor the wiring of small houses and workmen's dwellings, and would be of great advantage to the industry generally. He maintained that more co-operation between contractors, supply companies and municipalities than had hitherto existed was absolutely necessary. Several other gentlemen addressed themselves to the question. One, representing a local (municipal) authority, said that his local authority obtained sanction to spend £5,000 in free wiring, and, in his opinion, this had laid the foundation of its success. The undertaking had only been in operation for 18 months, and during the first half-year £800 profit had been made, and during the next year the profit was £2,000. There were between 600 and 700 consumers. He hoped nothing would be done to prevent parliamentary sanction being obtained to municipalities spending money on these schemes. In his district the municipality charged a halfpenny per unit extra to consumers wired free. About £4,000 of the original loan had now been spent, and the Local Government Board had refused sanction to any further expenditure in this direction without the consent of the House of Commons. The municipality did not, of course, carry out the work itself, and the speaker did not think this had ever been the intention on the part of municipalities. One private company reported that, by its system, the consumers made their own arrangements with the wiring contractor, the central-station company paid the bill, and was repaid by installments quarterly, or charged one penny per unit extra. But there had been no demand for the system, as in five years only 24 consumers had availed themselves of it, and during this time 2,751 consumers had been connected up. A representative of a borough council said that a great complaint was generally made against a definite increase in the price of the current in consideration of free wiring.

It was evident that there was a great opportunity for co-operation and standard practice in this matter of free wiring, and a committee of contractors and supply-station engineers was appointed to consider the subject at greater length. The situation is needlessly complicated and should be easily straightened out by a free discussion and a few mutual concessions.

IN WASHINGTON, and, indeed, throughout the country, it is recognized that one of the most prominent of the bureaus that will owe their inception to the new Department of Commerce will be that devoted to manufactures, provided, of course, that it is conducted in such a manner that it will foster, promote and develop the various manufacturing industries of the United States, as it can if care is taken in the gathering, compiling and distributing of all available information with regard to each manufacture, as conducted at home and abroad, all foreign markets, requirements as to invoices, bills of lading, preferred methods of packing, weights, measures and the other numerous incidentals that make for the ultimate control of any desired market. Much of this work has been done by our consular officers, and credit is due for what has already been accomplished along the prescribed lines, but these efforts have been more the result of individual enterprise and along lines that presented themselves in a favorable light, and in general terms, rather than along strictly commercial lines or covering the necessary technicalities that are always of such interest to the master minds of any particular industry. Under the contemplated arrangements, it is anticipated that work will be carried on along systematic lines and in conformity with some definite and comprehensive plan, thoroughly and persistently. This will require not only a good man at the head of the new bureau, who should himself have practical experience, but will call for the employment of a corps of assistants having similar knowledge, so that there may be hearty co-operation, with results that should be productive of far-reaching and remunerative returns.

ABOUT once in so often the public is regaled with a story setting forth that a zealous official of some American city has discovered a "mine of wealth" in the street refuse now going to waste, but which might, instead, be utilized as fuel under the furnaces of an electric-light plant, by which miles of streets might be illuminated, practically without cost. The latest of these prophets appears to be Mr. Woodbury, the commissioner of the Department of Street Cleaning in New York city, who has made a prediction, it is said, that in five years New York will be able to light half of its area, or nearly so, by energy divided from the incineration of waste material picked up in the streets, which until now has been thrown into the sea. "Mr. Woodbury has turned into fuel the material heretofore regarded as the most worthless of all the waste products of the city," says the pleasing account. "While it has cost the city from 19 to 30 cents a cubic yard to dispose of it in the past, bids are now being made for its purchase by the Manhattan Elevated and the Metropolitan Street Railway Companies. Commissioner Woodbury has demonstrated that he has opened a 'mine' which will produce the equivalent of 19,036 tons of the best anthracite coal annually, and the cost will be reduced to a minimum.

It is a pity to throw a damper on such glowing prospects, but, unfortunately, in England, where experiments with refuse destructors in electrical generating plants have been exhaustively carried out, the results have been unsatisfactory. The refuse can be destroyed in the incinerators all right, but the process is not economical from the steam-raising point of view. Of course, Commissioner Woodbury may have something new up his sleeve, but the probabilities are that his bright anticipations will never be realized.

Tullahoma Water and Light Plant.

As of some interest in itself and as helping to demonstrate the importance and value of many hitherto neglected waterpowers in the South, Mr. Granbery Jackson read a paper describing the Tullahoma (Tenn.) water and light plant before the Engineering Association of the South at Nashville on February 12th last. The following is an abstract of Mr. Jackson's paper.

In view of the fact that the Tullahoma installation is perhaps the first case on record in the South of a small municipality's supplying its citizens with water and light, with the source of power at such distance from the town as to require what is ordinarily termed a "high-voltage transmission line," a brief history and description of the plant, together with some observations and figures on the results obtained after several months' operation may not be without interest.

Tullahoma is a town of about 3,000 inhabitants, located on the Nashville, Chattanooga and St. Louis Railway, nearly midway between Nashville and Chattanooga.

In June, 1901, a bond issue of $35,000 was voted for a municipal water and light plant. Upon being employed as engineer, the writer, after investigating and rejecting one or two small waterpowers within a few miles of the town, negotiated with the water and light commissioners of Winchester (a town about 16 miles by rail from Tullahoma) to furnish power to Tullahoma from its waterpower plant, then just beginning construction at "Horseshoe Bend," on Elk River, at a point 10½ miles from Tullahoma, and about four miles from Winchester. A contract was finally signed by which Winchester was to furnish current at machine voltage, delivering same to its own switchboard in the power house and leaving Tullahoma to construct and operate the 10½-mile transmission line from that point to the Tullahoma sub-station. The contract price agreed upon was $100 a month for all current necessary to do the Tullahoma pumping, and, in addition, operate arc and incandescent lamps, whose combined equivalent was 1,250 16-candlepower incandescent lamps. The price per 16-candlepower lamps in excess of 1,250 was fixed at 10 cents per month, and water and light service was to be confined to the inhabitants of Tullahoma for public and private use.

The Winchester power plant has three 30-inch vertical turbines installed in separate penstocks, each delivering its power through vertical shaft and bevel gears to the horizontal shaft which carries the main driving pulleys. For controlling the speed a waterwheel governor of the compensating type was installed and connected to the gates of the three wheels. The engineers state that the plant will develop continuously at low water 170 horsepower; by ponding the water and using the surplus during a 10-hour run, the horsepower of the plant is materially increased, and believed to be sufficient for the water and light plants in the two towns. The total cost of the power plant was about $13,600, exclusive of engineering.

The electrical equipment for generating the current consists of two 100-kilowatt, three-phase, compound-wound, revolving-field, alternating-current generators, belted separately to the driving pulleys above mentioned. The current is delivered to the switchboards at 2,300 volts, at which pressure it is delivered over a four-mile transmission line into Winchester, and there used for arc and incandescent lighting, and also, by means of an induction motor, for pumping the city's water supply.

For transmission to Tullahoma, it was decided to step up from the machine voltage to 10,000 volts; and three 35-kilowatt, oil-cooled transformers were installed in the power house for this purpose. These were connected to the overhead wires by a heavily insulated, lead-covered cable, and a 10,000-volt series of lightning arresters connected to each wire. Similar sets of arresters were installed also at the Tullahoma end of the line; and each set of arresters was provided with a switch, by means of which it could be cut out of circuit at any time. The wiring consisted of three No. 6 bare copper wires, tied securely to the insulators with the same material.

The sub-station at Tullahoma is a plain, brick building, 20 feet by 30 feet, in plan. The 10,000-volt wires are connected on the pole nearest the building to heavily insulated, lead-covered wires, which are thence carried downward to a 10,000-volt oil switch, stationed a few feet behind the switchboard and encased in brickwork. The transformers are six in number, three of 20 kilowatts each and three of 15 kilowatts each. The larger set reduces the voltage back to 2,300, at which pressure the current is carried back to the switchboard, and thence sent out over two independent circuits for incandescent lighting, and through a constant-current transformer and series arc circuit for street-lighting service. Each of these circuits, of course, is taken from different phases, the incandescent circuits being single-phase.

The three 15-kilowatt transformers reduce the voltage direct from 10,000 volts to 200 volts for use by two 50-horsepower induction motors, one of which drives the air compressor for an air-lift pumping system; the other, a vertical, triplex waterworks pump. These transformers are also made to serve in the capacity of "station transformers" for lighting the station by using 220-volt lamps. A small 50-watt transformer is tapped in on the 10,000-volt line before it reaches the switch, reducing the voltage direct to 110 for use of the pilot lamp and voltmeter on the switchboard.

In designing the plant, it was decided to secure the water supply from deep wells, if possible to do so. An eight-inch well was drilled within 100 feet of the station, and at 120 feet a strong stream was struck, which rose immediately to within 45 feet of the surface, and when tested with a four-inch cylinder pump, it yielded the capacity of the pump—viz., 100 gallons per minute, with a reduction in head of only six feet. The second well was placed about 80 feet from the first well, and struck the same vein at practically the same depth, and it proved to be even a better well than the first one. For pumping the wells into a surface reservoir, the air-lift system was adopted as being best suited to the existing conditions; and a 12 by 12-inch duplex, single-stage compressor, arranged for belting to one of the 50-horsepower motors, was installed in the station.

The total cost of the Tullahoma plant, beginning with the step-up transformers at the power house, was $39,486, divided approximately as follows: Pipe system, including valves and hydrants, $13,240; tower and tank, $3,995; electrical apparatus, $6,257; transmission line and other electrical construction, $7,628; wells, $1,250; air-lift plant, $2,000; triplex pump, $1,550; reservoir $948; buildings, $738; engineering and superintendence, $1,880.

Union Engineering Building.

At the "library dinner" of the American Institute of Electrical Engineers in New York on February 9th last Andrew Carnegie was the guest of honor. He enjoyed the celebration and was particularly interested in Mr. Charles F. Scott's plea for co-operation on the part of engineering societies, with the consequent hope of a union engineering building. He asked Mr. Scott and Mr. Calvin W. Rice to call on him the next day, and after some conversation said that if the engineering societies would provide a site he would put up a building for them. The plan was submitted to other engineers, and was received with great favor. Mr. Carnegie then made the following written offer:

2 East Ninety-first Street, New York, February 14, 1903.
Gentlemen of American Society Civil Engineers, American Society Mechanical Engineers, American Institute Mining Engineers, American Institute Electrical Engineers and the Engineers' Club:
It will give me great pleasure to give, say, one million dollars to erect a suitable union building for you all, as the same may be needed. With best wishes, truly yours,
Andrew Carnegie.

Mr. Carnegie supplemented this generosity by advancing the money to buy the land on Fortieth Street and Thirty-ninth Street, between Fifth and Sixth Avenues, needed for the building. This money is to be repaid by the societies, but without interest, it is believed. After the options on the land had been secured the project was formally laid before the four societies at a meeting at the Engineers' Club on April 30th. There were present John Fritz, John C. Kafer, Alfred Noble, James M. Dodge, Charles F. Scott, George E. Weed, B. B. Lawrence, E. E. Olcott, Calvin W Rice, T. C. Martin, William A. Redding and John Thomson. The proceedings were formally opened by Mr. Redding, who, in introducing Mr. Scott to present a statement on behalf of the committee, made particular mention of the fact that the credit for bringing about this most desirable result was essentially and particularly due to Mr. Martin, Mr. Rice and Mr. Scott. And it was also pointed out that not only had these gentlemen distinctly disclaimed any right of precedence for the electrical engineers, but the project, in its present broad-gauge presentation, was due to their suggestion, at their first interview with Mr. Carnegie, which immediately secured his hearty approval. Mr. Scott made a general statement to the meeting and it was requested that William A. Redding should draw up a statement relative to the legal status of the project. This Mr. Redding did the next day. Mr. Redding suggested that there should be a joint committee, composed of the president and two other members of each of the organizations "that shall unite in accepting the gift of $1,000,000 from Andrew Carnegie, Esq., and this joint committee should have power to determine by the affirmative vote of at least two-thirds of all the members thereof the character and arrangement of the buildings to be erected on the site on Thirty-ninth Street and on the site on Fortieth Street." The site on Fortieth Street is that purchased for the new clubhouse of the Engineers' Club; that on Thirty-ninth Street that secured for the union building and contiguous to the former. Mr. Redding thought that the independence and integrity of each organization should be thoroughly preserved, and nothing should be done to affect or interfere with the same.

At an informal meeting on the evening of May 6th of members of the four societies interested and of the Engineers' Club, resolutions were adopted expressing gratitude to Mr. Carnegie for his generous offer.

On the evening of May 7th the boards of directors of the several bodies interested, as well as some other members of the different societies, held an informal meeting at the house of the American Society of Civil Engineers, to consider the subject. Sixty-five gentlemen were present. The meeting was organized with the election of Mr. Noble as chairman, and the appointment of Mr. T. C. Martin as secretary. A very free, frank and open discussion of the subject, its advantages and its possible objections, was had, lasting about three hours. Members of the conference committee were announced, then or afterward, as follows:

American Society of Mechanical Engineers—James Mapes Dodge, Prof. F. R. Hutton, C. Wallace Hunt.
American Institute of Electrical Engineers—Charles F. Scott Calvin W. Rice, T. Commerford Martin.
American Institute of Mining Engineers—Dr. A. R. Ledoux, Charles Kirchhoff, Theodore Dwight.

Other conferees will be announced later. The American Society of Civil Engineers already has a building, but it will probably join with the others. Representatives of the Engineers' Club express hearty accord with the general scheme.

Resolutions were adopted, without a dissenting vote, expressing appreciation and thanks to Mr. Carnegie for the generous offer which he has made, and a cablegram of gratitude to him for his offer was adopted and sent to London. It was agreed that the conference committee, consisting of three representatives from each of the five bodies, should be called to determine upon the next steps and the next action by the several bodies, at the call of Mr. Scott. Mr. Kafer stated during the evening that Mr. Carnegie had also undertaken to finance the land for the societies and that interest at four per cent. on the land investment would not be asked by Mr. Carnegie until the building itself was finished. Mr. Carnegie's financial agent, Mr. R. A. Franks, had already paid out for them $50,000 in options on the properties on Thirty-ninth Street, which now represented a buying price of $517,000.

Central-station Topics Discussed.

As briefly noted in the Western Electrician last week, the regular meeting of the Chicago branch of the American Institute of Electrical Engineers was held on the evening of May 5th, in the assembly rooms of the Western Society of Engineers. Mr. P. Junkersfeld, the new local honorary secretary, presided for the first time, and was greeted by a large attendance. The evening was devoted to a discussion of three papers on tendencies of central-station development which were presented at the Institute meeting in New York on April 4th. These papers were presented in abstract in the Western Electrician of May 2d. At the Chicago meeting Mr. Lardner's paper was abstracted by Professor P. B. Woodworth, Mr. Torchio's by W. G. Carlton, and, of course, Mr. Junkersfeld abstracted his own.

B. J. Arnold, the president-elect of the Institute, was called upon to open the discussion. Mr. Arnold spoke briefly, advocating a single central station for light and power service in large cities, with sub-stations having rotaries and batteries. He was, he said, a firm believer in divided power stations, generating current at as high a potential as could be used. In heavy electric-railway work, he believes in power houses of moderate size, located at points, say, 30 or 40 miles apart, and using as high potential as possible.

W. L. Abbott, chief engineer of the Chicago Edison Company, devoted his remarks principally to the fuel problem, and the boiler room of the central-power stations. An idea of the trend of Mr. Abbott's remarks was given in an editorial published in last week's Western Electrician. Other speakers were H. B. Gear, Mr. Carlton and J. R. Cravath.

Before the meeting adjourned Mr. Junkersfeld brought up the subject of the getting up of a party of Chicago members to attend the Institute convention in Niagara Falls next month. Consideration of this subject was deferred, however.

Purification of Water by the Ozone Process.

Assisted by Darius Otto of Paris, France, D. R. Lovejoy of Niagara Falls is to install an experimental station in that city for demonstrating the workings of the ozone process for purifying water for municipal use. Mr. Otto has reached Niagara, and the work of installing the apparatus will go forward as soon as possible. Considerable of it is to be brought from France. The capacity of the station will be such that ample opportunity will be afforded to see the workings of the process as well as to give opportunity for scientific tests to assure all that the plant does the work claimed for it. The tests will be extensive, and water and health boards of various places are likely to visit the Falls to view the operation of the plant. The ozone process is now in use in several places in Germany. Only within a short time Mr. Lovejoy, who is connected with the Atmospheric Products Company, paid a visit of investigation to Europe to witness the plants in operation. In Wiesbaden, Germany, there is an ozone waterworks, referred to and briefly described in the Western Electrician of January 17th and March 7th last.

A bill has been introduced in the City Council of St. Louis providing for a system of subways throughout the city. Eugene Devine, W. T. Coony and J. C. Kinney, all connected with leading manufacturing concerns of the city, are named in the ordinance as those seeking a franchise to run underground electric railways, construct pneumatic-tube systems and lay underground telephone and telegraph wires.

The Industries of the Consolidated Lake Superior Company.[1]

By E. G. M. Cape.

The interests of the Consolidated Lake Superior Company are not confined to the town of Sault Ste. Marie. Its mines, railways, land grants extend from many miles north of the "Soo" down to Sudbury, 150 miles to the east, while its steamers and barges carry cargoes through all the great lakes. It is those industries which are located about the company's power canal on the Canadian side of the river which will be chiefly considered in this paper.

Waterpower Development.

At Sault Ste. Marie, St. Mary's River falls through a height of 19.3 feet in a distance of about 3,000 feet. The volume of water discharged varies from 60,000 to 116,000 cubic feet per second; thus the total power represented by the water in its fall varies from a minimum of about 130,000 horsepower to a maximum of about 260,000 horsepower. Fig. 1 shows a map of the river at the rapids. There are four canals located there. Two are ship canals, belonging, respectively, to the Canadian and to the United States governments, and two are power canals belonging to the company. The power canal on the Canadian side is of 15,000-horsepower capacity. It was finished in 1896, and has since that time been in continuous operation, supplying power for the grinding of pulp and for the driving of electric generators.

On the American side of the river the company's power canal has just been completed. This canal is 2¼ miles long, with a minimum flow area of 4,300 square feet. With a velocity of flow of 4½ miles per hour, the discharge will be approximately 28,000 cubic feet of water per second. The waterwheels installed in the power house have an efficiency of 81 per cent., as determined by test, so that the power developed under normal conditions, allowing 0.7 foot as the loss of head due to friction in the canal and wheel-pits, will be about 50,000 horsepower. The power house, canal and head gates are completed, and the electrical machinery is now being installed. It is intended to use all the power for the development of electricity, which will be sold to various industrial concerns. The Union Carbide Company has contracted for 20,000 horsepower. The cost of the canal and power house will be in the neighborhood of $5,000,000.

To use the ore from its mines, the company is erecting blast furnaces, a Bessemer plant, and a rail mill near Sault Ste. Marie.

The company owns and operates the Elsie and the Gertrude nickel mines near Sudbury. The ore which contains nickel without copper is taken to the reduction works at Sault Ste. Marie. Here the sulphur is driven off and used in the sulphite mill, and the roasted ore is pressed into briquettes, which are to be used in the blast furnaces to produce ferronickel pig. From this pig nickel steel will be made at the Bessemer plant.

Some mention should be made of the electric street railway which has been built on both sides of the river at Sault Ste. Marie. The roadbed and wiring have been finished, and operation now awaits only the arrival of the cars. The power will be supplied from the company's canals. A ferry service crossing the river is to be given in connection with the street cars.

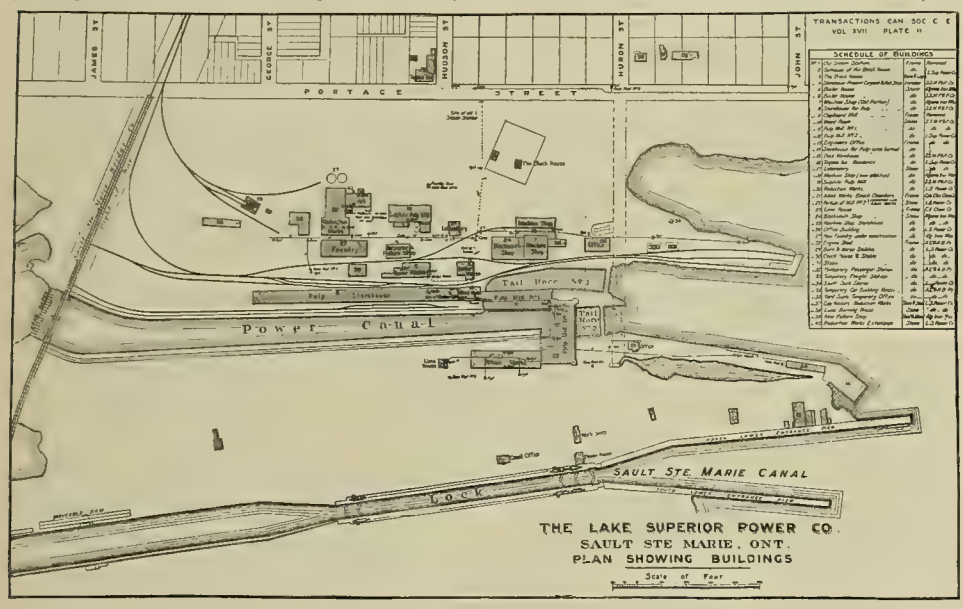
Power Canal and Power House.

In the year 1894 Mr. F. H. Clergue bought from the town of Sault Ste. Marie a half-finished power canal which it was struggling to complete. The work was vigorously revived, and two years later the canal and power house were completed. This canal closely follows the course of one of the streams which once were a part of the rapids, but which were to the north of the main portion of the falls, and were divided from the rapids by St. Mary's, Whitefish and other islands. The intake to the canal is a natural bay in the river, about 2,500 feet in length from the Canadian Ship Canal to the headgates, and varies in width from 500 to 1,500 feet. The natural bottom of this bay has been dredged to a depth at the center of the channel of from 12 to 14 feet.

The canal proper is 2,100 feet long, 200 feet wide and 12½ feet deep at the head-gates, changing gradually to a width of 90 feet and a depth of 15½ feet at a point 50 feet from the power house, and widening again to a width of 116 feet, with a depth of 15½ feet, at the power house.

The power house is an L-shaped building, the longer leg of which (known as Mill No. 1) is parallel with, and the shorter leg (known as Mill No. 2) is at right angles to, the axis of the canal. The basement walls of this building form a dam, in which are openings for admitting water to the penstocks. The penstock gates slide horizontally, except in front of one penstock, and are operated by hand wheel, worm gear, rack and pinion. In Mill No. 1 there are 12 penstocks, which are built of timber, supported by masonry piers and birch posts. The penstock floors, on which are set the turbines, are about four feet above tail-water level; and are fitted with draft tubes. The wheel-pits which carry the discharge water from the turbines to the tail race are 16 feet wide.

The tailraces from the two sections of the power house are for a short distance independent, and then join in a common tailrace, which is about 900 feet long, 320 feet wide, and 11 to 15 feet deep, and which discharges into a natural bay in the river.



POWER DEVELOPMENT ON CANADIAN SIDE AT SAULT STE. MARIE.

The annual mean head between the upper and lower levels of the river is 19.3 feet, and the frictional loss in the canal and tailrace under the full discharge of about 8,800 cubic feet per second is about 0.7 foot, leaving a mean effective head of 18.6 feet. The total horsepower developed at the turbine shafts and under mean head is 14,700, of which 8,400 is obtained in Mill No. 1 from 24 51-inch American register-gate turbines of 350 horsepower each, and 6,300 in Mill No. 2 from 18 51-inch McCormick cylinder-gate turbines of 350 horsepower each.

Mill No. 1 is devoted exclusively to the manufacture of ground wood pulp. There are 22 grinders, each one connected by bevel gears to a waterwheel, and taking its full power. The remaining two wheels drive the wood-room machinery, pumps, screens and dryers.

Mill No. 2 was first used as a pulp mill, but the grinders have been gradually replaced by generators to supply the increasing demand for electric power required to light the town and supply the numerous mills of the company.

The Algoma Iron Works.

The Algoma Iron Works has an up-to-date pattern shop, foundry, blacksmith, boiler and machine shop, and employs some 250 men. The machine shop is a substantial two-story stone building, 160 feet long by 80 feet wide. A side track from the railway runs through the center of the length of the building, and a 15-ton electric traveling crane runs above it, so that excellent facilities are secured for unloading and handling material. The equipment of the machine shop is very fine, the machine tools are up-to-date and of the best makes. They are driven by electric motors, and a steam engine is always ready, in case of emergency, to start immediately.

These shops of the Algoma Iron Works have furnished the entire equipment of the sulphite mill, with the exception of the digesters and motors. In the ground-wood mill they have built all the machinery except the waterwheels and the wet machines. They have recently built, from their own design, a 40-inch turbine for the Lake Superior Power Company, which will be used in the future. It is evident that they are pretty well equipped for making pulp and paper machinery.

Sulphite Mill.

At Sault Ste. Marie the ground-wood mill has a daily capacity of about 100 tons. A sulphite mill, designed for a daily output of 60 tons, was finished a year ago. A paper mill to use their products is a natural sequence, and, on a recent visit to the "Soo," the writer was informed that plans had been prepared for one to be built on the American side of the river. The pulp from the Canadian mills can be taken across to the paper mill in tank barges at very small expense. The "Soo" as a center for pulp industry possesses many advantages, the chief of which are that the necessary raw material is found in the neighborhood, and that power can be developed at a very low cost. The country from the great lakes to Hudson's Bay contains vast areas of spruce forests, from which the wood is cut. The rapids of St. Mary's River furnish the power.

The mill consists of three buildings—the sulphite mill proper, the chip-preparing plant, and the boiler house. The chip-preparing plant is a building 200 feet long by 50 feet wide, situated at a distance of 260 feet from the sulphite mill. Here 150 cords of wood can be prepared daily. One saw, eight barkers, one chipper, one crusher and screen are so connected by conveyors that this amount of wood can be passed in in the form of 16-foot logs, and come out in the form of three-fourths-inch chips. A 200-horsepower motor furnishes the power required. In the boiler house are five Stirling water-tube boilers, each of 250-horsepower capacity, and a Green's economizer, which is used for heating the feed water. The sulphite mill is a red-sandstone building, 170 feet long by 70 feet wide by 120 feet high in front. There is every reason to hope that the mill will soon be turning out about 50 tons of sulphite pulp daily. At present the mill is turning out unbleached pulp. Arrangements have been made with the Canadian Electrochemical Company to supply the bleach liquor, and bleach tanks have been erected in the basement of the sulphite mill.

Alkali Works.

The Canadian Electrochemical Company, Limited, of Sault Ste. Marie, Ont., manufactures caustic soda and bleaching powder, and its process of manufacture is an electrolytical one, with the aid of a mercury cathode. As is well known, all electrolytical processes for the manufacture of caustic soda and bleaching powder depend upon the fact that if a saturated solution of salt be subjected to the passage of an electric current, by having two poles placed in the solution, the salt will be decomposed, chlorine being given off at the positive pole and sodium being thrown down at the negative pole. Simple as this process may appear, it is beset with many difficulties, and many plans have been devised to obviate them.

Some of the great difficulties that stand in the way of producing an economical and practicable process are: First, isolating the products of electrolysis, so as to prevent chemical reactions, which cause the loss of electrical energy and a contamination of the electrolyte; and, second, the question of producing large quantities of chemicals by a plant that would not be too excessively large, and the cost of which would be reasonable, and which would cost little for maintenance and repairs.

To overcome these difficulties various methods have been suggested and tried. Generally, the methods employed may be divided into two classes, viz.—First, those in which some form of porous diaphragm is used with the object of mechanically separating the electrolyte from the alkaline solution, while allowing the current to pass; second, those employing mercury as a cathode.

When a film or layer of mercury is made the negative pole, the sodium which is thrown down upon the surface of it immediately forms an amalgam with the mercury. The essence of the mercury cathode process is, that this amalgam be immediately removed from the chamber through which the current passes into another chamber containing water, which extracts the sodium and forms sodium hydrate, giving off hydrogen.

The chlorine given off at the positive pole is conveyed into chambers containing slaked lime, the resulting product being known as bleaching powder.

The greatest problem in all electrolytical work is to make the apparatus lasting. In order to effect this, the surface exposed to the different chemicals must be of such a nature as to be attacked as little as possible. Hence it is of vital importance that no metallic substance should be exposed to the action of chlorine.

The cell employed by the Canadian Electrochemical Company is a very simple one. It consists of an outside shallow dish or containing vessel made of cast iron. Inside this iron vessel there is another vessel made of earthenware, from the bottom of which a series of open necks project, the edges of which pass down beneath a layer of mercury, which is placed in the bottom of the iron vessel. In the center of the top of the earthenware vessel there is a cylindrical opening or tube, which has a water seal at the top. This cylindrical pipe is made to revolve on its

1. Abstract of paper read before the annual meeting of the Canadian Society of Civil Engineers at Montreal, Que., on January 29, 1903.

center axis, so that the whole of the inside vessel is carried around the center axis of this pipe, which is kept in place by a bridge which spans the upper portion of the iron containing vessel. The revolution of the earthenware vessel, i. e., the electrolytic cell proper, is accomplished by a worm gear.

The top surface of the electrolytic cell has six or more upward protruding necks, each of which is perforated by a number of holes, through which carbon rods are inserted. Around the top center pipe of the electrolytic cell there is a ring of metal, which is carried around when the vessel revolves. All the carbon rods are connected up to this ring by suitable metallic leads. A sliding contact on the metallic ring around the center top pipe of the electrolytic cell connects the carbons with the positive pole of a dynamo or other source of electricity. The negative pole of the dynamo is connected to the cast-iron containing vessel. The action of the cell is exceedingly simple. The layer of mercury forms a seal with the downward projecting edges of the electrolytic cell, so that when the cell is filled with brine, and the outer annular space is filled with pure water, no connection between the liquid contents of these two compartments can possibly take place.

When the electric current passes through the cell, it passes from the lower ends of the carbon rods through the brine to the mercury surface. The chlorine is given off at the surface of the brine, and is carried away through the top center pipe to the bleach chambers.

The sodium-mercury amalgam forms upon the surface of the mercury inside the downward protruding necks at the bottom surface of the brine, and passes, partly by diffusion and partly by mechanical agitation of the mercury occasioned by the revolution of the electrolytic cell, to the outer annular space, where a layer of water extracts the sodium in the form of caustic soda.

The mechanical agitation of the mercury is assisted by placing radiating vanes in the bottom of the cast-iron containing vessel, which conduct the mercury to the outer edge of the vessel.

In order to permit the very highest current density, the electrolytic cell should always contain a concentrated solution of salt, which also reduces the electrical resistance of the cell, and permits the use of the very lowest potential difference. This existence of concentrated brine in the electrolytic cell is effected by a constant circulation of the liquid.

When the caustic-soda solution reaches a strength of 23 degrees Beaume (200 grams per liter), the solution is drawn off and conveyed into a sheet-iron store tank. The exact amount of such solution produced per hour by the current used is drawn off continuously; the outer annular space consequently always contains a 23-degree Beaume solution of sodium hydrate.

The chlorine given off at the positive pole, as already stated, is drawn off through a pipe in the center of the top of the electrolytic cell, and, through a system of earthenware piping, conveyed into the bleach chambers by means of suction. These chambers are connected up so as to permit any one of them being disconnected from the main chlorine supply pipe. When the slaked lime spread out on the floors of the chambers has absorbed chlorine gas to the extent of 36-38 per cent. of its own weight, the bleaching powder is ready, and is packed into barrels through discharge pipes.

At the Canadian Electrochemical Company's works at Sault Ste. Marie, Ont., electrical current is being developed by waterpower. The electrical installation consists of three 220-kilowatt dynamos, each developing 1,000 amperes at a potential difference of 220 volts. These dynamos are of the most modern design, and furnished by the Canadian General Electric Company of Peterborough. Each dynamo is driven by a separate waterwheel.

The electrolytical installation comprises 120 cells, divided into three units of 40 cells each, each unit deriving its electrical power from one of the above dynamos, the cells being arranged in series. A current of 1,000 amperes, at a potential difference of five volts, is passed through each cell.

The cell room also contains two brine tanks of 2,000 cubic feet capacity each, from which the brine flows by gravity to the electrolytic cell. The brine is pumped continuously from the cells back into the brine tanks, where it is strengthened and made ready for re-use in the cells. Ten five-ton bleach chambers, made entirely of sheet lead, and provided with a two-inch tile floor, are used for the manufacture of the bleaching powder. Disintegrator and dressing machinery for the daily output of 14 tons slaked lime are provided. The evaporation plant consists of 1,000 cubic feet sheet-iron store tank, weak-liquor apparatus and finishing kettles.

The daily output of the factory at full capacity would be, each cell using 1,000 amperes at a potential difference of five volts, with an efficiency of 90 per cent.: Nine tons 941 pounds of bleaching powder and four tons 565 pounds of caustic soda.

A party of London, New York and Boston capitalists, headed by A. E. Ginnis of London, has been in Texas for some time making investigations with a view, it is said, to investing largely in electrical properties in Dallas and other Texas cities. The Dallas and Fort Worth street-railway systems and the Interborough road, between the two cities, are the principal properties which are apt to change hands soon.

Clark Space-telegraph System in Detroit.

About a year ago Thomas E. Clark organized in Detroit, Mich., the Thomas E. Clark Wireless Telegraph-Telephone Company. This concern, for some months, did space-telegraph work along the lakes in the vicinity of Detroit. Since that time, however, the Clark system has been rapidly developing, and the company has now practically decided upon a site on which to build a large factory. At this point a complete and powerful sending station will be equipped with dynamo capacity sufficient to send a wireless message many miles. The purposes of these stations will be primarily, however, to test the various types of apparatus which the Thomas E. Clark Wireless Telegraph-Telephone Company is manufacturing.

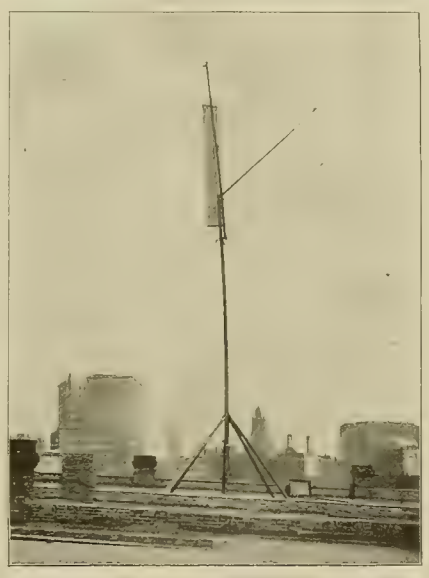


Fig. 1. Mast on Michigan Avenue.

Fig. 2. Mast above Chamber of Commerce.

CLARK SPACE-TELEGRAPH SYSTEM IN DETROIT.

At the present time the Clark Wireless Telegraph Company is sending and receiving messages from two stations in Detroit. Fig. 1 shows the mast on the roof at 71 Michigan Avenue, while Fig. 2 shows the mast above the Chamber of Commerce, a number of blocks away. The sending and receiving equipments, of course, are within the building. Fig. 3 shows a special type of instrument, which the company is now manufacturing and using in this service and which is particularly adapted for transmission from two to eight miles. It is to be remembered, however, that the distance of wireless transmission is largely dependent upon the energy behind the instruments; that is to say, the battery power.

FIG. 3. CLARK SPACE-TELEGRAPH SYSTEM IN DETROIT.—APPARATUS IN USE.

The set of instruments shown in Fig. 3, as a receiving station, consists at the same time of a Clark sending coil, microphonic responder, telephonic receiver, batteries, retardation coils, etc., in fact, everything to make it a complete wireless-telegraph station, except the antenna and the coil batteries.

As seen in the illustration, the apparatus is a sending and receiving station in one, consequently this one set may be used, if desired, to illustrate wireless-telegraph work; that is, it can be separated into two parts and the sending apparatus taken to a distance from the receiver. Of course, the complete outfit would be the sending coil and receiver together, as illustrated, one set like the illustration, at each station.

The sender is a high-frequency Clark coil, of the size and type that gives service, with proper arrangement of aerial wires, to a distance of five miles.

The illustration shows the receiver in actual operation for taking messages in the Morse code, by sharp clicks in the telephone, clamped over the receiving operator's ear. It should be borne in mind that the instruments shown in Fig. 3 are not adapted for receiving on the tape. The tape-writing machine can, however, be combined with this outfit, and with this latter addition the apparatus can be used for receiving by sound and tape, as well.

The set of instruments shown in the illustration is designed particularly for practical work for service between private houses, islands and the shore, boats and yachts, from a few hundred feet distance to two miles. The set is also particularly adapted to school and college demonstrations, where, by slight changes in connections, anyone familiar with electrical apparatus can adapt this wireless set to the starting and stopping of a small motor, the lighting of an electric light, the exploding of a bomb, the ringing of a bell, etc. It should be understood, of course, that the outfit illustrated herewith does not include coil batteries or aerial wire. It does include, though, the local cells for operating the telephone. Specifications are, however, sent along with the apparatus advising those using it just what aerial wire capacity to employ and the battery power to obtain the best results under various circumstances.

Charles E. Hossford of Butler, Pa., P. Zane, J. H. Garrison and George I. Garrison, all of Wheeling, W. Va., make up a company which has asked for a franchise and right-of-way to build an electric railway from Wellsburg, W. Va., to Bethany, same state, with a spur to Independence, Pa., and Bellevue Camp Ground.

DEVELOPMENT OF THE TELEPHONE FIELD.

Longest Submarine Telephone Cable in the World.

At the recent annual meeting of the Société Belge d'Electriciens Mr. Leduc, inspector of telegraphs for the Belgian government, read an interesting paper on the first Anglo-Belgian telephone cable, translated in abstract by the London Electrical Review. Mr. Leduc was the official delegate of the Belgian government at the laying of the cable in question, and bore testimony to the great skill shown by the English in laying submarine cables. The Anglo-Belgian telephone cable connecting England with the Continent is about 47.276 miles in length. It is the longest telephone cable yet laid. The Anglo-French cable, which comes next in length, is only about 40 kilometers. The making of the cable was entrusted to an English company.

The cable is 5½ centimeters in diameter. It contains four conductors, enabling two circuits to be established. It weighs 13.288 tons per naut, and costs, delivered on board the cable ship, £589 10s. per naut. The specifications demanded that each conductor should consist of a strand of seven copper wires, all of the same diameter, and forming a left-handed helix. The cable weighs 160 pounds per nautical mile, which corresponds to the weight of a copper wire 2.38 millimeters in diameter. At 75° F. its resistance is not to exceed 7.452 ohms per nautical mile. The weight per nautical mile multiplied by the resistance at 75° F. is not to exceed 1,192.

The conductors are insulated by means of a covering of three alternate layers of guttapercha and Chatterton's compound. The Chatterton layers are as thin as possible, and only sufficient to insure the adherence of the conductor and the layers of guttapercha. The weight of the dielectric which covers each conductor does not exceed 300 pounds per nautical mile, so that the weight of each conductor covered by its insulating envelopes is 460 pounds per nautical mile.

The specification demanded, moreover, that after the immersion of the core for 15 days, the temperature of the core tank should be for 24 hours raised to 75° F., and that, after the core had been subjected for a quarter of an hour to an alternating electromotive force of 5,000 volts at 100 periods per second, the insulation tests should be proceeded with. After one minute's electrification with a battery of 300 volts, the insulation resistance should not be less than 500 megohms per mile. The capacity of each insulated conductor should not exceed 0.275 microfarad per mile. The joint to be tested was charged with a voltage of 300 volts for one minute, and the trough was then discharged through a Thomson galvanometer. The loss at the joint should not be more than double that along an equal length of the perfect core.

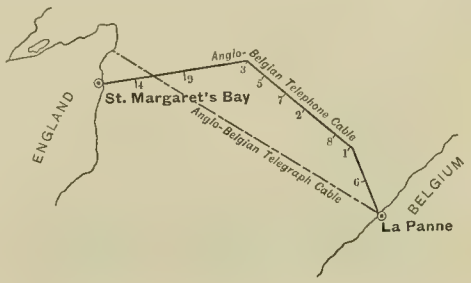
The four cores were wound helically around a center of tarred hemp rope, three-quarters of a centimeter in diameter. In the interstices between the insulated wires were wound threads of tarred hemp, which gave, as far as possible, a cylindrical form to the cable. The whole was covered with cotton tape treated with ozokerite, which again was wound with a ribbon of brass 0.004 inch thick and 1.25 inches wide. This was covered with a second winding of cotton tape. The object of the brass ribbon is to protect the guttapercha from the attacks of the teredo worms, the ravages of which are well known. Outside of the second layer of tape is a covering of tanned Russian hemp of the best quality.

Lastly, over the whole is a metal sheathing, consisting of 16 galvanized-iron wires, 7.1 millimeters in diameter. These were previously heated sufficiently to remove all traces of humidity. They were then plunged, while still hot, in gas tar free from naphtha. All the joints made during the manufacture of the cable had to be galvanized and tarred afresh. The metal sheating was, in its turn, covered with two layers of yarn formed of three strands wound in opposite directions. This yarn was first soaked in a mixture of 85 parts of pitch, 12½ of bitumen, and 2½ of resinous oil.

The most difficult part of the work was the laying of the shore ends. This was done by the small steamer Alert, whereas the deep-sea cable was laid by the Monarch, a much larger vessel. The Alert is a paddle steamer, 40 meters long and eight wide, of 300 tons burden, 193 being efficient. Its draft is usually only six feet of water, which enables it at high tide to pass the greater number of the buoys on the Belgian coast. It was rigged up specially with a view to the work to be done. The fore part was provided with two sheaves with deep grooves, and with a steam trolley. In the after part was the hold in which the cables were stowed. In the middle of the bridge was the testing room, provided with all kinds of measuring instruments, etc. The crew consisted of 12 skilled cable men, a number of marine engineers, stokers and mechanics and the sailors. The cable hands were under the direction of two electrical engineers, and the others under two marine engineers. The submarine superintendent was Mr. F. Pollard of the General Postoffice.

The laying of the cable began in September, 1891, but after two miles had been paid out, operations were interrupted by the discovery of defects in the manufacture of the cable. These defects were due to the fact that the metallic armor had been wound with too short a pitch, so that under the strain of the normal tension exercised by the vessel during the laying, the armor sheathing was stretched more than the cores could bear. The 23 miles of cable that had been made were rendered useless, entailing a loss of £20 per mile, or, for the whole length, £460. A new length of cable was then made.

Special care was taken in determining the route to be followed by the cable. Of course, in this work, depths such as those found in the Atlantic had not to be dealt with, but difficulties of another kind were encountered, especially on the Belgian coast. In the first place, there was the shallowness of the water, which threatened to leave the cable exposed at low tides; and, secondly, the fact that it would cross the old telegraph cable laid between La Panne and St. Margaret's Bay. The crossing must necessarily be in deep water. To mark the course to be followed the vessel fixed a series of buoys, which defined it exactly. This being done, the new cable was delivered on board on March 19th. After the embarkation the cables were tested. For the four wires coupled in series, the resistance measured shortly after embarkation was 254.2 ohms; at the end of nine hours it was 254.4, and it remained at this until



ROUTE OF ANGLO-BELGIAN CABLES.

the time of laying. A storm compelled this to be delayed for some days.

To effect the laying, it was necessary to bring to land the quantity of cable required to cross the foreshore and reach as far as the cable hut at La Panne. The foreshore extends at this spot for 350 yards, and the hut is 300 yards beyond the high-water mark.

In order to transport the 650 yards of short-end cable required, a raft consisting of two barges and a movable platform was required. This operation took place on March 23d; but just after the raft had started for the shore it sank. Fortunately there was no loss of life.

The sunken cable having been cut off, the vessel headed for Nieuport. Having arrived at about 650 yards from the cable hut, the vessel made a half turn and approached as close as possible to the coast. The amount of cable necessary to reach the hut was slowly paid out, and the Alert proceeded in the direction of Buoy No. 1. The vessel then began to pay out the cable, continually testing its insulation and conductivity. Before being sunk in the sea, the extremity of the cable was fastened to buoy No. 2, the conductors were joined together, and the joints covered with guttapercha.

Attempts were made to recover the lost cable, but the difficulties attached to laying the work compelled it to be postponed.

On March 24th the work was resumed, but, owing to various mishaps, the cable was only laid to halfway up the foreshore. The laying of the cable among the dunes was attended with great difficulty, owing to the gale which was raging at the time. The laying of shore end was finished on March 26th. On the 27th the Alert returned to the cable works, and the embarkation of the new length of cable took place the next day. On the 29th the Alert sailed to Dunkirk. On March 31st buoy No. 2 was picked up with the end of cable attached to it. This end was then spliced on to the cable in the vessel. The splicing being finished, the vessel was put in communication with the cable hut, and after a preliminary test, the communication was found to be excellent.

On April 1st some tests were made which gave perfectly satisfactory results, and the laying of the shore end was concluded.

Results obtained on April 1, 1902:

Exact length of cable	16.623 nauts.
Capacity, per wire	4.4375 microfarads
Capacity, per naut	0.26695 microfarad.
Resistance, per wire	117.9 ohms.
Resistance, per naut	7.092 ohms.
Temperature, calculated	45° F.
Temperature, observed	44° F.
Insulation, more than 1,000 megohms.	

The capacity and conductivity and the balance of the two circuits were perfect.

The laying of the deep-sea part of the cable was effected within the week from April 14th to April 20th by the Monarch, under the direction of Mr. W. Culley, the submarine superintendent. The 33 miles of cable completing the contract was embarked at Woolwich. The Monarch then steamed straight for St. Margaret's Bay, the starting point on the English coast. As, half a mile out, the sea is four fathoms deep at low tide, it was very easy to get there with the boats at high tide. The course was fixed by the telegraph cable from La Panne and the telephone cable from Calais, between which two cables the new one was to be laid. A buoy was placed at the intersection of the South Goodwin and the Dover lights. From this point to Buoy No. 1, placed by the Alert on March 31st, the sea everywhere exceeds 20 fathoms in depth, with the exception of the crossing from the Outer Ruytingen bank, where it only reaches six, or even 3½, fathoms.

In order to be sure about this part of the course, the exact position of three buoys which were in French waters had to be ascertained. It was found that all three had deviated from the position indicated on the chart to an extent, respectively, of 1½ miles, one-fourth and one-third of a mile. This correction having been made, the position of Buoy No. 1, placed by the Alert, was verified. This was found to be exactly in the position marked. After having connected by splicing the cable in the sea to that in the vessel, the real laying of the cable was proceeded with. This operation was accomplished without any hitch, the sea being calm and the weather splendid.

The shore end consisted of 300 yards of cable, which was placed upon a raft formed of two of the Monarch's boats, and brought by the steam tug to within a short distance from the low-tide limit, whence it was easily carried by men to the cable hut. The length of cable laid by the Monarch was 30.653 miles, which, with the 16.623 miles laid by the Alert, brings the total length to 47.276 miles.

The tests made on Sunday, April 20th, at the cable hut, St. Margaret's Bay, after the instruments had been connected up, gave the following results:

The resistance was:

Wire 1	331.3 standard ohms at 46½° F.
Wire 2	331.3 standard ohms at 46½° F.
Wire 3	331.5 standard ohms at 46½° F.
Wire 4	331.2 standard ohms at 46½° F.

The capacity was found to be:

Wire 1	12.617 microfarads
Wire 2	12.617 microfarads
Wire 3	12.575 microfarads
Wire 4	12.617 microfarads

The conditions having been fulfilled, the cable was accepted.

Expenses.

The price of one nautical mile of cable is £589 10s.

The expenses of the Alert may be estimated as follows:

(a) 16 days at £45, or 1,125 francs	18,000 francs
(b) 138 tons of coal, at 25 francs	3,450 francs
(c) Sundries	550 francs
Total	22,000 francs

The expenses of the Monarch were:

(a) Nine days, at £75	16,875 francs
(b) 43 tons of coal, at 32 francs	1,376 francs
(c) Sundries	49 francs
Total	18,300 francs

Various other expenses amounted to 825 francs, the total cost amounting to 778,000 francs, from which must be deducted the cost of 2.389 miles of cable which were returned to the works, or 35,773.28 francs. The remainder equals 742,226.72 francs.

The share of Belgium in this expenditure was 130,000 francs.

It will be remembered that the Brussels-London system includes 383 kilometers—156 in Belgium, 88 at sea, and 140 in England.

The charge for communication is 10 francs for three minutes.

The laying of this cable will not fail to produce economic consequences of great importance. Submarine telephone cables supply a want that is continually becoming felt more and more, viz., the suppression of distance. The new cable has just succeeded in overstepping the barrier that separates Britain from Belgium. It will, no doubt, be as regards submarine telephony as it has been with telegraph cables, and also with ordinary lines and wireless telegraphy, i. e., we shall go on step by step. Every day we increase the distance, to-day 100 kilometers, to-morrow 1,000, and, finally, we may hope for the transmission of speech across the Atlantic. Perhaps this glorious feat is reserved for the Pupin system. The recent experiments of Siemens & Halske are full of promise as regards its realization.

New England Telephone Company.

The annual report of the New England Telephone and Telegraph Company (Bell) for the year ended December 31, 1902, as issued on May 2d, makes a satisfactory showing and indicates that the company's business for the year had an exceptionally good development. The income account shows a gross revenue of $6,024,609, or an increase of $847,197 over the previous year. The operating and maintenance expenses were somewhat heavier than usual, and this fact brought the net revenue down to $1,168,769, or a gain of only $131,286 over the previous year. The exchange stations on December 31, 1902, numbered 100,864, an increase of 16,282: private line stations, 6,744, an increase of 45. The number of regular employes of all classes is 3,894, of whom 1,737 are males and 2,157 are females.

Telephone News from the Northwest.

The Standard Telephone Company at Mabel, Minn., has made arrangements with the rural telephone lines entering the city, whereby the latter will run into the former's exchange.

M. F. Kaveney and O. G. Snell have a franchise for a rural telephone line out of Bryant, S. D.

The Twin City Telephone Company had in operation May 1st, 9,184 telephones in St. Paul and Minneapolis. During the last year the pole installation has been increased 30 per cent.; the aerial wire about 50 per cent.; the underground conduit about three per cent.; the underground cable in Minneapolis 18 per cent., and in St. Paul 34 per cent. The cash collections were $25,380 for April, a yearly average of $304,560.

The Twin City Telephone Company's patent mold for joining conduits is to be used in the construction of 1,000,000 feet or more of conduit work in Minneapolis and St. Paul this season. The Twin City Rapid Transit Company will use it, as will the Minneapolis General Electric Company, and the Twin City Telephone Company uses it on its own work. The mold is said to be the only entirely satisfactory mode of joining conduits, and guaranteeing against a break and the entrance of water or gas and the resultant electrolysis. In addition to this work in the Twin Cities, the company has also placed it for outside work.

R. A. DeMars has sold his franchise at Fertile, Minn., for a telephone exchange to the Wheeler Telephone Company, which has started work for the installation of an exchange.

The linemen of the Bell Telephone Company at Duluth, Minn., and its corresponding company in Superior, Wis., the Douglas County Telephone Company, have struck for an eight-hour day, without reduction of wages, and for a recognition of the union.

The Twin City Telephone Company has finally succeeded in securing a franchise at Grand Forks, N. D., for a competing local exchange.

The Milwaukee Railway has removed the telegraph instruments at Dundas and at Cannon Falls, Minn., and substituted telephones. The station agent will have charge of all business, as well as operating the telephones. Train orders will be forwarded to these stations by telephone.

Leander Choate, who purchased the plant of the Little Wolf River Telephone Company of Fond du Lac, Wis., states the company will be reorganized and the lines put in first-class condition.

The Northwestern Telephone Exchange Company will install a local exchange at Hawley, Minn.

The Wisconsin Telephone Company has transferred its local exchange at Merrill, Wis., to the Merrill Telephone Company, under an arrangement whereby the local company adheres to the local field and the Wisconsin company connects for long-distance service.

The Austin Telephone Company has been granted a franchise for a local exchange at Austin, Minn.

The Johnson Telephone Company secured a temporary injunction at Davenport, Iowa, requiring the Union Electric Telephone and Telegraph Company to resume connection with the plaintiff until a trial of the case can be heard, when the motion to make the injunction permanent comes up.

Frank P. Sullivan seeks a franchise for a local telephone exchange at Sault Ste. Marie, Mich. Proceedings are about to be begun against the Michigan Telephone Company to compel it to accept the rates fixed by the city ordinance for service. R.

Ohio Telephone Notes.

The Marysville Telephone Company, Marysville, has been incorporated with a capital stock of $50,000 to build and operate an exchange and also country lines in Union and other counties. W. O. Shearer, George E. Whitney, H. T. Stevenson, N. E. Liggett, R. L Woodburn and B. C. Carmean are the incorporators.

The Flushing Telephone Company, Flushing, has increased its capital stock from $10,000 to $25,000.

The Cincinnati Telephone Company, incorporated some time ago, has applied to the Probate Court of Hamilton County for a franchise to operate a telephone system in Cincinnati and asks the court to locate positions for poles, lines and conduits.

The linemen, foremen, inspectors and other employes on the lines and conduits of the City and Suburban Telephone and Telegraph Company went out on a strike at Cincinnati on Friday morning of last week. They asked for more wages. The manager refused to treat with the union in regard to the matter, but said he would treat with the men as individuals and would pay just as much as the men in other cities receive. This was unsatisfactory and the strike resulted.

The Dillonvale Telephone Company, incorporated some time ago with a capital stock of $50,000, will build a line between Dillonvale and Smithfield.

The Parsons Telephone Company of Parsons, W. Va., has been incorporated with a capital stock of $10,000 to build and operate a system in that town and lines in several counties adjoining. J. B. Jenkins of Albert, W. Va., A. C. Helmich of Thomas, W. Va., and others are interested.

Senator J. F. Laning of Norwalk has sold his holdings in the People's Telephone Company of Shelby to a number of Shelby people, among whom are W. W. Skiles, Edwin Mansfield and T. J. Green. It is stated that Mr. Laning held about $50,000 of the stock. There are also a large number of small stockholders in the town and country about. O. M. C.

Indiana Telephone Items.

The Plainfield and Danville telephone companies have consolidated and will hereafter be known as the "Consolidated Telephone Company," with Dr. Amos Carter of Plainfield as president.

The United Telephone Company has decided upon extensive improvements at Hartford City and Montpelier. More than 6,200 feet of cable will be strung in Hartford City and 6,500 feet at Montpelier. The work will be commenced at both places in a few weeks. The Montpelier office will be moved into more commodious quarters in the new bank block.

The People's Telephone Association of Indiana has purchased the property of the Dearborn County Telephone Company, organized nearly three years ago. This line runs from Lawrenceburg to Manchester, Weisburg, Moore's Hill and numerous intermediate points.

The following newly organized companies filed articles with the Secretary of State during the week ended May 9th. The name and address of the company amount of capital stock, territory to be served and name of one director being given:

Farmers' White Line Telephone Company, Mt. Comfort; $15,000; Mt. Comfort and Hancock and Marion Counties; David Kellar.

McCarty Bell Telephone Company, Brimfield; $10,000; Brimfield and Noble, Kosciusko, Whitley, Elkhart, De Kalb and Lagrange Counties; W. A. McCarty.

Eckhart Telephone Company, Buck Creek; $10,000; Buck Creek and Tippecanoe and Carroll Counties; J. C. Eckhart.

Orestes Telephone Company, Orestes; $7,000; Orestes and in Madison County; Andrew T. Greenlee.

Oakalla Central Telephone Company, $2,000; Oakalla and in Putnam County; John T. Johnson.

Range Line Telephone Company; $1,600. This company will establish an exchange in D. H. Gates' residence and furnish service to the farmers. James H. Binford is a director and may be addressed at Greenfield. F.

Long-distance Independent Telephone Connection Secured in Cincinnati.

Reports come from Cincinnati, Ohio, that 12 Independent telephone companies of Ohio, Indiana and Kentucky have combined and secured an entrance into Cincinnati, which will enable them to establish long-distance service in and out of that city. The entrance is secured over a new line of wires entirely independent of those of the Cincinnati and Suburban Telephone Association, the local Bell company. Representatives of the Independent companies met with President Philip Fitzsimmons and Secretary D. J. Hauss of the Fitzsimmons Telephone Manufacturing Company and signed a 10-year co-operative agreement between the two interests. It is said that the syndicate of Independent lines is backed by unlimited capital, and that Fitzsimmons and Hauss are to have access to its treasury for funds to fight the Bell telephone interests in Cincinnati.

The Fitzsimmons company now has two exchanges in Cincinnati, which connect hotels and some manufacturing and business plants. A third exchange will be established to connect the drug stores and wholesale houses, and 20 trunk lines will be constructed to accommodate long-distance business. Under the plan, the long-distance telephones, as far east as New York, are to be available. All Michigan lines are also included. The rates of the new company will be 50 per cent. of the present rates of the Cincinnati and Suburban Telephone Association.

It was officially announced that a plan is on foot to raise $2,000,000 additional capital, and negotiations are in progress whereby other telephone lines than the original 12 may become identified with the new syndicate. It is stated that by June 1st a system of uniformed messenger boys will be established.

It is reported that Harry B. Gates, Joseph C. Schaff and E. I. Fisher of Indianapolis and George W. Beers, a well-known Independent telephone man of Fort Wayne, are promoting a company to build an exchange in Cincinnati. The Fitzsimmons people say they have no connection with the new project, which has been mentioned for the first time within the last few days.

The Evansville Situation.

The City Council of Evansville, Ind., after some hesitancy and misgivings, has granted a franchise to what is known as the Municipal Telephone Company, claiming a subscribed capital stock of nearly $200,000. The officers say that the work of constructing the system will begin at once and that it is expected to have it in operation within a year. On the other hand, the streets and alleys are already used for the wires and poles of the Cumberland Telephone Company, which has gone right ahead and completed a new exchange building, thoroughly modern, commodious and entirely fireproof. A large number of citizens has visited the new exchange building during the week and they are astounded at its perfection and elegance, but question the wisdom of so great an outlay by a company whose franchise has expired. Many of these people are bitterly opposed to a dual service and have done what they could to influence the council to withhold the municipal franchise until the courts decide what authority, if any, the Cumberland company has to continue business in the city.

United States Telephone Company.

The statement of the United States Telephone Company for the first three months of this year shows the following figures: Gross earnings, $88,722.33; expenses, including taxes, $51,728.42; net earnings, $36,742.37; surplus for stock, $11,937.37. The gross earnings for March were $32,151.76, as compared with $22,746.18 for the same month of last year. After deducting expenses, which were several thousand dollars more than for March, 1902, there is a net surplus for stock of $6,392.10, as compared with $2,000 the year before. New lines are now being constructed from London to Richmond, Ind., passing Springfield and Dayton in their course. From Hamilton to Tippecanoe City is another new line, and the third extends from Chillicothe southeast to Jackson. Besides these improvements, much new wire has been strung on the pole lines already up. It is estimated that, with the expenditure of $100,000 more, the company would be in most excellent condition. The line extending from the Ohio cities to Richmond, Ind., will connect the United States company with the New Long-distance Telephone Company of Indianapolis.

GENERAL TELEPHONE NEWS.

E. M. Nettleton, C. W. Rush and R. L. McKinney have organized a company and will construct a telephone system at Covington, Va.

Judson Hill of Morristown, Tenn., is at the head of a company being organized to construct a telephone system connecting Morristown, Greenville, Bristol and Knoxville, Tenn.

The Anchor Telephone Company was incorporated on May 7th and will operate a telephone system at Anchor, Ill. The company is capitalized at $2,500. Jacob Martens is one of the incorporators.

The Illinois Legislature, at the recent session, passed the Evans bill, giving telephone companies the right to invoke the law of eminent domain and condemn the right-of-way for their poles and wires.

The Columbus (Ga.) Telephone Company, incorporated for the construction of telephone systems, has completed organization with a capital of $1,000,000. John T. Norman of Columbus is president and G. R. Young, secretary.

A. T. Wix, manager of the toll department of the Chicago Telephone Company, died of consumption at his home in Chicago on May 5th. He was born at Channahon, Ill., in 1869, and came to Chicago 20 years ago. He had been in the employ of the Chicago Telephone Company since that time, rising from the position of messenger boy. A widow and a son survive him.

The Rapid Transit Company of Honolulu, Hawaii, proposes to install a system of telephones to cover its entire system of lines, for greater convenience in operating the road. It is further the purpose of the company to permit Guy Owens to install his new automatic telephone at the Walkiki end of the line, temporarily, with a view to making a thorough test of his system.

About 30 business firms and individuals are complainants in another suit filed in the Circuit Court last week, attacking the right of the Chicago Telephone Company to charge more than the franchise rate of $125 a year for the use of its telephones for business purposes. The complainants ask for an injunction to restrain the company from charging more than $125 a year and a decree requiring the company to pay back all excess charges.

MANUFACTURERS AND DEALERS.

The strike of the machinists, metal polishers and the brass and metal workers employed at the factory of the Automatic Electric Company of Chicago has been settled, all differences having been satisfactorily adjusted. The 300 deaf mutes employed as assemblers, who were called out, have also returned to work.

The International Telephone Manufacturing Company, Chicago, it is reported, is having a heavy demand for its special bridging telephones for country party-line work. It is said that this instrument has all connecting wires, binding posts and terminal screws concealed, and has no exposed metal parts forming any part of the circuit, making it especially adapted for rural systems.

The new telephone wire now being sold by the Electric Appliance Company, Chicago, is of the celebrated "O.K." manufacture. It is a two-conductor glazed-braid telephone wire, made with trace thread in one conductor, then twisted. It is carried in Chicago stock in black, maroon and nut-brown colors, No. 18 B. & S. gauge copper. The insulation does not rot or deteriorate and the company says the wire is cheaper than many rubber wires of greatly inferior quality.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago, Ill., and Rochester, N. Y., has about completed the installation of a 4,800-ultimate-capacity lamp-line multiple switchboard, with 2,400 lines present capacity, for the Interstate Telephone and Telegraph Company at Springfield, Ill. The Interstate company has nearly completed its underground system, which extends over the major part of the city. The Stromberg-Carlson company has recently sold telephones and material to the Yantisville Telephone Company of Yantisville, Ill., and the O'Dell Farmers' Telephone Company of O'Dell, Ill.

Alternating-current Electric Elevator.

Alternating-current motors have not been much used for elevator service on account of the difficulties of control and variation of speed, and interest, therefore, attaches to a motor-controlling apparatus designed especially for alternating-current motors which has been devised by John D. Ihlder of Yonkers, N. Y. The objects of this invention are primarily to enable the starting, stopping and reversing of the motor to be readily controlled in a simple and efficient manner and to enable the application of the brake to be controlled by means of the same apparatus which controls the motor. Fig. 1 is a perspective view of the principal mechanical parts of the apparatus assembled and illustrated as applied to elevator control. Fig. 2 is a diagrammatic view of the motor, the reversing switch showing the motor circuit closed in one direction and the starting switch

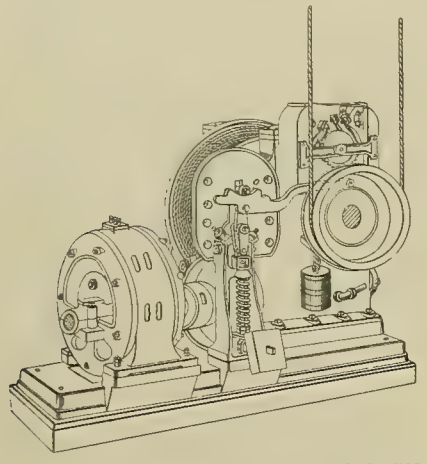


FIG. 1. ALTERNATING-CURRENT ELECTRIC ELEVATOR.—PERSPECTIVE VIEW.

in open circuit, with suitable operative circuits and connections between the switches and motor.

By Mr. Ihlder's construction means are provided for reversing an induction motor connected to a three-wire alternating-current circuit, since the current in two of the leads can be changed at will, while the third lead will always remain unaffected. Suitable connections are made for this purpose from the mains (34) (35) (36), (Fig. 2), through switches (37) (38) (39), by wires (40) (41) and (42) to contacts (25) and (29) of the reversing switch, while the contacts on the arms are connected by flexible conductors (43), to binding posts (44), which in turn are suitably connected by continuations of the lead wires to the binding posts (45) (46) (47) on the starter or primary (a) of the induction motor (B) in such manner that the current will be reversed in the connections leading to the binding posts (45) and (47), but will never be reversed in the connection leading to the post (46), as is well understood in the art. Cross-connection (48) is made between contacts (25) on the reversing switch to carry out this end.

In Fig. 2 the starting switch (M) is also diagrammatically illustrated in order to show more clearly the circuits. In order to obtain larger starting torque for the current drawn and to prevent a too great

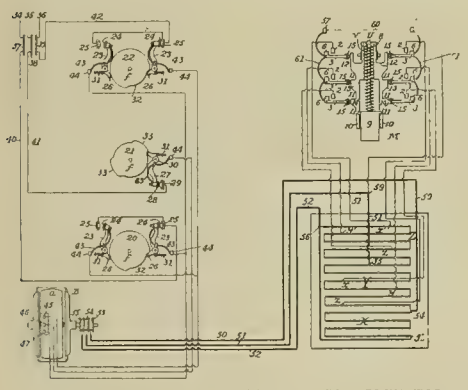


FIG 2. ALTERNATING-CURRENT ELECTRIC ELEVATOR. CIRCUIT CONNECTIONS.

rush of current when the motor is switched, a resistance is inserted in the circuit of the secondary of the motor, which resistance is gradually short-circuited, as the motor speeds up. As is well known, a three-phase winding for the motor or secondary is the best for cases where starting resistance is inserted, and such secondaries may, of course, be employed in any induction motor, whether two-phase, three-phase, or single-phase, provided it is designed for the same number of poles as the primary. Such three-phase secondaries may be either star-connected or mesh-connected, and they may be either lap or wave-wound. In view of these conditions the inventor prefers to use a three-phase secondary or motor the winding of which may be of any desired character, and between the circuit wires (50) (51) and (52) led, respectively, from the brushes bearing on the slip rings (53) (54) (55). Preferably, non-inductive resistances (X) (Y) and (Z) are inserted in this instance in mesh-connection, or what is known as "delta" fashion, although they could be star-connected, if desired. Preferably, two of these resistances—as shown, (Y) and (Z)—are variable, while resistance (X) is fixed or constant, and is so maintained as the motor starts, not being short-circuited, while the resistances (Y) and (Z) are varied as the motor speeds up. The leads (50) (51) (52) (shown in heavy lines) are lead from the motor to the resistances, and the fixed resistance (X) is connected between the end (53) of lead (52) and the end (54) of lead (50). The variable resistance (Y) is connected between the end (54) on lead (50) and the end (55) of lead (51), while the variable resistance (Z) is connected between the end (55) of lead (51) back to a point (56) on lead (52).

The mechanical construction of the starting switch is shown in diagram in Fig. 2; but instead of pivoted contact arms (3), it will be assumed that the arms move to and from the stationary contacts (2) in order to make and break the circuit. As the plate (T) moves upward, first the lowermost pairs of movable and stationary contacts are closed, and so on, upward.

Electrical connections are made from points (x) (y) (z) on variable resistance (Y) to contacts (2) on the right of the switch, and connections are also made from the points (x′) (y′) (z′) on variable resistance (Z) to contacts (2) on the left of the switch, while connection is made between contacts (57) and (58), by means of a wire (60) and connection is made from contact (58) to a point (59) on lead (51). The movable contacts (6) on each side of the switch are then connected to each other, preferably, by flexible conductors (61).

When the lowermost pairs of fixed contacts (2)

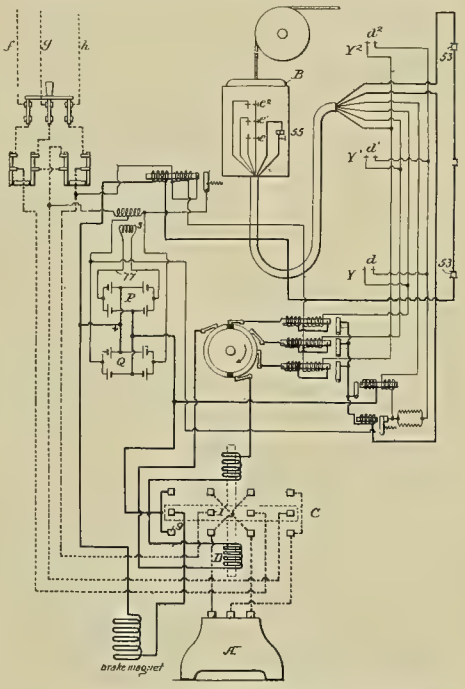


FIG. 3. ALTERNATING-CURRENT ELECTRIC ELEVATOR.—CONTROL SYSTEM.

and movable contacts (6) are closed, a portion of each of the resistances (Y) and (Z) is short-circuited. In other words, that portion of resistance (Y) included between the points (x) and (54) remains in circuit and that portion of resistance (Z) included between the points (x′) and (55) remains in circuit. When the middle pair of contact arms (3) are actuated, the portions of resistances (Y) and (Z) included between the points (y) (54) and (y′) (55) are still included in circuit, and when the uppermost contact arms (3) are actuated the whole of resistances (Y) and (Z) are short-circuited, it being understood that there may be any desired number of steps in varying the resistances to short-circuit the whole of (Y) and (Z) as the motor speeds up.

The objects of another invention of Mr. Ihlder are to improve upon that class of elevator-controlling apparatus utilizing both alternating currents and direct or rectified currents in the motor-controlling circuits, whereby safety and certainty of operation are secured and saving of current obtained. Fig. 3 is a diagrammatical representation of circuits and apparatus embodying this invention. Referring to the drawing, (A) represents an electric motor, shown in this instance as an alternating-current motor, which may be of any suitable type. Suitable means should be provided connecting the motor (A) with a car (B).

Means are provided for controlling the operation of the car, both from the car and from a series of stations (Y) (Y′) (Y²), and push buttons or switches (d) (d′) (d²) are provided at the stations, while push buttons (e) (e′) (e²), corresponding to the floors or stations, are provided upon the car. Upon the manipulation of a push button at the station or on the car the motor will be set in operation to move the car in one direction or another and bring it automatically to a stop at the desired station. In such elevator-controlling apparatus means are provided, such as a suitable reversing switch (C), for controlling the direction of rotation of the motor, and in this instance a floor controller (D) is connected in circuit for breaking the controlling circuits and stopping the motor automatically at the desired stations.

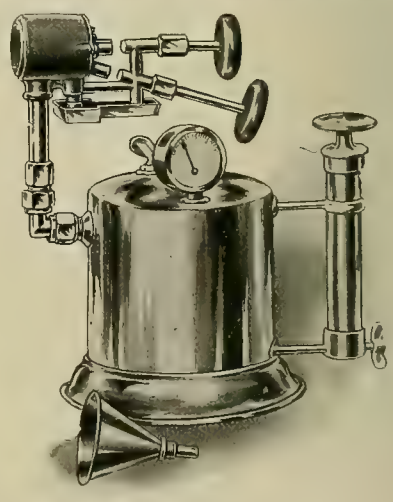
According to the invention, a portion of the motor-controlling circuits are provided with currents of low potential, since it is undesirable to supply currents of high potential to controlling circuits which lead throughout the elevator well and to the car. While various means may be utilized for supplying current of low potential, the inventor prefers to use a rectified or direct current, obtained either from a rotary transformer or from electrolytic current-rectifying cells (P) (Q), which may be so grouped in sets as to rectify both the positive and negative portions of an alternating current. In this instance the rectifying current for the controlling circuits is supplied from the high-potential alternating-current mains (f) (g) and (h).

One of the objects of the invention is to prevent accidents in elevator apparatus, and to this end there are provided means whereby control of the motor and the elevator car is excluded from the stations after the car has come to rest—that is to say, after the car has been started by the operation of a car push button and the desired station has been reached and the car has come to rest—the elevator motor cannot again be set in operation from the stations until the control has been restored to the stations from the car by the operation of the safety switch (55), or else the control may be restored by the operation of some other suitable switch, as by the opening and closing of door contact (53). In the case of the safety switch (55) on the car, in order to restore control of the motor to the station after the car has come to rest the switch must be opened and then again closed, and the same is true of the door contacts. In other words, the door switch must have been opened and then again closed.

The operation is designed to prevent accidents and increase the safety of operation of elevator-controlling apparatus, because the control of the motor and the car is left entirely in the hands of the operator on the car after the car has come to rest. Should the elevator car have been started from a station, it would not be desirable nor necessary to leave the control of the car entirely at the will of the operator from the station, for confusion might arise, and, therefore, according to the apparatus, after the car has been started from a station and come to rest it may again be started from either a station or from the car.

New Double-jet Gasoline Torch.

The Turner Brass Works of Chicago are introducing the new double-jet gasoline torch illustrated herewith. The special features of this torch are that the reservoir is fitted with a pressure gauge, the burner is swiveled and a funnel is supplied which automatically prevents overflowing and indicates when the reservoir is properly filled with gasoline. The gauge shows exactly the amount of pressure in the reservoir, indicates when more pressure is needed and enables the operator to determine at what pressure the torch gives the most satisfactory results. The failure of gasoline torches to produce their maximum heat is frequently caused by either too great or insufficient pressure in the reservoir, and as the best results with the Turner double-jet torch are obtained at a pressure of from 30 to 40 pounds, this torch is entirely under control of the operator, and he is enabled to obtain a temperature about twice that of the ordinary torch. The compound swiveled burner permits the flame being turned in any direction. The reservoir holds about two quarts of gasoline. The torch is nickel-plated, and the material and workmanship are of the very best. This torch is especially designed for use at the bench, although it is not too heavy to be used as a hand torch. A one-quart torch of this type is also made.



NEW DOUBLE-JET GASOLINE TORCH.

BOOK TABLE.

SECONDARY BATTERIES: THEIR THEORY, CONSTRUCTION AND USE. By E. J. Wade. London: The Electrician Printing and Publishing Company. New York: D. Van Nostrand Company. 1902. Pp. (5½ by 8½ inches), ix., 492, with 265 illustrations. Price, $4.

The scope of this work is general and the various commercial types of storage batteries are considered, but nevertheless, as the author says, the book "substantially resolves itself into a treatise on the lead/lead-peroxide combination—the storage cell of commerce—because all others still seem to be practically negligible." Due mention is made, however, of alkaline and other types of cells and especially the new Edison cell, which Mr. Wade speaks of as "the latest and most promising attempt at a new departure" from the lead cell.

The book is divided into 10 chapters, the first of which is introductory and gives some early history, nomenclature, and components and classification of electrodes. Chapter II. is mainly historical, lead cells in their various constructions being considered. Storage cells other than lead are next taken up, Edison's battery receiving prominent mention. Then the author discusses in succession in different chapters, the properties and behavior of lead cells, the chemistry of lead cells, the design of lead cells, the manufacture of lead cells, the treatment and testing of lead cells, and the erection, connecting-up and regulation of lead cells. The last chapter is devoted to present-day cells and a number of English, American and Continental batteries are given separate descriptions. The American cells treated are the Chloride (as made in the United States), Gould, Willard, American, Porter, Clare, Reuterdahl, Sperry, Osburn and Conrad.

There is a mass of valuable information in this book on the subject of storage batteries and the author has presented it in a fair and conservative manner, due mention being made of such information that was obtained from manufacturers and not confirmed by impartial test. English battery practice is dwelt upon, perhaps, more than the American reader would desire, but this may be accounted for when it is remembered that the development of secondary batteries in this country was held back for many years by patent litigation, and has only reached much imiportance within the last decade. The illustrations in the book are numerous and of good quality. A general index and an index of cells and electrodes complete the work.

Allis-Chalmers Company to Manufacture Gas Engines.

A. Rieppel of Nuremberg, Germany, the managing director of the Augsburg-Nuremberg Manufacturing Company, is now visiting this country for the first time. His company employs about 16,000 men. Its latest success has been with gas engines, both for gaseous and liquid fuel. It has long built these engines, in smaller units up to 400 horsepower and operated with petroleum, but for the use of waste gas, as well as producer gases and in larger units it has recently developed an entirely new design constituting the result of many years of extensive experience. The engine, which is of the double-acting four-cycle type, generally in tandem arrangement, is best adapted for the various purposes of modern power development up to the largest units required by municipal central stations and iron and steel works. Mr. Rieppel's visit to this country was made to interest the Allis-Chalmers Company in the manufacture of the products of his company, and a contract was entered into by the two companies giving the Allis-Chalmers Company the exclusive right to manufacture and sell the Nuremberg gas engines for this country and selling rights in many foreign countries, especially the Far East and South Africa. The Augsburg-Nuremberg Manufacturing Company, under the direction of Mr. Rieppel, has made a phenomenal success with this new gas engine, having within the last few months received orders for some 50,000 horsepower, throughout Germany and Spain, chiefly for generating electric energy and for blast furnaces and spinning-mill work.

Lighting at Fort Sheridan.

The War Department at Washington, through the quartermaster-general, has finally awarded the contracts by which Fort Sheridan, the government post about 26 miles north of Chicago, will be electrically lighted. Alternating current will be supplied by the North Shore Electric Company from its Highland Park station, and about 4,500 incandescent lamps and 40 street lights will be necessary to illuminate the buildings and grounds. The contract for the wiring was secured by the Sanborn-Marsh Company of Indianapolis. Electricity was only decided upon after a sharp contest with the gas people. A regiment of regulars is stationed at Fort Sheridan, and heretofore the officers' residences, barracks and grounds have been lighted by oil lamps. When a change was decided upon, both the electric and gas people wanted the business, but the electric company was successful.

The city of Griffin, Ga., will have a special election on June 10th to vote on the proposition of bonding the city for $100,000 to improve the electric-light plant and for putting in a system of sewers.

CORRESPONDENCE.

London Letter.

London, April 29.—The trains which have been delivered upon the experimental line of the electrified service of the Metropolitan District Railway Company, as well as the Inner Circle, are now being fitted with their electrical equipments on the spot. There are two trains, one of which will be equipped on the Westinghouse electropneumatic system and the other on the British Thomson-Houston system, otherwise known as the Sprague system. When completed, a series of trial trips will be made to determine which system of control is the better. The trains are made up of seven coaches, three being motor cars and four trailers. Painted externally a bright yellow, they appear entirely different from anything hitherto seen on a surface railway in Great Britain. In fact, nothing is done to disguise the fact that they are built on American lines in British workshops. Each car is 50 feet long, with seating capacity for 48 passengers in the trailers and a few less in the motor cars, owing, naturally to the space occupied by the driver's cab. All the seats are longways, on each side of the car, with a passageway down the center. There are 16 electric heaters in each car, fixed under the seats, a regulator being at one end of the car. Slide doors are provided in the center of the coaches, which can be utilized as emergency exits, if necessary, and in this respect they differ from the cars on the Central London Railway. Otherwise they are very similar. Of course, one class of passengers only will be provided for, as on all the tube railways up to the present.

The government has just introduced a bill with the object of facilitating the introduction and use of electrical power on railways. Under this measure the Board of Trade may issue orders, possessing the same effect as acts of Parliament, authorizing a railway to use electricity in addition to, or in substitution of, any other motive power. The necessary capital required for this purpose would also be authorized under these orders, and should any company object to the restrictions which the Board of Trade may impose, power is given of appeal to the railway commissioners. The precise object of the bill would appear to give a cheaper and quicker method of enabling railway companies to secure these powers than would ordinarily be the case, and being a government measure, there is no doubt that it will eventually pass. It has already been read once.

The only tube-railway bill for London, providing new lines, which has been allowed to proceed this session, is one dealing with half the route over which J. Pierpont Morgan proposed to build a line last year, but had a misunderstanding with the parties in the undertaking. This deals with two branches running from the city to the north and northeast, and some figures of cost have been now given to Parliament. The proposed capital of the company is put at $30,000,000, the portion of the "tube" wholly in the city at $5,000,000 (a distance of about a mile), the cost of the remainder of the tube at about $2,250,000 per mile, and the remainder of the lines which are on the surface, $1,125,000 per mile. There are at present three means of communication, more or less over the same route, viz., two steam railways and a tramway company which is about to change over to electric traction. Therefore great opposition is being given to the proposal by these concerns, and already the proceedings before the House of Commons committee have lasted for three weeks, and the case may be said to be about half finished.

A large number of our municipal tramway undertakings are now introducing collapsible coverings to the open top decks of their tram cars, and a corresponding increase in the traffic receipts is reported in every case. In the case of the Liverpool tramways, the actual seating capacity of the cars has been increased by nearly a dozen, and although the general appearance of the covering cannot be said to improve the appearance of the cars, yet the financial results justify the step, and this, after all, is the main end in view.

The estimates of the Manchester corporation electricity committee for the coming year have now been issued. On the three generating stations the amount to be expended is put at $1,150,000, and upon the distributing stations $300,000. Some $200,000 will be spent on mains and $25,000 on motors.

The daily wireless-telegraph service from America to the Times has now been inoperative for a fortnight. Mr. Marconi, by the way, has been nominated as a member of the council of the Institution of Electrical Engineers. W.

New York Notes.

New York, May 9.—The Remsen East River gas bill, over which there was a sensational struggle in the closing hours of the state Senate, has been sent by Governor Odell to Mayor Low. The mayor has made no decision as to what he will do, but it is generally believed that a message recommending that the bill be vetoed will be prepared. Commissioner Monroe of the Department of Water Supply, Gas and Electricity is opposed to the bill on the ground that it extends the privileges of the East River Gas Company, but the city gets no increase in compensation. Formal protests have been made against the bill by the Citizens' Union and the Merchants' Association.

The Collins wireless telephone was tested on the North River ferry boats yesterday afternoon, with considerable success. The apparatus used was of the simplest kind, consisting of a wire going to the masthead and one going to a submerged copper plate used for what would correspond to the ground-circuit connection in an ordinary telephone. These wires were attached to ordinary telephone instruments. A conversation was carried on at a distance of about 700 feet.

The new offices of the Western Union Telegraph Company and the Brooklyn District Telegraph Company have been opened at the corner of Fulton and Johnson Streets. A new switchboard has been installed and a large force of men has been at work connecting the 70 wires which lead into the building. Manager Magowan has announced that a branch office will be opened in the Germania Bank Building.

At a meeting of the rapid-transit commissioners it was decided to take no action on the strike of the rockmen and excavators employed on the subway until Monday. The general sentiment among the contractors is that if by Monday the strikers do not return to work their places should be filled without delay by any men who can be procured. Such action, it is feared, might precipitate riots unless the entire line of the subway were well policed. Officers and delegates of the Rockmen's and Excavators' Union met at the same time and it was decided by unanimous vote to prolong the strike for a period of six months or longer, if necessary, in order to obtain the demand they now make on the contractors. The men are nearly all Italians and number about 3,000.

Controller Grout has declared against the plans for rapid-transit subways now being worked out by Chief Engineer Parsons of the Rapid Transit Commission. He does not intend to oppose the plans for rapid-transit extension when brought before the board, but declares that they have serious defects in that they provide for nothing but extensions and connections with the existing lines of travel. Every line suggested by Engineer Parsons is an extension of some present elevated or surface line. The independent system, according to Mr. Grout, is that all the proposed extensions should connect with the main system of the underground road, and not terminate abruptly at certain points, leaving these terminals at the mercy of the private corporations which have connections at those points, which would make the subway extensions useless, if the private lines suddenly concluded to cease operations.

The Metropolitan Engineering Company has been incorporated with a capital of $30,000. The company intends to manufacture electrical advertising devices in this city. The directors are Frederick W. Jesser and Alexander H. Laidlaw, Brooklyn; Maitland E. Elliott, Manhattan.

District Attorney Jerome has made public the report of an expert accountant, who has been examining the Metropolitan company's books for him. This report sets forth that the deficit claimed by Messrs. Hertle and Teichman is not substantiated either in principle or in fact. The liabilities which have been omitted from the balance sheets, other than taxes, would, when brought into the balance sheets, add assets of a corresponding value. The theory upon which it is claimed that dividends paid were unwarranted or unearned is entirely wrong in principle. O.

New England News.

Boston, Mass., May 8.—The Waltham Street Railway Company, which is in financial difficulties, has made a truce with the Newton Street Railway Company and has been enabled to begin running cars, the power and cars being furnished by the Newton company. The latter is a constituent of the Boston Suburban Electric Companies, and undoubtedly will eventually obtain the controlling interest in the Waltham company. The Newton company now owns the Boston and Lexington, the Commonwealth Avenue, the Wellesley and Boston and the Newton and Boston Street Railway Companies.

The New England Trackless Trolley Company has changed its name to the American Trackless Trolley Company and has increased its capital stock from $9,000 to $500,000.

The Lynn Gas and Electric Light Company has declared a quarterly dividend of 2½ per cent. and an extra dividend of 25 per cent. The latter will require the disbursement of $143,750 from accumulated earnings, which amounted to $518,507 on June 30, 1902, the close of the company's fiscal year. The company's capital amounts to $575,000.

The Crest Manufacturing Company of Cambridge, Mass., manufacturer of automobiles, has elected the following-named officers: President, H. W. Lamb of Brookline, Mass.; vice-president, Isaac Davis; treasurer and manager, W. O. Adams of Cambridge, Mass.

The Holyoke (Mass.) Street Railway Company and the Laborers' Union have had a controversy over wages which has been settled by the company granting an increase of 25 cents per day and making the working day one hour shorter. The men will get $2 for nine hours' work. They demanded $2 for eight hours.

Foster Crowell and H. W. Brinckerhoff, civil engineers; Dr. George A. Soper, an expert on sanitation, and F. F. Woodward, secretary, and N. Flanter of the Merchants' Association of New York, forming the association's sub-committee on engineering and sanitation, recently inspected the Boston street-rail-

[illegible] of passenger transportation, as a part [illegible] investigation of New York's transit facilities.

[illegible] May [illegible] gale of wind demolished two car barns and damaged three cars in Adams, Mass., belonging to the Hoosac Valley Street Railway Com-

The Connecticut House of Representatives has [illegible] bill incorporating the Wallingford Tramway Company and authorizing it to build an electric railway from the Wallingford terminus of the Meriden Electric Company's lines to Montowese, where it will connect with the Fair Haven and Westville Railroad Company's system, forming the connecting link in the continuous electric railway between New York and Boston. The company has a capital of $500,000 and it can make traffic agreements with connecting companies. It has almost unlimited powers of consolidation, with gas, electric-light, power, or railway companies. Walter J. Leavenworth, Frank A. Wallace, George E. Dickerman, Charles B. Yale and Ralph T. Ives of Wallingford are the incorporators.

The Connecticut Legislature has passed a bill authorizing the Windsor Locks and Rainbow Street Railway Company to increase its capital from $100,000 to $300,000. The company's franchise allows it to build an electric railway between the Windsor terminus of the Hartford street railway and the Suffield terminus of the Suffield street railway. This will complete a through electric line between Hartford, Conn., and Springfield, Mass., on the west side of the Connecticut River.

The Norwich, Mystic and Westerly Street Railway Company has begun surveys for an electric railway between Norwich, Conn., and Westerly, R. I., via Preston, Ledyard, Stonington and North Stonington, Conn. The company's stock amounts to $700,000 and it is authorized to make traffic arrangements or consolidate with other street-railway companies in Connecticut or Rhode Island. State Treasurer Henry H. Gallup, Costello Lippitt, William B. Young, Reuben S. Bartlett, Aaron Lucas and Ediwn H. Knowles are the incorporators.

The Somers Electric Company has been incorporated by a special act of the Legislature. It has a capital of $50,000 and is authorized to make and sell electricity for lighting and power in the town of Somers, Conn., and adjacent towns in Massachusetts.

As a result of a hearing reported in a previous letter, the Massachusetts railroad commissioners have issued a finding stating that the management of the Gloucester lines of the Boston and Northern Railroad Company is incompetent and that the company should use heavier rails in that city.

The stockholders of the Danbury and Harlem Traction Company have ratified the directors' action in favor of increasing the stock and issuing bonds. The company has made an underwriting contract with A. M. Chandler, a Philadelphia banker. It is believed that there are now no more obstacles to the building of the company's electric railway between Danbury, Conn., and Golden's Bridge, N. Y., a distance of 17 miles. B.

Canadian Intelligence.

Ottawa, Ont., May 9.—The Toronto and Niagara Power Company is making satisfactory progress in erecting its power plant at Niagara Falls. The specifications for the plant are completed and call for five generators of 12,000 horsepower each, making 60,000 horsepower in all. These generators will be the largest in the world. The company expects to deliver electricity in Toronto in about two years.

A company organized by Mr. B. E. Kingman, with whom are associated several American capitalists, has concluded arrangements for establishing at Shawinigan Falls, Que., works for the production, on a large scale, of ferro-manganese. The negotiations, which have covered several months past, were concluded a few days ago, and cover the delivery to the company by the Shawinigan Water and Power Company of electrical power to the amount of 5,000 horsepower. The necessary plant will be installed at once, and to facilitate the operations of the company during the construction of permanent works a temporary arrangement has been made with the Shawinigan Carbide Company to operate in a part of the latter company's buildings. This will allow the manganese company to begin production in July next. The initial installation will employ 1,200 electrical horsepower, and the output will be sold to manufacturers of steel, both in Canada and the United States. W.

Southern Developments.

Charlotte, N. C., May 7.—Richmond and Norfolk (Va.) capitalists have purchased the franchises of the Roanoke Navigation and Water Power Company near Weldon, N. C. It is said that the purchasers will build electric lines and enlarge the power of the canal.

Negotiations for the merging of the street railways of Chattanooga, Tenn., are said to have been practically concluded. The new company will be known as the Chattanooga Light and Power Company, chartered in New Jersey, with $750,000 capital. Large amounts will probably be expended in improvements.

Two 80-horsepower dynamos have been contracted for by Dr. J. I. Triplett of Woodstock, Va., for installing in the flour mills and lighting the town of Woodstock.

The annual meeting of the stockholders of the Consolidated Railways, Light and Power Company was held recently at Wilmington, N. C., and the old officers were re-elected.

Dr. George E. Coughlin of Illinois, who is interested in the interurban electric line between Greenville and Anderson, S. C., says that the line is a go and that the capital stock has been subscribed. Detailed information will soon be given out.

Electrical experts from New York have made a survey of the city of Richmond, Va., to discover the cause of the electrolysis which has been doing much damage in the city.

The Pope Electrical Company of Atlanta will erect a plant betwen College Park and East Point, to supply these towns with light, a contract to this effect having been made. L.

From the Buckeye State.

Cleveland, Ohio, May 9.—Dr. J. D. Johnson, representing Willard Muchmore & Co. of Newark, N. J., has purchased the rights-of-way and franchises which Dr. O. C. Stutz of Upper Sandusky secured for an electric road between Marion and Tiffin. This is an important connecting link between northern and southern Ohio roads.

It is stated that the Springfield and Xenia Traction Company, now owned by the Bushnell syndicate of Springfield, will build a branch line, beginning at Yellow Springs and extending to Clifton, Jamestown and Cedarville. The promoters are planning to begin work on the Springfield, Troy and Piqua line within a short time. A portion of the Troy end of the road has already been graded.

An ordinance has been introduced in the City Council of Cleveland providing for the issue of $200,000 worth of bonds for the purpose of building a municipal light and power plant. Charles E. Phelps, Jr., of Baltimore made a report to the council to the effect that a plant sufficient to light the West Side, furnish lights for the public buildings and a great amount of current for power could be built and equipped for a little over $375,000, and that the street lights could be maintained at $53.67 each. The present contract price is $75. Mayor Tom L. Johnson's message strongly advised the plan of establishing a light and power plant by the city, and this ordinance was prepared to start the ball rolling.

The annual meeting of the stockholders of the Cincinnati Gas and Electric Company was held Monday. An increase of $2,000,000 in the capital stock was authorized. The new directorate consists of the following-named gentlemen: A. Hickenlooper, S. R. Burton, J. T. Carew, B. S. Cunningham, W. A. Goodman, R. A. Holden, Jr., A. H. Hinkle, Norman G. Kenan, M. E. Moch, C. H. Rowe, Charles P. Taft, J B. Foraker, Jr., M. M. White, William C. Proctor and J. G. Schmidlapp. On account of pressure of other business, George Bullock and M. E. Ingalls resigned.

The officers chosen by the board of directors of the Cincinnati Gas and Electric Company are as follows: President, Andrew Hickenlooper; vice-president, Norman G. Kenan; treasurer, Henry A. Branhorn; secretary and assistant treasurer, H. W. G. Sage; auditor, H. R. Cooper.

The Sandusky Heating and Lighting Company, Sandusky, has been incorporated with a capital stock of $125,000. George H. Tuttle, C. I. Ashley and others are interested.

J. B. Hoefgen will again apply to the Cleveland council for franchises over 11 different routes, over about the same streets as the old franchise, which was defeated, provided for. He will be aided by Mayor Tom L. Johnson. The Citizens' Taxpayers' Association favors seven tickets for a quarter.

The Canton-New Philadelphia Street Railway Company has purchased the property of the Tuscarawas Traction Company, consisting of lines from Canal Dover to Uhrichsville, and from Uhrichsville to Dennison. The purchasers assume a bonded indebtedness of $250,000, which the Mandelbaum-Pomeroy syndicate had on it.

The Dayton and Southwestern Traction Company of Dayton has been incorporated for the purpose of building an electric line from Dayton to Camden. The capital stock is $10,000, and the incorporators are M. L. Mowser, V. J. Drayer, A. J. Miller and others.

The Ohio River and Columbus Railway Construction Company has been incorporated in West Virginia with a capital stock of $25,000, for the purpose of building an electric road from Ripley, Ohio, to Hillsboro and other points. B. G. Blair, Albert White of Ripley and others are the incorporators.

The following-named companies have opened offices in the Citizens' Building, a new office building, corner of Euclid Avenue and Erie Street, Cleveland: General Electric Company, Electric Storage Battery Company, Algonquin Electric Brake Company.

The executive committee in charge of the improvements of the Lake Shore electric-railway lines has voted to recommend the expenditure of $125,000 for ballasting, lengthening switches and other improvements. Ten new cars will be put on the line.

The Eastern Ohio Traction Company will sell $500,000 of its five per cent. bonds at once, the proceeds to be used for improvements. A branch will be built from Garrettsville to Warren, a distance of 15 miles.

At a meeting held in Cincinnati a few days ago the affairs of the Richmond and Portland (Ind.) Traction Company were discussed. Peter Schwab of Hamilton, one of the promoters, said that the company had just been financed for $2,500,000, and that they expect to have it in operation by November. It will be 86½ miles in length. O. M. C.

Michigan.

Detroit, May 9.—The Detroit, Ypsilanti, Ann Arbor and Jackson electric line is working on an extension to Vandercook Lake, about four miles south of Jackson. A feature of the new line will be an extension bridge over the Michigan Central and Lake Shore and Michigan Southern tracks.

An automobile line has been established in Bay City and West Bay City in opposition to the electric lines.

The Kalamazoo Valley Power Company has been granted a franchise for a pole line through the city of Marshall. The line will carry high-potential wires.

George Silsby, an electric-railway promoter, who conceived the idea of building the Saginaw Suburban railway, and of which he was president, was forced out of office at a late directors' meeting, his place being taken by A. G. Bishop, cashier of a Flint bank. Mr. Silsby has instituted suit to recover salary due him and $60,000 expended by him. As the company now has good financial backing, it will go ahead with the completion of the road between Saginaw and Flint.

The Grand Rapids, Holland and Lake Michigan electric road, running between Grand Rapids and Holland, is being double-tracked between Holland and Macatawa Park. This company has also made arrangements with the Graham & Morton boat line to carry the perishable freight immediately to Grand Rapids upon the arrival of the boats from Chicago in the morning. This will bring the freight into Grand Rapids seven hours earlier than heretofore.

The proposition to bond the city of Belding for an electric-light plant was carried at a recent election.

A party of Detroit capitalists, with Dr. J. B. Kennedy, will organize a company with a capital of $100,000 for the construction of an electric line from the present Rapid Railway line to the Grande Pointe Hotel and loop around the head of the island, following the shore line of the "Flats." The new line will receive its power from the Rapid Railway.

The Lansing, St. Johns and St. Louis electric road is contemplating an extension to Mount Pleasant, Evart and Cadillac. This is the line for which B. J. Arnold of Chicago is furnishing the new system of electropneumatic equipment, the operation of which is being watched with interest. C. G. W.

Information from Indiana.

Indianapolis, May 11.—The Logansport, Hammond and Chicago Traction Company was incorporated last week. The capital stock is placed at $100,000, and George F. McCulloch, Horace C. Stillwell, A. L. Drumm and H. F. Guthrie are named as directors. The company will build from Logansport to Chicago by way of Winamac, Valparaiso, Star City, Winona, Hobart, Royal Center, Whiting and Hammond and other intermediate towns. It is understood that work will be begun as soon as it is possible to get material and workmen on the field.

Messrs. Hubbard and Yorder, representing Indianapolis and Chicago capitalists, secured a franchise for an interurban line from Madison, on the Ohio River, to Columbus. This line when completed will connect with the Indianapolis, Franklin and Columbus line, and thus give Madison direct trolley connection with Indianapolis.

An event of considerable importance was the purchase by the Union Traction Company of all interests of the Ft. Wayne and Southern Traction Company which undertook to construct a line from Ft. Wayne to Marion by way of Huntington and Warren. The company immediately reorganized by electing George F. McCulloch president of the company. Mr. McCulloch says work on the line will be pushed as it is intended to make it a part of the proposed through line from Indianapolis to Ft. Wayne.

The purchase of stock of the Indianapolis, Shelbyville and Southeastern Interurban Company by R. C. Light, Fletcher Hines and other Indianapolis men during the week gives them a controlling interest in the road. The company is now building an extension from Shelbyville to Greensburg with a view of reaching Cincinnati later on. A reorganization of the company's management is now anticipated at the next meeting and President Adams will be succeeded by an Indianapolis man.

C. L. Henry, president of the Indianapolis and Cincinnati interurban line, now building, says he has discarded the idea of equipping his power house at Rushville with turbine steam engines. "We have found that the turbine engines now in use are yet in the experimental stage and we prefer to let the other fellow do the experimenting for awhile," said he.

The Consolidated Traction Company, building a line from Crawfordsville to Indianapolis was granted a franchise to enter Indianapolis, through Holmes Avenue to the local company's line in Michigan Street.

Oxford (Ind.) officials are ready to contract for the construction of an electric-lighting plant.

The Indianapolis Electric Manufacturing Company has been incorporated to carry on the manufacture of electrical apparatus and to furnish motive power. Henry E. Kattman, Ansel Fatout and C. E. Morgan are directors. F.

Northwestern Notations.

Minneapolis, Minn., May 9.—A strike of electrical workers at Duluth, Minn., has been settled by arbitration. The men get their hours reduced to eight, without a reduction of wages.

The electricians of Butte, Mont., want higher wages. They have been receiving $3.75 per day, but want $4.50, with a uniform working day of eight hours.

W. P. Fowler of Morris, Minn., who has a lighting plant, seeks a franchise for 15 years, and a contract for street lighting for a similar length of time.

An electric railroad is projected from Warroad to Stephen, Minn. Warroad is on the southwest shore of Lake of the Woods, and has railroad connection with Winnipeg, but is otherwise not accessible save by stage for 75 miles from Stephen.

An alderman at Duluth suggests the appointment of a street-car inspector by the council whose duty it shall be to ride on a number of cars each day, on every line, observing the conditions, number of passengers carried, heating of the car, congestion of traffic, and other items of interest.

W. M. Brogan of Omaha has formed a partnership at Rochester, Minn., with Roth & Freeman for an electrical supply business.

Citizens of Dubuque, Iowa, have subscribed for the necessary bonds to insure the construction of the proposed Iowa, Illinois and Wisconsin electric railway. Work is soon to be begun. The line will cost $750,000.

It is understood that the Burlington Railroad will carry out its plan of extending an electric-trolley line from Lead to Spearfish, S. D., this summer.

The Grand Forks (N. D.) Storage and Commission Company has engaged in business and will carry a line of electrical supplies. The manager, James R. Fulthorpe, has been with the city electric-light plant in East Grand Forks.

H. H. Eckstromer has formed a new electrical company in Minneapolis, to be known as the Northwestern Electrical Company. It will do a general electrical and construction business and have offices in the Andrus Building.

The Western Union Telegraph Company has resumed messenger service in Duluth, after the strike, employing girls, men and some non-union boys. The striking boys have inaugurated a co-operative messenger service.

The Gedney Block and the street railway of Independence, Iowa, have once more been transferred to new owners. The new company will put on new cars at once and make repairs to the system.

Electrical machinery has reached Whatcom, Wash., for the power plant of the Nooksack Falls Power Company, where it will remain until the new railroad extension to Nooksack Falls is completed. The company's intention is to have the power plant in operation by the first of September. R.

Among the Rockies.

Salt Lake City, Utah, May 7.—A meeting of prominent citizens of Utah County was held recently, at which the proposed dyking of Utah Lake was discussed. The meeting was conducted by the officers of the Utah Lake Association, which was organized some time ago. A committee was appointed with instructions to co-operate with the state engineer and irrigation commission with a view to learning definitely the feasibility of converting the lake into an immense reservoir. A controversy between Salt Lake and Utah County people regarding water rights in the lake has been long pending, and an effort will be made to bring about an amicable settlement of this issue. Government engineers will be invited to look into the project, and if they consider the plan a good one, pecuniary aid from the government will be solicited for the construction of the reservoir. This proposition has been agitated for years, and the present active interest in the matter indicates that some definite action towards the fruition of the scheme will be taken at an early date. Early action in the matter has been made imperative on account of the amount of water drawn from the lake by the Jordan Narrows electrical pumping plant.

The County Commissioners of Utah County have granted a franchise for the construction and operation of an electric railway and telephone system at Provo City, Utah, and surrounding towns. The incorporators of the new company are United States Senator Reed Smoot, Jesse Knight, C. E. Loose, George Havercamp and S. R. Thurman.

Work is proceeding as rapidly as possible on the dam and power plant on Lolo Creek, near Greer, Idaho. On account of the high water work has been retarded, and it is probable that the dam, which is being built upon an elaborate and permanent basis, will not be completed until early in December. G.

Butte, Mont., May 7.—The Butte Electric Construction Company of Butte has filed articles of incorporation with the secretary of state for the purpose of transacting a general machinery business. The concern is capitalized at $20,000, and of this amount one-half has already been subscribed. The directors are A. B. Elliott, Charles Bowman and Robert F. Hopper.

Trouble is expected in electrical circles in this city very shortly. It is stated that the electricians have made a demand for an increase of wages and for a uniform working day of eight hours. It is said the electricians ask an increase from $3.75 to $4.50 per day.

At a recent meeting of the stockholders of the Fort Benton (Mont.) Light Company it was arranged to secure the controlling interest in the stock held by local persons, in order that improvements may be made and better service given. New machinery has already arrived, which, when put in place, will effect a great saving in fuel and at the same time nearly double the power.

Samuel Mendenhall, manager of the Gallatin Light, Power and Railway Company of Bozeman, Mont., has left for New York, to arrange the details of the transfer of the plant, which, it is understood, has been sold for about $25,000 to eastern capitalists who propose to build an up-to-date electric plant this summer. W. A. Livingston will in all probability be the manager.

R. W. Ferris, a prominent contractor and mining man of Boise, Idaho, who has the contract for the big irrigation dam and canal at Twin Falls, on the Snake River, has purchased machinery, including an electrical plant, at a cost of over $40,000, all to be installed at Twin Falls, Mont.

The City Council of Sandpoint, Idaho, has granted M. R. Rutherford of Missoula, Mont., a franchse for an electric-light system in that town. H.

Jottings from Japan.

Tokyo, April 15.—The Japan Electric Society of Tokyo, Japan, is preparing a representation to the government in reference to the official principles of electric-railway administration. The society's committee, whose business is to investigate the matter, consists of Messrs. Ando and Shioya of the Tokyo Electric Car Company, Mr. Arita of the street-railway, and Mr. Kodama of the Tokyo Electric Light Company. The representation asks for a simplification of the procedure required for obtaining the railroad charter, permission to construct an overhead-trolley system within the city, non-restriction of speed for the traffic in the suburbs, etc.

On March 12th Ryojiro Dogura obtained permission from the governor-general of Formosa to construct a waterpower plant for the purpose of generating electricity in the vicinity of Taipeh, and to supply electric power to the city. The capital for the business is said to be 200,000 yen (about $100,000). Mr. Dogura believes that he can supply 3,000 electric lights, each light being 16 candlepower, and costing 1¼ yen (about 62 cents) per month.

It appears that a hitch has occurred in connection with the construction of the Hanjin electric railway, now under construction at Osaka, Japan. It is proposed to run the line through certain public roads at the northern end of Fukushima, in the city. The Osaka municipality claims that the public roads of the city are the city's property, over which the municipality, since the outbreak of the trouble with the Osaka Gas Company, claims the sole right of control. The dispute is very similar to that arising out of the Osaka Gas Company question. It is maintained on one side, however, that the Hanjin Electric Railway Company is already in possession of a charter empowering it to construct the line, this having been obtained from the ministers of state in accordance wih the railway act, so that the Osaka municipality is not entitled to raise any objections to the roads being used. It is reported the case will go to the courts, and will be fought hard by both sides.

Subscriptions for the newly organized Tamagawa electric railway, whose projected route runs from Shibuya to Futagono-watashi (Twin's ferry) of the Tama River, a distance of three miles, in Tokyo, Japan, will be invited in a short time. The scheme of constructing an electric railroad to be used for the transportation of the gravel of the Tama River to the city, has been on foot for some time. P.

PERSONAL.

The award of a certificate of merit has been made to W. J. Phelps of Detroit by the Franklin Institute of Philadelphia for his invention, the Hylo incandescent electric lamp.

Bernard E. Sunny, western manager of the General Electric Company, was re-elected president of the Civic Federation of Chicago at the ninth annual meeting of that body held on May 8th. All the old officers were re-elected.

Frank J. Sprague of New York has been awarded the Elliot Cresson medal by the Franklin Institute of Philadelphia for the benefits to the operation of electric roads derived from the application of his multiple-unit system of train control.

Briggs C. Keck sailed from San Francisco on May 6th for the Philippine Islands, where he will have charge of the accounts of the new rapid-transit company at Manila. Mr. Keck was at one time treasurer of the United Railways Electric Company of New York city.

A. W. Martin, secretary to the general manager of the New York, New Haven and Hartford Railroad Company, has resigned that position to accept the general managership of the Worcester (Mass.) and Connecticut Eastern street railway, which is controlled by the railroad company.

Daniel Drawbaugh, well known for his early telephone inventors, and a man of wireless-telegraph ideas, was beaten and robbed at his home near Harrisburg, Pa., on May 5th, by a number of robbers. Jewelry and several valuable papers were taken. Mr. Drawbaugh is 73 years of age.

Thomas A. Edison was granted last week three United States patents. One of these is for an improvement in grinding rolls and the other two relate to his new alkaline storage battery and consist of an improved electrode of copper and iron and a process of making electrolytically active finely divided iron for the electrode.

John F. Calderwood, who left Chicago a year ago to become assistant to the president of the Brooklyn Rapid Transit Company of Brooklyn, N. Y., was, on May 5th, elected vice-president and general manager of the company. The promotion was a great surprise to Mr. Calderwood. It is only a few years since he was a reporter on a Chicago paper.

G. Marconi was made a Roman citizen on May 7th by Prince Colonna, the mayor of Rome. In the afternoon Marconi delivered a lecture in the great hall of the capitol before King Victor Emmanuel and a large audience on what he had done and what he hopes to do in wireless telegraphy. At the conclusion of the lecture the king shook hands with Marconi and called him a glory to Italy.

Joseph W. Mauck, vice-president and manager of the Chicago and Milwaukee electric railway, was given a farewell greeting at Fort Sheridan Park pavilion, near Chicago, on the evening of May 7th by the employes of the company. Mr. Mauck has been elected president of Hillsdale College, Michigan, where he will soon take up his new work. At the meeting he was presented with a number of valuable presents by the employes and directors.

William A. Jackson, grand president of the Electrical Workers' Union of the United States and general foreman of the aerial and underground electric-circuits department of the city of Chicago, was married to Miss Josephine Williams, stenographer for City Electrician Ellicott, in Chicago on May 7th. After the wedding the young couple departed for a trip to Washington. Mr. Jackson has been in the employment of the city for nine years and has a host of friends who extend their congratulations.

ELECTRIC LIGHTING.

An electric-light plant is being established at Canton, Mo.

Neola and Muscatine, Iowa, are about to install electric-lighting plants.

Anita, Iowa, is agitating the question of establishing an electric-light plant.

A new electric-light and waterworks plant will soon be erected at New Franklin Mo.

The Calumet (Mich.) Heat, Light and Power Company was recently incorporated with a capital of $80,000.

The city of Kenton, Tenn., will issue bonds in the amount of $12,500 for an electric-light plant, to be erected at once.

D. O. Lively, T. J. Douglas and T. W. Freeman have organized a light and power company at Sour Lake, Texas, with a capital stock of $10,000.

Fire destroyed the municipal electric-light plant, two mills and five business blocks at Kennebunk, Maine, on May 4th, entailing a loss of $100,000.

At a recent election in Sandersville, Ga., the voters decided to issue $30,000 bonds for the erection of a municipal electric-light plant and waterworks.

The city of Martinsville, Va., will receive bids until May 23d for a franchise for installing an electric-light plant for the city. Address S. A. Gravely, city clerk.

The contract has been let for the new electric-lighting plant for the Chattanooga (Tenn.) Light and Power Company. The plant is to cost about $200,000, it is said, and when complete will furnish power for the Chattanooga Electric Railway Company, also.

The Ballard Electric Company has taken possession of the municipal lighting plant of Ballard, Wash., under a 50-year lease, and will begin work at once to increase the capacity of the plant from its maximum of 2,500 lights to a capacity of 17,500 lights. An 800-horsepower plant for manufacturing purposes will be installed and machinery for the purpose will be on hand in a few weeks.

The City Council of Park River, Walsh County, N. D., will receive applications for the position of superintendent of the electric-light system and waterworks of the city for a period of 6½ months, commencing June 15th, the vacancy being caused by the resignation of the present incumbent. If his work is satisfactory the successful applicant will likely be hired for another year. Applications should be sent to E. Smith-Patersen, city attorney, Park River, N. D.

The entire plant and equipment of the Ashland (Ore.) Electric Power and Light Company will be transferred shortly to the Siskiyou Electric Power and Light Company, a California incorporation. The latter company has developed power on Fall Creek and Klamath River to the amount of 22,000 horsepower, and its plan is to supply towns in southern

Oregon and northern California with power for electric lighting, street railways and manufacturing enterprises.

ELECTRIC RAILWAYS.

H. P. Pearson, Jr., ex-president of the New Orleans Railway Company, has pleaded guilty to charges of failing to provide screens to separate the motorman from the street cars in New Orleans. He was fined $1,100.

Promoters of an electric railway to connect Decatur and Bloomington, Ill., announce that their plans have so far progressed that the contract has been let for the construction of a power house at Clinton to cost $175,000.

The first car over the new electric road between Utica and Little Falls, N. Y., was run last week. Enthusiasm among the residents along the line ran high. Regular service has been inaugurated, cars leaving each end of the line every half hour

At a recent annual meeting of the stockholders of the Springfield (Ill.) Traction Company, George W. Parker of St. Louis was re-elected president; A. J. Eisenmeyer of Springfield, vice-president; C. H. Smith of St. Louis, secretary, and J. F. G. Bentley of Springfield, treasurer.

Belgian newspapers state that the International Sleeping Car Company has given orders for building an electric autocar, which by August next will be running upon the Belgian State railroad between Brussels and Ostend. The distance of 78⅛ miles will be covered, it is stated, in less than an hour. The car will carry 40 passengers.

Rails are being delivered for the track of the extension from Decatur to Springfield, Ill., of the Danville, Champaign and Decatur Interurban electric railway. Cars are already running between Champaign and St. Joseph and between Danville and Vermilion Heights. A gap between St. Joseph and Vermilion Heights will be completed and cars running by July 1st.

The stockholders of the Hammond, Whiting and East Chicago Electric Railway Company, a road controlled by the South Chicago City Railway Company, held their annual meeting in Hammond, Ind., on May 7th. The retiring directors were re-elected and the following-named officers elected: President, D. F. Cameron; vice-president, D. M. Cummings; secretary and treasurer, O. S. Gaither.

The right-of-way for the electric railway to connect Kenosha, Wis., and Waukegan, Ill., has practically all been purchased, and the work is about to be begun. The road is to be built by Bion J. Arnold of Chicago and will probably be equipped with the Arnold electropneumatic railway system now under test in Lansing, Mich. The new line will unite with the Chicago and Milwaukee road at Waukegan.

AUTOMOBILES.

Out of 500 registered automobile owners in Cleveland, Ohio, 261 own gasoline vehicles, 145 steam and 94 electric.

President Charles A. Singer of the New York and Stamford (Conn.) Electric Railway Company has purchased a large automobile to use for making inspection trips over the road and to reach the scenes of accidents.

Captain Henry H. P. Deasey recently accomplished an automobile journey from London to Glasgow without stopping the engine or the car. The journey of 427 miles was made in 21 hours and 16 minutes, in the face of rain and a gale of wind.

A Parisian engineer has invented a new electric water sprinkler which will sprinkle the street at a rapid rate. It will be an automobile, and will be able to water the Champs Elysées and the Avenue Bois de Boulogne in 15 minutes. The machine costs but $3,000. If successful, the city will order a large number.

SOCIETIES AND SCHOOLS.

The department of electrical engineering of Iowa State College at Ames, Iowa, has recently moved into commodious quarters in a new engineering hall. The new laboratories include a dynamo laboratory, which is equipped with 20 experimental dynamos and motors, a bank of 20 transformers and suitable lamp banks and switchboards. In addition, there is a good equipment in electrical measuring instruments and all appliances requisite to a complete and practical laboratory course in electrical engineering.

The Bulletin of Purdue University, Lafayette, Ind., for its March issue takes the form of the annual catalogue of the university for 1902-1903. It contains lists of faculty and students, equipment of the university, courses of study, conditions of admission and miscellaneous and general statements. The summary of students shows a total attendance for this year of 1,336. W. E. Goldsborough, professor of electrical engineering, and his associate, Professor C. P. Matthews, are well known to the electrical world.

The Register for 1902-1903 has just been issued by Cornell University. It is a complete catalogue, embodying the university records, and gives a list of the students, professors and faculty. The total number of regular students at present is given at 2,968. Over 500 pages are full of information and records of the various departments of the institution. Considerable space is devoted to Sibley College of Mechanical Engineering and the Mechanic Arts, organized as a technical and professional department of the university. The electrical-engineering department of the college is in charge of Professor Harris J. Ryan, M. E., assisted by Professor Henry H. Norris, M. E. Sibley College has 886 regular students.

Among the subjects of theses to be presented by candidates for degrees of Lehigh University this coming June are the following by electrical-engineering students: "An Investigation of the Thermal Conductivity of Various Steam-pipe Coverings by an Electrical Method and a Discussion of Its Bearing on Central-station Economy;" "Experimental Study of the Variation of the Stray Power Losses in Direct-current Dynamo Machines;" "Experimental Study of a 7.5-horsepower Induction Motor;" "Experimental Study of an Open-coil Arc-lighting Dynamo;" "Experimental Study of the Instantaneous Contact Method of Measuring Alternating Electromotive Force and Current;." "Experimental Study of Liquid Rheostats;" "Tests on Alternate-current Transformers."

PUBLICATIONS.

The Century Glass Company of Bellaire, Ohio, manufacturer of electrical glassware, has issued a booklet descriptive of opal electric shades and shades and cylinders for incandescent burners and a new edition of its Red Book, which describes the inner and outer globes and shades for arc lamps that the company carries in stock.

W. N. Matthews & Bro., 600 Carleton Building, St. Louis, Mo., have issued a neat 27-page catalogue relating to guys and guy anchors. Interesting illustrations show the many uses to which the Stombaugh guy anchor can be put. Reliable data on the holding power of the different sizes of anchors and methods of finding the strains met with in pole-line construction are given. The front cover of the booklet bears the appropriate inscription, "Let Us Cast Your Anchor."

The Chicago Fuse Wire and Manufacturing Company of Chicago has just issued a new catalogue descriptive of fuse wire, fuse strip and fuse links for electric-lighting and power circuits, also fuse blocks and fuses for telephone and telegraph work, together with wire joints and sundry items, all of the company's manufacture. The list is neatly printed on green-tinted paper, with a gilt cover, and is convenient size for an ordinary pigeon-hole. It is comprehensive and convenient to order from. The company now carries stock at its three offices in Chicago, Buffalo and New York.

The Fort Wayne Electric Works of Fort Wayne, Ind., has issued a comprehensive instruction book which describes the installation and operation of direct-current series arc apparatus, embodying the Wood system. The book discusses the theory, construction, operation and assembling of the generators, describes the switchboards, connections, lamps, etc., and also gives a number of explanatory illustrations and diagrams and tables. Recent bulletins issued by the Fort Wayne Electric Works describe and illustrate arc-circuit cut-outs, single-phase generators and belt-driven direct-current generators for lighting and power.

TELEGRAPH.

The Postal Telegraph-cable Company has opened a telegraph office at Ventura, Cal., with C. H. Harpst as manager.

A dispatch from Berlin states that the laying of a duplicate German-Atlantic cable was begun on May 11th at Borkum, an island in the North Sea, 26 miles from Endem. A large number of people attended the ceremony, and cheers were given for the German emperor and the president of the United States.

The Commercial Telegraphers' Union of America has filed a petition in the United States District Court at St. Louis asking Judge Adams to issue an injunction to restrain the Western Union Telegraph Company from discharging men belonging to the union, and asking that the company be restrained from blacklisting members of the union and from interfering with them in any manner.

Officials of the Western Union Telegraph Company believe that they have unearthed a scheme to defraud the company and that the amount involved has already reached $100,000. An investigation, begun at the New York headquarters, has revealed the fact that accounts of the expenditures received from the foremen of the several construction corps throughout the country do not agree in many ways, and it is alleged that many foremen on the lines from New York to Chicago are padding the payrolls. Numerous arrests have been made and many more will follow.

Vice-president George G. Ward, of the Postal Telegraph and Cable Company, announces that the Pacific cable, now being placed by the company, is nearing completion. Steamers are now on the ocean between Honolulu and Manila putting down the remainder of the cable as fast as possible. The station in Manila will be put in readiness, and the first messages to come direct from the Philippines will probably pass between the President and Gov. Taft on the morning of the Fourth of July. Immediately after this exchange of messages a test will be made as to the time consumed in encircling the globe with a telegraph message.

SPACE TELEGRAPHY.

At a recent meeting of the board of directors of the Marconi Wireless Telegraph Company of America the following-named officers were elected: First vice-president, Guglielmo Marconi; second vice-president and general manager, W. H. Bentley; secretary and treasurer, John Bottomley. It is said to be the intention of those in control of the company to consolidate the American and Canadian companies. Willard R. Green, who was in control of the American company, has sold his interests to J. D. Greenshields, who controls the Marconi Wireless Telegraph Company of Canada.

MISCELLANEOUS.

The annual report of Water Commissioner Edward Flade of St. Louis sets forth that the city water pipes have been damaged to the amount of $1,175,000 as the result of electrolysis. The report censures the street-car companies, as no provision has been made in the electrical system for the return of the current.

The Treasury Department has extended its regulations of November 19, 1902, establishing a rate for allowance of drawback on electric storage batteries manufactured by the Electric Storage Battery Company of Philadelphia, in the manufacture of which refined lead produced from base bullion was used, to similar manufactures by that company from imported lead and imported antimony.

A Norwegian scientist, Professor Birkeland, has recently given demonstrations of the powers of his electromagnetic cannon at the Royal Norwegian Academy. He says that the efficiency of his gun at the present time is such that with a 30-centimeter gun he could discharge a projectile weighing 500 kilograms at a speed of 200 meters per second without flame or explosion. By means of an electric current the shock consequent upon a discharge of such strength is greatly lessened.

A new method of applying electricity in surgery was demonstrated recently at the navy yard at Vallejo, Cal., where an employe was injured by a piece of steel which flew from a tool and embedded itself in his face. Master Electrician Petrie removed the metal, after several unsuccessful attempts by surgeons, with a magnet of his own design, capable of lifting 500 pounds. The magnet was held directly over the wound, and the current turned on. In an instant the metal flew from the wound and attached itself to the magnet.

The largest power house in Buffalo, N. Y., is being completed by the Larkin Soap Company of that city. The factories are being equipped to be operated entirely by electricity. Twenty 500-horsepower boilers are being installed. Two 300-kilowatt, three 115-kilowatt, and one 50-kilowatt generators, each direct-connected, respectively, to 450, 150 and 75-horsepower engines, are being installed. Three-phase alternating current will operate induction motors. The power house will be 120 feet wide and 256 feet long, with a smokestack 250 feet high, having an inside diameter of 14 feet.

A new use of electricity is in the destruction of animal life in the earth inimical to vegetation, such as worms, slugs and insects. By the use of a small current of 110 volts between terminals in the earth it is possible to kill or drive away all obnoxious forms of animal life about the roots of plants. The author of these experiments, a German, sees an explanation of the remarkable influence which electricity exercises on the growth of vegetation, for he says it is clear that a plant the roots of which are not injured by worms and slugs will be much more prosperous than one which is attacked by these injurious animals.

TRADE NEWS.

The Walker Electric Company of Philadelphia has recently opened a branch office in the Old Colony Building, Chicago, with F. D. Walker as manager.

The Conrad Rawles Shoe Company of Louisville, Ky., announces that it is in need of a 100-horsepower engine and boiler, also a dynamo and steam-heating apparatus and sprinkler system.

The Guarantee Electric Company has been incorporated to do business at St. Louis, Mo. The company is capitalized at $6,000. C. J. Briner, L. T. Nolker and J. P. Casey are interested.

The Karas Electric Company has been incorporated with a capital of $10,000 and will manufacture electrical, mechanical and chemical specialties in Chicago. The incorporators are L. and B. Summers and Joseph Karas.

George Welsby Scott, consulting engineer of Chicago announces his removal from the Rookery to

larger offices at 1301-2 Security Building, where the increased facilities will enable him to care more fittingly for his large engineering interests.

Steadily increasing business has made it necessary for Rossiter, McGovern & Co., dealers in electrical machinery, to seek larger quarters. They now occupy new offices in the Whitehall Building, 17 Battery Place, New York city. A pleasant room has been set apart for the use and convenience of callers.

About $75,000 worth of improvements and alterations in the way of lighting, heating and ventilating are soon to be made to the Iowa state Capitol at Des Moines. The commissioners have practically approved the plans and specifications prepared by C. L. Linley of Boston for the mechanical and electrical equipment and remodeling, and are prepared to receive bids.

J. W. Holcomb and J. E. Latimer, under the firm name of Holcomb, Latimer & Co., will open offices at 203 Ellicott Square, Buffalo, N. Y., for the purpose of handling securities of various kinds. They are Cleveland (Ohio) electric-railway men, and will retain their business interests there, the Buffalo offices being opened as an aid to their operations in that section of the country.

Sealed proposals will be received until June 11th for the construction, including electric wiring and conduits, but not including heating apparatus, of the extension to the United States postoffice, courthouse, and specifications, copies of which may be had at the office of the custodian at Paducah, Ky., or James Knox Taylor, supervising architect, Treasury Department, Washington, D. C.

A consolidation of the interests of the Electric Supply Company, Safety Electric Company, Newman & Spranley, and Stern & Marks, all of New Orleans, etc., at Paducah, Ky., in accordance with drawings has been effected, and the four concerns will operate two electrical supply houses under the name of the Interstate Electric Company, to be incorporated with a capital of $1,000,000. Charles Weinberger will be president; Sam Hyman, vice-president; Robert P. Pollock, secretary-treasurer, and P. Stern, general manager.

F. D. Saylor, a well-known electrical engineer and salesman, is about to embark in the electrical contracting and supply business in Pittsburg, Pa. Associated with him will be his two brothers, Charles C. and B. D. Saylor, and the name of the new concern will be the Saylor Electric Company. F. D. Saylor is an old General Electric man and for three years was connected with the engineering department of the Western Electric Company. During the last two years he has been a traveling salesman for the Commercial Electrical Supply Company of St. Louis, Mo. His brother, Charles C., has been connected with the Bell Telephone Company in Pittsburg, and B. D. Saylor has held a position with the traction company in Pittsburg, so the new company will start out with men of considerable experience in all branches of electrical work.

BUSINESS.

G. M. Gest, the well-known underground-conduit engineer and contractor, reports that his business is "booming," both his New York and Cincinnati offices being busy carrying out several large contracts.

The William Mueller Company, Chicago, one of the largest producers and dealers in cedar poles, is enjoying one of the most successful seasons in its history. Its recent purchase of the cedar-pole business of the Holcomb-Lobb company has greatly increased its facilities, and it is now in a better position to fill orders than ever before. The company says that it is prepared to make attractive prices on mixed carloads of poles. It has nine concentrating yards, and is therefore able to make prompt shipments to all parts of the country.

The steam-turbine plant of the Hartford Electric Light Company, Connecticut, which at present consists of a 2,000-horsepower set, is soon to be duplicated by machines built by the contractors for the original installation, the Westinghouse Machine Company. This was the first American plant where steam-turbine units of large size were installed, and their complete success is highly gratifying to the maker. The aggregate power of steam-turbine sets completed, in hand and in order to the Westinghouse Machine Company, does not fall far short of 200,000 kilowatts.

The Ewing-Merkle Electric Company of St. Louis, Mo., and Shreveport, La., is having a large sale of dynamos and motors of the Commercial make, for which it is the general selling agent. Among the sales for complete plants reported by the company for last week are: Huie-Hodge Lumber Company, Hodge, La., 20-kilowatt; Keith Lumber Company, Voth, Texas, 30-kilowatt; Eagle Lumber Company, Eagle Mills, Ark., 40-kilowatt; T. C. Reed, Cerro Gordo, Ill., 60-kilowatt; Shreveport County Club, Shreveport, La., 6¼-kilowatt; William Cameron & Co., Saron, Texas, 30-kilowatt; French Creek Lumber Company, Chidester, Ark., 6¼-kilowatt; Val Ries & Co., Belleville, Ill., 25-horsepower. This company also reports the sale of a very large amount of supplies and equipment for telephone companies.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 5, 1903.

726,837. Electrical Distributing System. Leonard Andrews, Hastings, England. Application filed May 10, 1902.

An electric supply system comprises an alternating-current generator a conductor to be supplied with current from the generator, a discriminating choking device, and duplicate feeders including respectively separate coils of the choking device.

726,846. Insulator for Electric Wires. Joseph R. Bell, Peckville, Pa. Application filed June 28, 1902.

The insulator has a screw-threaded shank, the converging sides of the channel of the shank having frets thereon arranged to engage the wire when compressed within the channel.

726,848. Electric Street-car Lamp. Charles C. Benson, Newburyport, Mass. Application filed April 18, 1902.

The lamp has a solenoid, a jointed operating arm terminating in a clutch at its lower end, a movable armature and an armature lifter provided with a rod on which the armature lifter operates.

726,860. Electric Furnace. Joseph M. Carrere, New Brighton, N. Y. Application filed May 22, 1902.

In the furnace combined with non-rotatable cap ends and supporting bases therefor are a cylinder extending between and passing into the ends, a lining of a substance of low electrical conductivity within and insulated from the cylinder, means for producing heat within the cylinder, and means for concentrating the heat produced within the cylinder at any given point thereof.

726,868 and 726,869. Trolley Wheel. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Applications filed August 21, 1902.

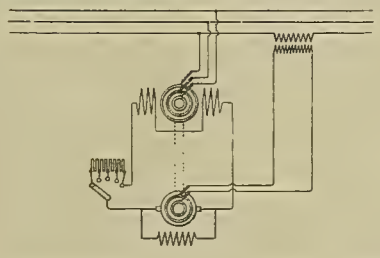
Improved trolley wheels are described.

726,882. Signal Recorder. Herman W. Doughty and Clarence E. Beach, Binghamton, N. Y., assignors to the Star Electric Company. Application filed May 16, 1898.

An electromechanical stamping or punching device is described.

726,912. Electric-light Hanger. John P. Hebendahl, Elizabeth, and John J. Gaffney, Newark, N. J. Application filed November 26, 1901.

The hanger has a casing, an insulator projecting from one end of the casing, a bolt run through the insulator and extending beyond its end, a hood on the casing, an eye having its shank fitting on the bolt and secured thereto and a suitably insulated hook projecting from the opposite end of the casing.



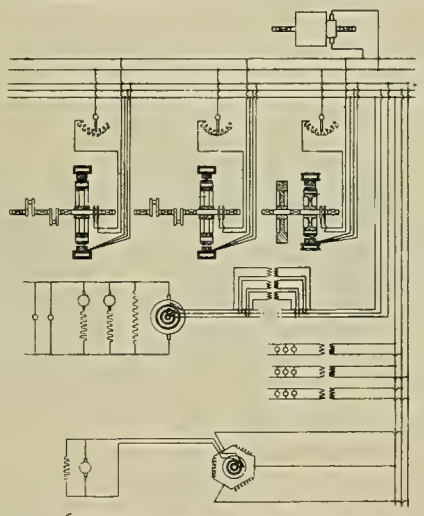
NO. 726,935.—REGULATION OF ALTERNATING CIRCUITS.

726,917. Trolley-wire Finder. Thomas S. Herrick, Muncie, and John H. Bissett and Franz M. Merrick, Anderson, Ind., assignors to John C. Griesheimer, Edward Tuhey and Thomas Scott Herrick, Muncie, Ind. Application filed August 23, 1902.

The finding device for the trolley wire consists of a spiral groove roller and a guide and lifting wheel eccentrically secured thereto.

726,929. Incandescent Lamp. John W. Howell, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 29, 1901.

A high-voltage incandescent electric lamp has a filament composed of a number of independent treated sections, the sections being joined near the stem on the end of a supporting wire of smaller heat-radiating capacity than the terminals.



NO. 726,952.—MEANS FOR AVOIDING HUNTING OF ALTERNATORS.

726,935. Regulation of Alternating Circuits. Thomas J. Johnston, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 20, 1901

The invention consists of a synchronous motor and an exciter dynamo, the armatures of which rotate in synchronism, an electrical connection between the armatures by which the alternating current passes through the exciter armature, the polar points of the exciter armature being displaced from those of the motor, whereby when the current leads, the motor furnishes a compensating inductive reactance, and when current lags a capacity reactance, tending to correct the dephasing characteristics of the circuit and maintain the power factor approximately at unity. (See cut.)

726,936. Transformer. Thomas J. Johnston, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 1, 1902.

The casing is provided with one or more channels for the circulation of a cooling medium.

726,945. Electrical Outlet Box. Hubert Krantz, Brooklyn, N. Y. Application filed February 26, 1902.

The box has a receptacle part with an opening to hold a switch or the like within the box and a ball-joint adjustment for the receptacle part.

726,952. Means for Avoiding Hunting of Alternate-current Machinery. Henry C. Leake, Newcastle-upon-Tyne, England. Application filed April 9, 1901.

A number of prime movers without fly-wheels and a number of alternating-current generators running in parallel driven directly by the same, the combined moments of inertia of the rotating parts of the prime movers and generators being reduced to substantially the minimum necessary for constructive reasons, are combined with a compensating synchronous motor running in parallel with the generators and means for controlling the compensating synchronous motor in order to maintain the potential difference of the system substantially constant in effective value and periodicity without material variation in its speed, by absorbing energy from and restoring the same to the system. (See cut.)

726,963. Means for Preventing the Disturbance of Telephone Circuits. Carl J. A. Michalke, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed June 27, 1898.

Combined with a direct-current system of electrical distribution and a plurality of motors connected in parallel to mains of the systems are condensers connected respectively to the motors so as to be responsive to voltage fluctuations of the motors, the condensers thereby being adapted to dampen the effect of the small voltage or pressure changes of the direct current.

726,964. Central-energy Telephone System. Kempster B. Miller, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 26, 1900.

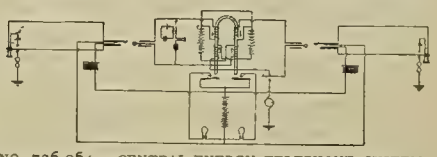
A number of telephone lines, each having a microphone connected directly in circuit at the sub-station, are combined with means for connecting any two of the lines together in pairs for conversation, a repeating coil interposed between the lines of each connected pair, and a pair of common sources of electricity at the central station, one source placed in circuit with each line of each pair and a winding of the repeating coil by the act of establishing the connection for conversation. (See cut.)

726,984. Telephony. William E. Pembleton, Wittenberg, Wis. Application filed June 19, 1901.

In a party-line telephone system are an automatic current generator in the primary circuit of each subscriber telephone, means constituting part of the telephone for automatically preventing cut-in of same when there is current on the line, and other means for short-circuiting the generator at will subsequent to a cut-in of the telephone to divert current temporarily from the line to permit the cut-in of another telephone called by the one aforesaid. (See cut on next page.)

726,987. Motor Controller. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 2, 1899.

The electric controller described has a series of operative positions or steps, means for causing a sudden movement of the movable member of the controller as it is moved from step to step, and means for positively preventing a rapid movement of the member through a series of steps.



NO. 726,964.—CENTRAL-ENERGY TELEPHONE SYSTEM.

727,015. Self-lubricating Bearing for Trolley Wheels. Charles E. Stanley, Canton, Ohio. Application filed December 16, 1901.

A self-lubricating bearing for trolley wheels is described.

727,021. Trolley. William S. Stockton, Philadelphia, Pa. Application filed March 13, 1902.

Improvements in mechanical details are described.

727,023. Electrical Jacquard Mechanism for Looms. Jan Szczepanik, Vienna, Austria-Hungary, assignor to Société des Inventions Jan Szczepanik & Co., Vienna, Austria-Hungary. Application filed September 24, 1900.

In the mechanism combined with the needles and needle board, are a series of stationary magnets arranged to

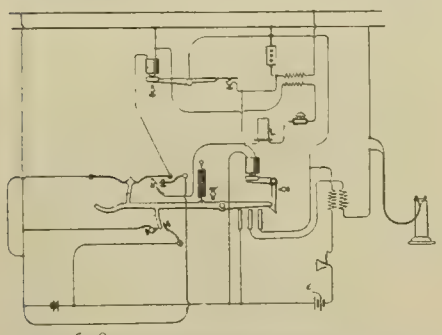
operate the needles, a contact, a flat electrical card, and a series of fingers adapted to receive a slight rotation by reason of the passage of the card thereunder, each in electrical connection with a magnet and arranged to touch the card.

727,031. Electric Conductor or Cable. Francis Tremain, Highgate, England. Application filed April 24, 1902.

In the cable are a multiple induction-coil consisting of coils formed of one or more lengths of wire the coils being threaded on a core wire or wires on which core-disks are also threaded between the coils, and longitudinal wires or strips attached to or threaded through the disks and fastened at a distance from their ends to end rings, thus forming a flexible cage or housing in which the coils are enclosed.

727,041. Index Needle or Pointer for Electrical Measuring Instruments. Edward Weston, Newark, N. J. Application filed May 7, 1902.

The needle has one or more counterweights integral therewith.



NO. 726,984. PARTY-LINE TELEPHONE SYSTEM.

727,060. Telegraph Apparatus. John C. Barclay, New York, N. Y., assignor to the Western Union Telegraph Company, New York, N. Y. Application filed January 10, 1903.

Combined with a line conductor are two transmitters having each two contacts, one of which is closed when the other is open, two direct-current generators, one for each of the transmitters, having opposite poles connected to ground, and commutating means connected to both contacts of each transmitter, to both generators, and to ground, arranged to connect one contact of each transmitter, to its respective generator and the other contact to ground, at intervals, and so to connect the contacts of the two transmitters in alternation. (See cut.)

727,063. Jail. Otto W. Becker and William G. Stuelpnagel, Milwaukee, Wis.; said Stuelpnagel assignor to Becker. Application filed March 15, 1902.

An automatic signaling system is part of the invention.

727,064. Circuit-closer. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed January 2, 1903.

In the mechanism are an insulated trolley wire support, a trolley wheel flanked by insulated disks, contacts in engagement with the disks and connected with a controllable circuit on the car, and terminal contacts on the support engaging the disks.

727,068. Collector for Electric Tramroads or Railroads. André Bolzano, Munich, Germany. Application filed December 23, 1902.

One claim reads: In an electric railway, the combination of a slotted conduit, a conductor within the conduit, a movable contact extending into the conduit to bear against the conductor therein, and a mixture of vaseline and glycerine filling the conduit.

727,077. Apparatus for Locating Metals, Minerals, Buried Treasures, etc., Without Digging. Fred H. Brown, Los Angeles, Cal. Application filed February 28, 1902.

A box rigidly attached to the fixed terminal contains the circuits of the Wheatstone bridge, and the other circuit terminal is independent of and freely movable with respect to the fixed terminal.

727,089. Printing Telegraph. Henry Casevitz, Paris, France. Application filed October 10, 1901.

Electromagnets are used in the operation of the drum.

727,095. Method of Utilizing Calcium-carbide Refuse and Product Thereof. George E. Cox, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed September 3, 1902.

The method consists in interposing a body of the refuse between electrodes of higher conductivity than the refuse, and passing between the electrodes an electric current of sufficient amperage to convert the body into an ingot.

727,097. Automatic Door-closing Mechanism. William A. Cross, Chicago, Ill. Application filed June 20, 1902.

An electric-operating mechanism for elevator hatchway doors is described.

727,101. Ozone Generator. George L. Curtis, New York, N. Y., assignor to Edward C. Goodwin, Worcester, Mass. Application filed January 17, 1903.

The generator comprises an open-ended shell, an exhausted tube mounted within and insulated from the shell, a metallic cap on one end of the tube, electrical connection with the cap, and a handle fastened to the shell.

727,117. Reversible Galvanic Battery. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed October 3, 1902.

The battery employs an alkaline electrolyte and one electrode contains finely divided metallic iron or an oxide thereof mixed with copper and flake graphite.

727,118. Process of Manufacturing Electrolytically Active Finely Divided Iron. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed October 21, 1902.

The process consists in reducing an iron compound by hydrogen in the presence of heat, and then flooding the reduced mass with water to prevent atmospheric oxidation.

727,124. Motor. Harleigh Gillette, Chicago, Ill. Application filed July 17, 1902.

An electromagnetic vibrating device is described.

727,147. Automatic Operating Mechanism for Electric-railway Switches. Gray W. Johnston, New York, N. Y. Application filed July 16, 1902.

A conductor extension is located between and in line with the sections of a sectional conductor, and an electromagnet is provided for operating the switch.

727,150. Adjustable Hanger for Incandescent Lamps. Peter P. Keller, Knoxville, Tenn. Application filed June 18, 1902.

The hanger has a revoluble drum with a suspending cord extending through the casing.

727,182. Armature-winding Apparatus. Fred P. McBerty, Warren, Ohio, assignor to the Peerless Electric Company, Warren, Ohio. Application filed July 7, 1902.

In the apparatus are a single chuck having means for clamping the opposite ends of the armature shaft, mechanism for rotating the chuck and a wire-guide for leading the wire to the armature.

727,206. Electric Switch. Vernon Royle, Paterson, N. J. Application filed March 4, 1902.

The switch has a skeleton plate provided with fastening arms projecting from one side and a spring-supporting arm projecting from the opposite side with a binding post at the hub of the plate.

727,227. Electric Railway. Clendinen A. Thompson, New York, N. Y. Application filed February 4, 1903.

The conducting rail and its insulated support have a guard or hood for partially inclosing the rail.

727,276. Motor Vehicle. Thomas L. Boyle, Ogden, Utah. Application filed November 14, 1902.

The motor comprises a magnet with inner opposing concaved terminal surfaces, and an armature provided with segmental curved plates rotatable between and in close proximity to the curved surfaces and having a co-operating commutator.

727,315. Thermal Electric Fire Alarm. Thomas B. Duncan and Francis A. Duncan, Newberg, Ore. Application filed March 6, 1902.

In the alarm are combined a thermic cell, a contact point movable therewith, a combined contact lever and indicator arranged in the path of the contact point, both the contact point and lever being included in an electric circuit, and a regulating device associated with the contact lever also included in the circuit.

727,325. Transmission and Receipt of Signals. Reginald A. Fessenden, Allegheny, Pa. Application filed June 2, 1900.

The method described consists in generating electromagnetic waves of a predetermined electrical frequency in groups of a predetermined frequency lower than the frequency of the waves forming the groups and producing indications or signals at the receiving station by selecting groups of the predetermined frequency.

727,326. Selective Signaling by Electromagnetic Waves. Reginald A. Fessenden, Manteo, N. C. Application filed August 27, 1902.

Radiating and receiving systems have one or more elements in common and a receiver is so related to the systems as to be responsive to electromagnetic waves received at the station, while at the same time unresponsive to effects produced by the generation of electromagnetic waves at the station.

727,327. Receiver for Electromagnetic Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed September 27, 1902.

At the receiving station are a receiving conductor, a step-down transformer in operative relation to the conductor, two carbon bodies in contact with each other in series with the secondary of the transformer, and an indicating circuit also including the carbon bodies.

727,328. Receiver for Signaling. Reginald A. Fessenden, Fort Monroe, Va. Application filed December 29, 1902.

An imperfect contact receiver for signaling has in combination two parts or members each having a uniform surface, means for moving one of the surfaces relative to the other, and an indicating mechanism adapted to respond only to impulses of a predetermined frequency.

727,329. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed March 14, 1903.

The method consists in generating electromagnetic waves at a station, producing intelligible indications by such waves at the desired station, and neutralizing the effects of such waves on the receiving mechanism at the transmitting station.

727,330. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Fort Monroe, Va. Application filed March 21, 1903.

This method consists in varying the character of radiation periodically at a rate independent of the natural periodicities of the system.

727,331. Receiver for Electromagnetic Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed April 9, 1903.

The receiver has a small heat capacity and consists of a small quantity of liquid.

727,360 and 727,361. Electrical Water Heater. Harry M. Hill, St. Louis, Mo., assignor to the Hill Electrical Manufacturing Company, St. Louis, Mo. Applications filed March 31, 1902, and May 10, 1902.

The heater combines an outer electrode, an inner electrode therein, both having water passages therethrough, and a discharge shell surrounding the electrodes, forming therewith a water channel between the outer electrode and the shell.

727,381 and 727,382. Means for Prevention of Weakening Propeller Shafts by Electrolysis. Adolphus A. Knudson, Brooklyn, N. Y. Applications filed April 5, 1902.

Combined with a tail-shaft for a marine propeller are a closely adherent and impermeable covering of a different metal from the shaft, and liners of the same or substantially the same polarity as the covering, and separated from the tail-shaft by the covering, for the prevention of electrolytic action between the tail-shaft and liners.

727,411. Alternating-current Motor. Fred P. McBerty, Warren, Ohio, assignor to the Peerless Electric Company, Warren, Ohio. Application filed June 30, 1902.

In the motor combined with the armature is starting mechanism comprising means for setting the armature in rotation, and a motor switch connected to the starting mechanism so as to be moved to operative or inoperative position thereby.

727,429. Electric Stop Motion for Knitting Machines. Arthur L. Patterson, Albemarle, N. C. Application filed October 30, 1902.

An electric circuit is arranged to be closed by the movement of the resilient arm when released from the yarn, and an electromagnetic stop mechanism has its electromagnet connected in the circuit.

727,457. Apparatus for the Continuous Practice of Electrolytic Processes. Pedro G. Salom, Philadelphia, Pa. Application filed September 17, 1902.

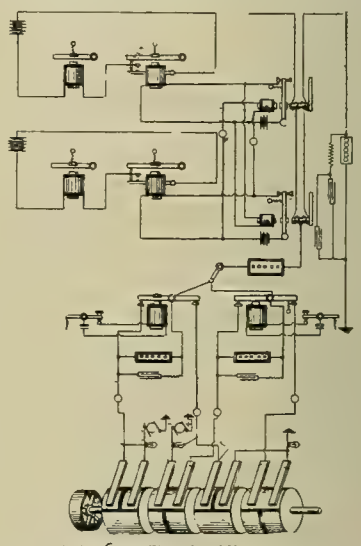
In an electrolytic cell are means for evenly spreading over the surface of one of the electrodes, without interruption of the process, a coating of a material which is to be acted upon or transformed by the electrolysis.

727,468. Electric Curling Iron. Murray Shepherd, Salt Lake City, Utah. Application filed April 29, 1902.

A pair of conducting wires have their terminals arranged within and out of circuit with the hollow member of the curling iron. There is resisting material between the terminals. The wires extend through the hollow handle and have their outer ends connected with contacts arranged at the end of the handle opposite the hollow member.

727,471. Combined Electrolytic and Mechanical Interrupter. Horace R. Smith, Altoona, Pa. Application filed July 25, 1902.

The invention comprises an electrolytic interrupter capable of acting as a condenser and a mechanical interrupter, the interrupters having independent periods of interruption and being normally connected together in series, and means controllable at will for connecting the interrupters in parallel.



NO. 727,060.—TELEGRAPH APPARATUS.

727,478. Electric Switch. John L. Steeb, Butler, Pa., assignor of two-thirds to William M. Carnahan, Pittsburg, Pa., and Frank M. Megogney, Elizabeth, Pa. Application filed August 30, 1902.

A pair of spring-pressed shoes are pivoted to the fender of a car. A switch is located on the car, and electrical connections are provided between the switch and the shoes whereby the circuit is completed through one of shoes and one of the contacts to one or the other of the electromagnets to operate the switch tongue.

727,496. Plate for Electric Accumulators. Donato Tommasi, Paris, France. Application filed August 3, 1901.

The plate has strips spaced apart for holding active material, divers of the strips being provided with tubular eyes integral therewith for permitting the electrolyte to circulate through the plate.

727,501. Stop-motion Mechanism. Louis D. Wade, Cedartown, Ga. Application filed October 16, 1901.

An electric stop-motion device is described.

727,525. Electric Battery for Body Wear. Richard Wingren, Burlington, Kan. Application filed February 16, 1903.

The battery has an inflexible plate element formed integrally with a widened loop at one side.

727,549. Cathode Holder. Joseph Matthews, Birmingham, and William Davies, county of Worcester, England. Original application filed March 29, 1901. Divided and this application filed April 21, 1902. Renewed March 5, 1903.

A cathode holder for electrolytic purposes is characterized by the lower extremity of the cell-like laterally open cathode holder being provided with a trough-like receptacle to receive the metal falling from the cathode.

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Latest Developments in Central-station Engineering in Chicago.

To the student of electrical progress the development of the central-station industry in a large city like Chicago is a subject of absorbing interest. The marvelous growth of the business of supplying electric light and power, the difference in the size and type of the machinery used in the generating systems of, say, 1891 and 1903, the automatic methods of handling coal and ashes, the evolution of transmission and distribution systems, the appearance of the alternating current for local transmission and the introduction of the rotary sub-station, the increased use of the storage battery, the greatly augmented complexity of all financial, administrative and engineering problems involved—these are some of the characteristics of the history of electric lighting in any large city of the United States, and particularly in Chicago, during the last dozen years.

As readers of the Western Electrician are aware, the central-station industry of Chicago is in the hands of the Chicago Edison Company and the Commonwealth Electric Company. A number of articles have appeared in this journal, from time to time, descriptive of the growth and development of the plants of these companies. In the New Years issue of 1902 the Western Electrician described the installation of the first of three very large reciprocating-engine and alternator units which were being placed in the Harrison Street station of the Chicago Edison Company, and also mentioned other additions and extensions of the two companies. This was followed later in the year by a description of the large new Randolph Street rotary-converter sub-station. It is the present intention, in a survey of the whole interlaced systems of the two companies, to bring the description up to date, with some reference to radical innovations in the design of the Fisk Street station that have attracted widespread attention.

Harrison Street Station.

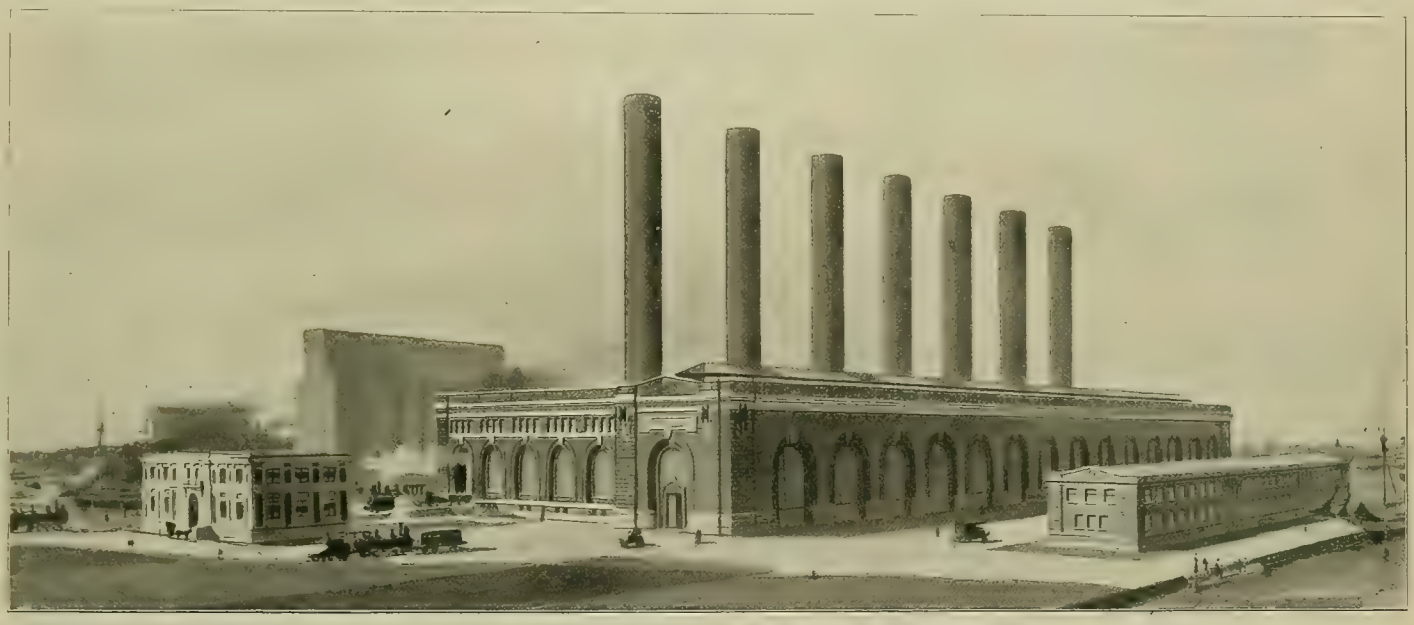
Ten years ago the Harrison Street station of the Chicago Edison Company, which supplies current to both the Edison and Commonwealth companies, and is now the largest generating station in the city, was first put into operation. At that time it was considered that this station would be large enough to supply the companies' demands for many years to come. There was then installed a total of seven boilers and 10 engines, the engine capacity being considerably in excess of the company's maximum demand. During the 10 years that has passed, the original building has not only been filled up with a type of generating units entirely different from that originally contemplated, but every inch of ground has been covered with additions, until now the plant has an overload capacity of about 10,000 kilowatts, not including the storage battery on this particular property, which has a capacity of 17,000 ampere-hours at the rate of eight hours' discharge. Fig. 2 is a diagrammatic plan of the Harrison Street station, showing the additions since its original installation. It gives an interesting commentary on the growth of the system.

During the last year there have been some improvements and additions to the Harrison Street plant. The boiler capacity has been increased by the addition of four new Babcock & Wilcox boilers located in an addition on the south side of the original engine room and on the opposite side of building from the original boiler room, as shown in Fig. 3, which is a view taken from the southeast, and which indicates that the entire property is now covered by buildings. These additional boilers meant an entirely separate boiler room with separate facilities for handling coal and ashes. The four new boilers each have 5,000 square feet of heating surface and are equipped with Babcock & Wilcox chain-grate stokers. The steam piping is so arranged that these four boilers supply a separate header which, in turn, is connected with the main steam header in the original boiler room. From this separate header the connections are made to the engines in what is known as the annex engine room. The new stack, which is the fifth in the building, will, when completed, be 170 feet high. There is also in process of erection a new 32 and 64 by 60-inch vertical cross-compound Allis-Corliss engine running at 75 revolutions per minute. This will be direct-coupled to a 40-pole, 1,800-kilowatt, 25-cycle, revolving-field, 9,000-volt General Electric alternator. The condensing equipment for this unit consists of a jet condenser and a 24 and 48 by 24-inch Dean air pump.

The high-tension switching apparatus is being considerably enlarged and improved to take care of the increased generator capacity and the increased number of transmission lines from this plant. When completed, the generator and feeder oil-switch equipment will be divided and installed in three entirely separate and independent fireproof rooms, the arrangement of generator and feeder connections being such that the 9,000-volt generators can be run in a number of independent sections or all in multiple. Moreover, the isolation of this apparatus is such that it is practically impossible for the entire 9,000-volt system to be shut down, no matter what the accident might be.

Washington Street Station.

This station (at Washington and Market Streets) was designed originally for a large number of series arc machines and some small 500-volt and single-phase generators, driven from three lines of shafting. It has been increased and rearranged, so that it now has a rated capacity of 4,500 kilowatts in direct-coupled generators feeding into the Edison network. This consists of one 1,500-horsepower and four 600-horsepower tandem-compound Southwark engines, driving 300-volt and 150-volt direct-current generators. Two of the 600-horsepower and one 1,000-horsepower Williams engines formerly driving line shafting have been equipped with direct-coupled direct-current generators. Work of similarly equipping another 600-horsepower Williams engine is under way. Within a few weeks the last remaining portion of the line shafting will be shut down, the series arc having been replaced by constant-potential lamps, the few remaining 500-volt generators being driven by 250-volt motors and the single-phase alternating-current load transferred to new frequency-changing motor-generator sub-stations. This transformation to direct-coupled units delivering current to Edison network exclusively will probably mark the beginning of the last chapter in the history of one of the pioneer stations of Chicago, as the Washington Street plant was originally the station of the old Chicago Arc Light and Power Company.



Office Building. Boiler House and Turbine House. Switch House.

FIG. 1. LATEST CENTRAL-STATION DEVELOPMENTS IN CHICAGO.—FISK STREET STATION, NOW BUILDING, AS IT WILL APPEAR WHEN COMPLETED FOR ULTIMATE CAPACITY OF 70,000 KILOWATTS.

Rapid Growth of System.

How necessary were the additions at Harrison Street and how the demand on the company's generating capacity has increased may be noted by the following figures, which show the increase in maximum demand and total kilowatt-hour output on the system from 1898 to 1903:

Years.	Increase in Maximum Demand. Per Cent.	Increase in Kilowatt-hour Output. Per Cent.
1903 over 1902	35.6	43.5
1902 over 1901	49.5	24.5
1901 over 1900	28.2	17.2
1900 over 1899	15.1	19.4

THE FISK STREET STATION.

A careful consideration of these increases and an estimate of the probable future rate of increase made it apparent that additional generating capacity should be supplied, and that the addition should not be a small one and a temporary expedient, but should be of considerable magnitude and of such capacity as to provide for any great amount of increase that might take place in the next few years. The situation was thoroughly canvassed and studied in every detail. A number of locations were considered, and finally a site was secured on the South Branch of the Chicago River near Fisk and Twenty-second Streets, as indicated by (18) in Fig. 4. This site is about 3½ miles from the electric center of the total load of the two companies, which is a point that is continually shifting, but is within two blocks of the intersection of

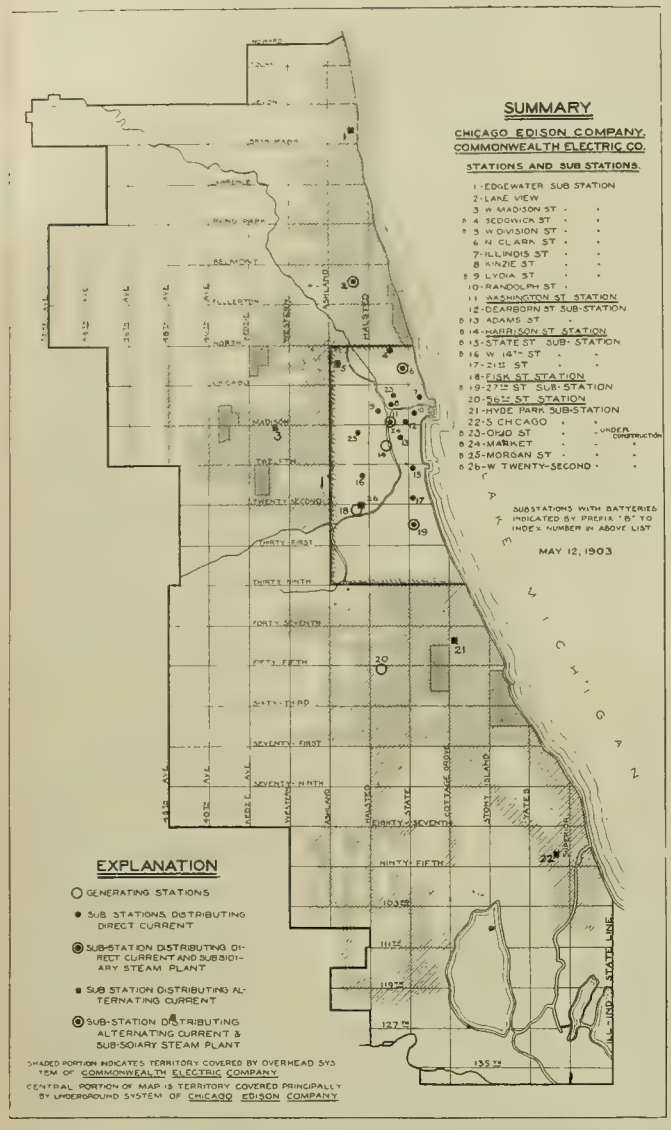


FIG. 4. GENERAL MAP OF CENTRAL AND SUB-STATIONS IN CHICAGO.

Clark and Monroe Streets. The property secured consists of about 14 acres of ground, divided into two portions, as indicated on the map, Fig. 5. The larger portion, consisting of about 13 acres, is situated on the north bank between two slips of the river, which at this point runs almost in a westerly direction. The smaller portion is located directly opposite on the south bank of the river.

On this site the Commonwealth Electric Company decided to erect a central generating station that should be of ample capacity and which should embody the most modern ideas in central-station practice. A very important consideration in the location of the plant at this point was the fact that the real estate was secured where it was commercially feasible to adopt the very best arrangement of apparatus that could be had, the supply of condensing water and facilities for handling and storage of coal also being excellent. No pains were therefore spared to design the station in all its details, so that the highest possible coefficient of reliability could be obtained. The result is that the station as now being constructed will embody features which in some instances will mark a radical departure from the ordinary central-station practice, but which, on the other hand, have been very carefully thought out and sanctioned by the best of engineering ability. A general perspective view of the new station as it will ultimately appear, looking southeast, is given in Fig. 1. On the left is represented an office building that may eventually be built and on the right the switch house.

General Characteristics of Fisk Street Station.

After the subject had been worked over pretty thoroughly, it was finally decided to design a plant which would ultimately contain 14 turbo-generator units, rated nominally at 5,000 kilowatts each. This building would be divided into seven bays, each containing two units, as shown in Fig. 5. The first two bays are now under construction. The building, however, is so designed that in case it is later found advisable, reciprocating engines can be installed in the remaining five bays. This would mean that the engine room, or turbine house, as it is called, would have to be widened somewhat, but there would be no change in the boiler-house portion or in the height of the roof of the engine-room portion.

The development of the system of high-potential generation and transmission has been such that by next fall the Edison and Commonwealth companies will have in service about 60 miles of 9,000-volt, three-phase, 25-cycle transmission lines. This will supply current to sub-stations aggregating about 24,000 kilowatts in rotary converters and about 4,000 kilowatts in frequency-changing motor-generator sets.

The experience in Chicago and other large cities has demonstrated that there is a practical limit to the amount of high-tension cable which at time of heavy load should be operated in parallel as a single interconnected network. The extension of the transmission and sub-station system during the last two years has been carried on with the idea that at a very early date the system would be sectionalized, and, furthermore, that the new Fisk Street station could be arranged so that the units could be operated independently. So completely has this been worked out, that, beginning with an independent coal conveyor, boilers, steam piping, generating units and condensing plant, sectional bus-bar and separate transmission lines from each unit feeding sub-stations, there may be absolutely independent operation of every link between coal pile and interconnecting street mains or direct-current sub-station bus-bars. Moreover, all the large sub-stations are supplied from at least two different generating units.

This plant, therefore, consists essentially of 14 plants of 5,000-kilowatt rated capacity each, located end to end. It secures, therefore, all the advantages of a large plant in having a minimum of unproductive labor involving less unproductive investment, securing a very economical and reliable arrangement in the handling of coal and condensing water. By independent or sectional operation it also secures practically all of the advantages that might be claimed with the use of a number of smaller plants.

Description of Fisk Street Station Building.

The building, as shown in the plan, Fig. 5, is divided into three sections—the boiler house, with batteries of boilers extending east and west; the turbine house at the west of boiler-house section, extending north and south, and the coal-receiving house on the east of the boiler house, extending north and south, thus forming a unit of construction of the batteries of boilers, one generating unit and the coal-handling machinery, in the direction of east and west—this unit to be repeated in the direction of north or south, as requirements may demand, for additional capacity. The completed building will be 600 feet long and 230 feet wide. The exterior of the

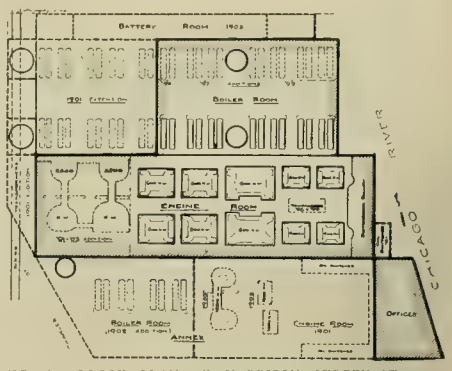


FIG. 2. BLOCK PLAN OF HARRISON STREET STATION, SHOWING ACCRETIONS.

building is designed in red pressed brick with cut-stone trimmings. There are large window openings, designed in ornamental iron, with pivoted sash for complete ventilation.

The interior of the boiler house is designed with glazed brick and terra-cotta wainscoting eight feet high, the balance of the walls being of pressed brick. The coal-receiving shed, being open to the

FIG. 3. HARRISON STREET STATION OF CHICAGO EDISON COMPANY.

outside weather, through the large arched openings, is finished in red pressed brick, the same as the exterior walls of the building.

The turbine house is finished in glazed brick and terra cotta from floor to ceiling, with ornamental terra-cotta architraves to all openings, and with pilasters and ornamental string courses forming an

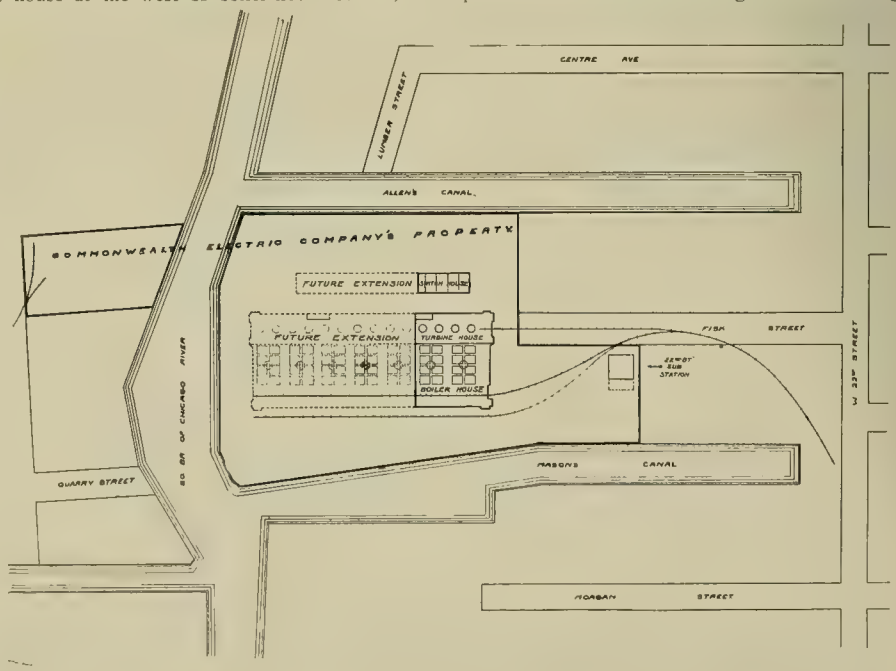


FIG. 5. MAP OF FISK STREET PROPERTY.

architectural treatment. The floor is to be laid in vitrified German tile, of small size, laid in pattern to give a general mosaic effect. On each side of the turbine house there is a narrow gallery extending the full length of the room, constructed of ornamental iron, and with tile floors. The switchboard gallery is two stories in height, with ornamental staircases, switchboard frame, etc.

The main entrance to the turbine house is of such design as to allow of a car being run into the room for the delivery of machinery, and unloaded by the cranes, which travel the full length of the room.

The group of illustrations shown in Figs. 6, 7, 8 and 9 is of construction views of the station taken at intervals during the last four months. Fig. 7 is a view taken on February 13th and shows the steel skeleton framework of the building, with the turbine house on the left. Fig. 8 was taken on March 8th and represents the north end of the structure. Figs. 9 and 6 are birdseye views of the station, taken, respectively, on April 16th and May 8th. The latest one shows foundations for walls and columns and gives a good idea of the extension of the building.

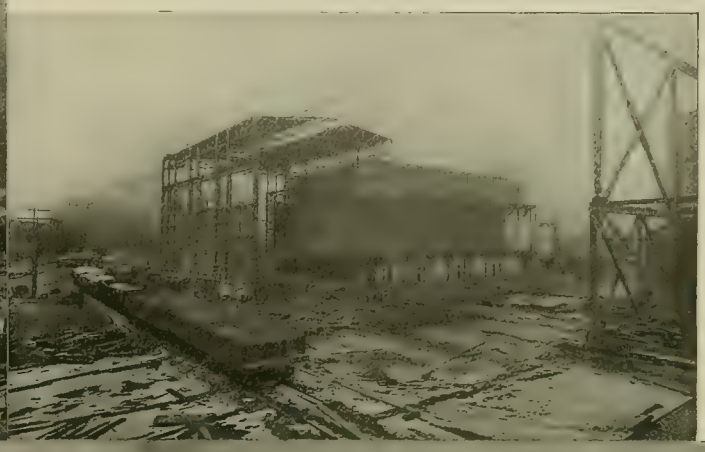


Fig. 6. Taken May 8, 1903.
Fig. 8. Taken March 12, 1903.

Fig. 7. Taken February 13, 1903.
Fig. 9. Taken April 16, 1903.

VIEWS SHOWING FISK STREET STATION UNDER CONSTRUCTION.

Boilers.

The arrangement of the steam plant is such that eight boilers constitute one unit of boiler house, and are set up on a line at right angles to the line of turbines, that is, eight boilers directly opposite each turbo-generator unit. This is a radical departure from the conventional method of setting lines of boilers parallel to the line of engines. In this particular installation all boilers are set on one floor, this floor being on a level with the floor of the gallery that passes around the turbine room. The boiler-house units at each end of the plant will have an independent firing space. In all the intermediate units a single firing space will be common to two rows of boilers. Each boiler-house unit consists of eight Babcock & Wilcox water-tube boilers having 5,000 square feet of heating surface and equipped with super-heater and Babcock & Wilcox engine-driven stoker. The boilers generate steam at 175 pounds' pressure with 150 degrees of superheat. One of these sets of boilers is now practically completed, as may be seen in Fig. 10. There will be one stack for each two boiler-house units, making a total of seven stacks for the completed plant. These stacks are 205 feet high above the boiler-room floor and 18 feet in diameter.

Coal Handling and Storage.

Coal is brought into the building in hopper-bottom cars and is dumped into a hopper leading to a coal crusher, which delivers to a main conveyor, this in turn delivering coal to the coal bunkers located above the boilers. There is a separate crusher and conveyor for each boiler-house unit. The coal conveyors are being installed by the John A. Mead Manufacturing Company, the well-known McCaslin gravity buckets being used. The ash pits are located directly beneath the chain-grate stokers, and are so arranged that they deliver directly into the main coal conveyor, which also delivers ashes to a large ash hopper at the end of each boiler-house unit and directly above the railroad tracks. An auxiliary fine-coal hopper is also arranged under the front of each boiler to receive any fine coal that would otherwise frequently find its way either to the boiler-room floor or to the ash pit. All of this fine coal can be delivered to the main coal conveyor and again dumped into the bunkers above.

About eight per cent. of the total cubical contents in this building is devoted to coal storage. Coal capacity is provided for about 1,000 tons for each set of eight boilers, or 14,000 tons for the completed station.

The facilities for storing coal at this new site are excellent. Railroad connections are made with the property on both sides of the river, as shown in Fig. 5, and coal can also be carried there by boat.

During the last year, on account of the coal strikes, this matter of storing large quantities of coal was one of vital importance, and on the plat of ground on the south side of the river the company stored a very large amount. This coal was unloaded from the cars and then loaded again on flat boats and delivered to the Harrison and Washington Streets stations, both of which are located on the river. On the property on the north side of the river coal can be stored in bulk, or a considerable amount of trackage can be provided so that coal can be stored in cars for a comparatively short time. Plans are under way for handling this coal from one side of the river to the other in the most economical manner. On the larger piece of property, where the station is located, the coal will be unloaded from boat or hopper-bottom cars spoken of above. These latter cars will run into the station on a special track that will extend the whole length of the building on the east side, passing by the ends of the various boiler-house units, and depositing the coal into the desired conveyor or crusher.

Steam Connections and Condensing Plant.

Each boiler-house unit has an individual steam header connecting directly with the corresponding turbine unit. This individual header is located in the basement and directly back of the boilers, and is enclosed in a separate room running the entire length of one boiler-house unit. Between each two adjacent individual headers there is a connection of sufficient capacity for carrying all the steam required for any one unit. These connections are also located in the basement of the boiler room. Remote-controlled motor-operated valves are used. The whole arrangement of boiler room and boiler-room piping is such that any accident would not be likely to effect more than one boiler-house unit.

The 14 5,000-kilowatt (General Electric) Curtis vertical turbines are located in the center of the turbine house, as indicated in Fig. 5. Steam from the boiler-house unit directly opposite is taken directly to the first-stage wheel of each turbine almost on a line with the individual headers. The exhaust from the second stage is carried directly to a condensing plant furnished by the Alberger Condenser Company, New York. Condensing water for the plant is taken from the east slip through a large concrete tunnel, and after passing through the surface condenser is discharged through another tunnel into the slip on the west side of the property. This, together with the fact that the current of the river is from east to west, makes a very considerable difference in the capacity of the condensing plant, as the condenser discharge flows into the river several hundred feet below the intake slip.

Reasons for Installing Steam Turbines.

Realizing the possibilities in the use of steam turbines in large central stations, the officials and engineers of the Chicago Edison and Commonwealth Electric Companies took great interest in the development of the turbo-alternators. The advantages of such units which appealed most strongly were:

First—Great saving in weight and floor space and

consequent reduction in cost of building and of foundations for generating units.

Second—Practically a straight-line economy, thus greatly improving the average 24-hour steam consumption.

Third—Simplicity of the generating unit, requiring a minimum of attendance.

After a careful investigation into the state of the art and prospective developments in this country and in Europe, a contract was finally entered into with the General Electric Company, calling for the delivery of 5,000-kilowatt vertical turbo-alternators.

FIG. 10. A ROW OF BOILERS AT FISK STREET STATION.

These units were not only the largest, but also the first vertical turbo-alternators contracted for in this country.

Description of Curtis Turbine.

These vertical units consist of the Curtis type of steam turbine, a general description of which was given by Mr. W. L. R. Emmet in a paper published in the Western Electrician on April 18th last. The 5,000-kilowatt units, the first of which is now being erected in the new Fisk Street station of the Commonwealth Electric Company, are known as two-stage turbines. After the steam is expanded in the nozzle, and subsequently the velocity abstracted by successive impacts with buckets on the first wheel, the steam passes through another set of nozzles and the process is repeated. Excessive peripheral speed is thus obviated, as there is no longer a necessity for moving the buckets at one-half the velocity of the jet, a necessary condition for attaining the highest efficiency with a single set of buckets. A factory view of the first of these units is shown in Fig. 11.

In the "Chicago units," as they are at present being called, there are three sets of buckets on each of the two wheels corresponding to the two stages. The size and arrangement of buckets are so proportioned for the particular rotative speed that the velocity is only partly taken out in the first stage, and what remains is practically all abstracted in the second stage. So low is the velocity of steam after leaving the second stage, that the exhaust opening was made as large as possible, and the surface condenser placed almost against the side of the turbine.

The governing is done by successive closing of nozzles, provision being also made so that each nozzle can be closed gradually in regular sequence and can be worked continuously at any position between full open and closed. The governor itself is the uppermost part of the unit, being located on top of the alternator and connected to the end of the shaft.

The steam consumption of these turbines is expected to be, under full load, somewhat better than that which can be secured from the best compound, condensing engines of the same capacity under test conditions. On account of the turbine having practically a straight-line economy, the steam consumption under actual operating conditions should be very much better.

In exterior dimensions the turbine unit is about 26 feet high and 16½ feet in diameter. It sets on a foundation about four feet above the floor, so the total height of the unit above the floor is 29 feet.

General Electrical Features.

The electrical equipment of the Fisk Street station will contain several distinctive features. In the entire design the experience of European as well as American stations has been carefully considered. While each of the different generating units will ordinarily be operated independently and supply three or four feeders, provision is made so that any unit can be connected in multiple with any other, or any unit can replace any other with reference to its group of feeders.

Each turbo-alternator, with its switching apparatus and connections to outgoing feeders, forms a separate unit by itself, and is either located distinct from the adjacent units or effectually separated therefrom by fireproof partition walls. The high-tension oil switches, current and potential transformers and all connections to feeders are located in a separate building, thus eliminating all high-potential apparatus and connections from the turbine house, except the individual generator leads, which take the shortest route under the floor to the west wall, and are carefully encased.

As the arrangement of bus-bars, oil switches, etc., is necessarily influenced by space available and involves some sacrifice in the steam or electrical portion of the plant, and sometimes in both, a separate building, known as the switch house, was provided.

Generators and Exciting System.

The electrical generating portion of these turbo-alternators is very similar to the five generators which are being installed in Power House No. 2 of the Niagara Falls Power Company. The generators have internal revolving fields, and the provision for ventilation is very good. Each machine has six poles and runs at 500 revolutions per minute. These alternators are guaranteed to operate at full rated load continuously, with a rise of temperature not exceeding 35 degrees C. in any part above the room temperature under normal conditions of ventilation. The inherent regulation of the machines is eight per cent. Each turbine generator will deliver normally 5,000 kilowatts of three-phase, 25-cycle current at 9,000 volts' pressure. The machines are wound with star connection and the neutral will be grounded.

An individual motor-generator exciter set consisting of a 75-horsepower induction motor mounted on the same base and shaft, with a compound-wound direct-current 125-volt dynamo of 50 kilowatts, will serve for exciting purposes and will be located at the west wall of the turbine house opposite each turbine generator. The induction motor will be connected to a 75-kilowatt, three-phase transformer of 9,000 to 230 volts' pressure, located in the switch house, so that only three-conductor No. 0000 cables of low pressure enter the turbine room. These three-conductor cables will be laid in vitrified duct.

There will be provided also two steam-driven exciters, each of 75-kilowatt capacity, with a storage battery of sufficient size.

All these different sources of supply for the excitation will be connected so that any exciter can be used to excite any one of the turbine generators. Provisions are also made to connect to the exciter bus-bars a rotary-converter sub-station of 4,000 kilowatts' capacity located on the same property, so that absolute continuity of current for the exciting of the turbine generator fields is secured.

From the connection boards on the turbo-generators 500,000-circular-mil lead-covered single-conductor cables with paper insulation carry the three-phase current to the switch house.

Switch House.

The switch house, when completed for all 14 units, will be a building about 460 feet long and 50 feet wide and will consist of a basement and two stories. The basement will contain the bus-bars, all high-tension connections and instrument transformers. On the first floor will be located the oil switches, exciter transformers and panels with supplementary indicating and recording instruments. The second floor will have a meeting room, lockers, toilet and bath and other accommodations for the turbine house employes.

Operating Gallery.

For the completed installation of 14 units there will be two operating galleries on the west wall of the turbine house, each serving for seven units. The first operating gallery will be located opposite the fourth unit. The gallery will be constructed of steel, marble and slate.

The lower story will be on the turbine-house floor and will contain office space for the chief engineer and his assistant. All turbine-house employes will pass through an adjoining room, which is at the entrance of a tunnel or passageway, running over from the switch house.

On the first floor, 14 feet above, on the same height as the main gallery, which runs around the whole turbine house, provision is made for the office of a load dispatcher, a toilet room and a small portable-instrument room.

On the floor above, and overlooking the whole turbine house, there will be one independent operating and instrument panel for each turbine generator, carrying instruments, switches, and all other necessary apparatus, as well for the generator as for the corresponding feeders or transmission lines.

In order to simplify the work of the switchboard operator as far as possible, all instruments which might be desirable for a control of the system, but which are not absolutely necessary for a safe operation, have been removed from the operating gallery and placed in the switch house, where special care can be taken for the attendance of the recording instruments and control of the overload devices.

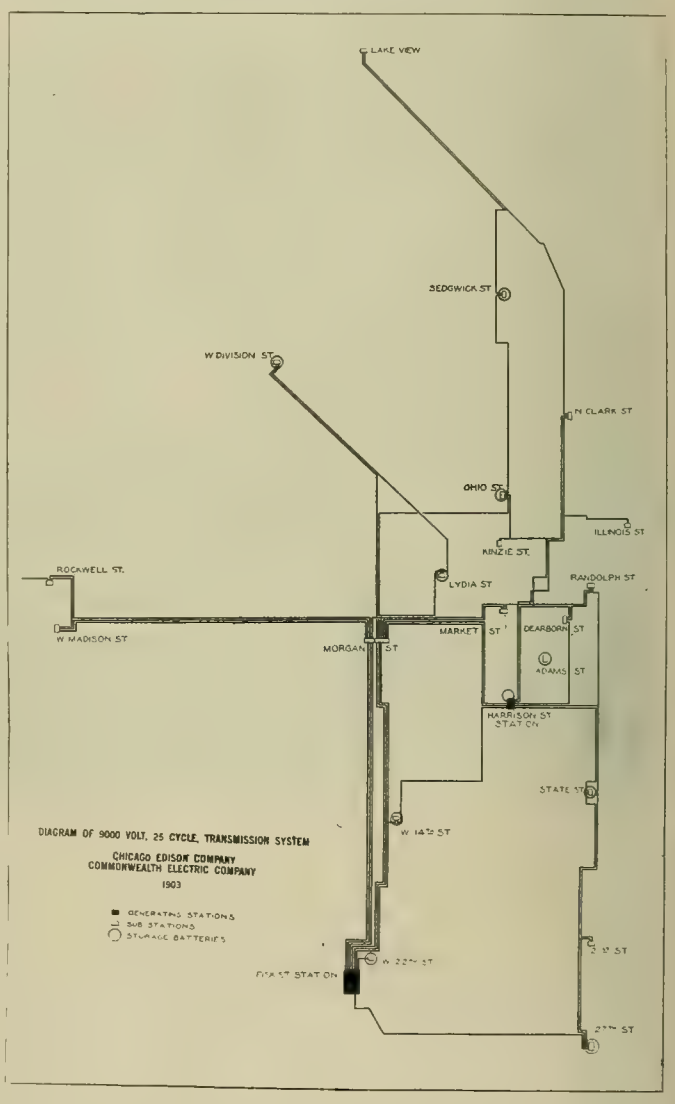


FIG. 12. ALTERNATING-CURRENT CENTRAL STATION TRANSMISSION IN CHICAGO.

Remote Control and Instrument Wiring.

All remote-control wires consist of multiconductor lead-covered cable, arranged so that cables belonging to one unit are absolutely separated from those belonging to another unit either by vitrified ducts, fireproof walls, or slate partitions. The whole remote control wiring has been designed so that no crossings at all are required in any place; therefore all cables come over to the switch house in just the same arrangement as they leave the operating gallery. The advantage of such a lay-out with reference to repairs or inspections is evident.

Transmission Lines to High-tension System.

The transmission lines or feeders to the high-tension system are so arranged that for the present there will be three lines connected through oil switches to each individual generator bus. The different generator buses can all be connected together by means of tie switches. In case of trouble, there will be two oil switches in series on generators and lines. The distribution of 9,000-volt 25-cycle lines between the different generating stations and sub-stations of the Edison and Commonwealth Companies, including the connections with the Fisk Street station, is shown in the diagram, Fig. 12.

Light and Power for the Station.

Careful consideration led to the decision to feed the whole light and power installation for the station itself by direct current from the Twenty-second Street sub-station, located on the same property with the Fisk Street power station, and not by alternating current. This arrangement requires, of course, a certain investment in converting apparatus of somewhat lower efficiency than alternating-current transformers, but, on the other hand, direct current appeared to be much more convenient for the running of different motors, and, owing to the use of a large storage battery, it was more reliable, so that the three-wire direct-current system was adopted.

Benefits for Employes.

Ample provision has been made for the comfort and convenience of the men employed at the Fisk Street station in the way of toilet, locker and bath rooms. All of the boiler-house employes will have quarters located directly above the firing space of the north boiler-house unit. The boiler-house engineer, who will be directly in charge of this vitally important part of the plant, will have an office here, and will thus be in close communication with the men. Ample facilities in the way of shower baths, etc., will be provided.

The turbine-house employes will have their quarters on the second floor of the switch house. Here will be located their locker and bath rooms, and also an especially equipped assembly room, which can also be used as a sort of reading room for the men. Every opportunity will be taken to provide for the comfort of the men and to encourage them in reading technical literature and improving their general efficiency.

Electric Launch.

After the Fisk Street property was secured and building operations were commenced, it soon became apparent to the officers of the company that better transit facilities than those afforded by street-railway lines would be very desirable in getting from the office building of the company on Adams Street to the property. As the site is located on the river it is easily accessible by boat, and an electric launch was therefore purchased to ply between the central part of the city and the new station. This launch, which has been named the Rotary, runs on a regular schedule from the foot of Quincy Street to the Fisk Street property and also makes stops at the Harrison and Washington Street stations of the Edison company. Department mail is carried to the stations. The launch is one of those used at the Pan-American Exposition and will seat about 20 people. It is provided with 44 Chloride cells of storage battery of 120-ampere-hour capacity and is propelled at five different speeds by a six-horsepower 88-volt motor. The launch can make four round trips a day on one charge. Fig. 13 is a view of the launch, with some of the officials of the company on board. The photograph was taken on March 9th, the day the corner-stone of the station was laid, and represents the party leaving the station.

Personal Mention.

The general officers and the engineering department of the Commonwealth Electric Company are entitled to great credit for their acumen, self-reliance and enterprise in launching an enterprise of such magnitude as the Fisk Street station, with so many new features—features, however, which have been indicated either by the past experience of the company itself or by the latest developments of engineering design generally. Among the contributors to this great work prominent mention should be made of the company's consulting mechanical engineer, Mr. Frederick Sargent (of the firm of Sargent & Lundy), who designed the very simple plan of the turbine and boiler house as well as the arrangement of the steam and mechanical portions of the plant, which are being installed under his general supervision, while the arrangement of the electrical plant is planned and the apparatus is installed by the company's permanent engineering staff. Shepley, Rutan & Coolidge, the architects, have designed a group of buildings whose massive proportions are emblematical of a great industrial purpose, but are still not ungraceful. As the Curtis steam turbine is so conspicuous a feature of the installation, a reference to the work of W. L. R. Emmet of Schenectady, whose untiring and well considered efforts in the face of many obstacles have had so much to do with the perfecting of that interesting type of apparatus, should be made.

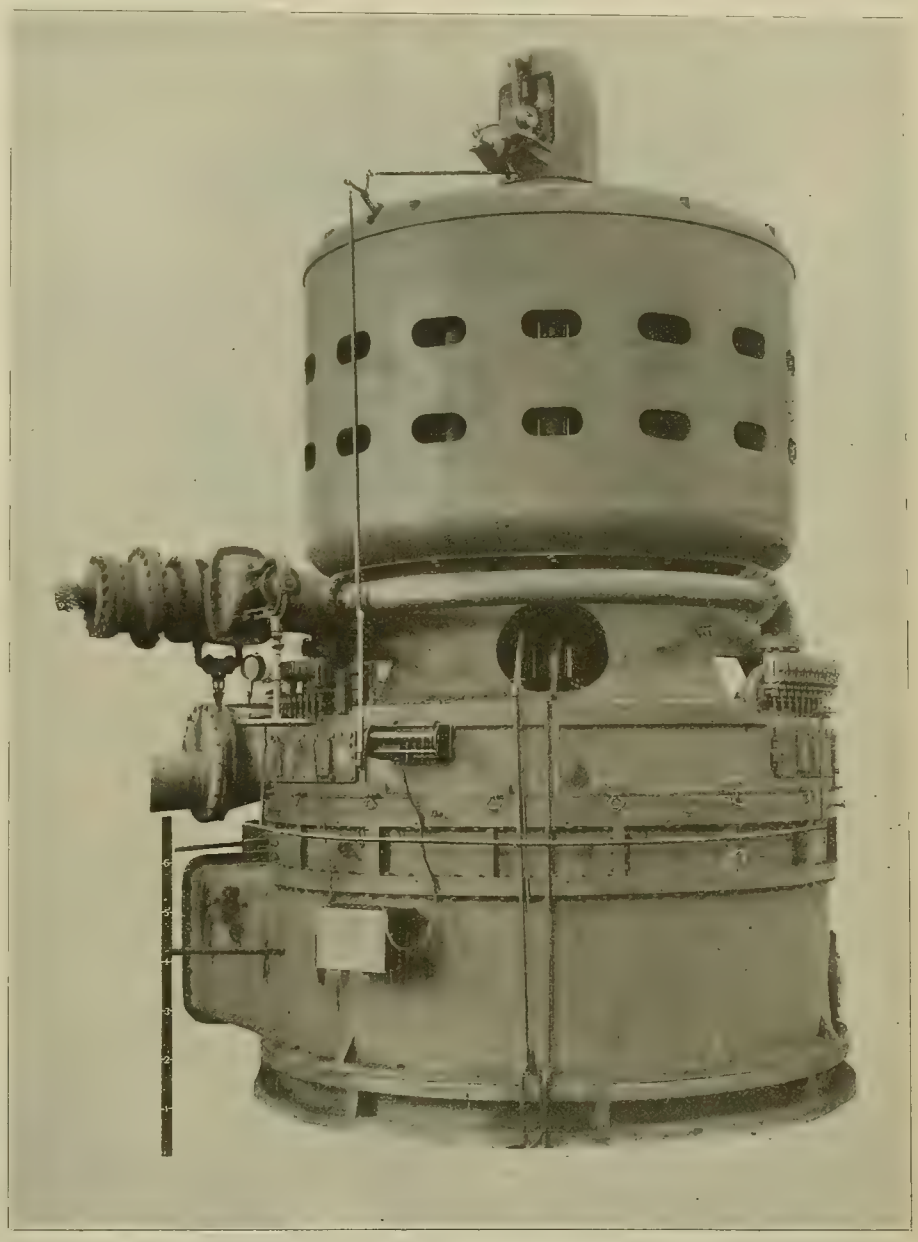


FIG. 11. 5,000-KILOWATT CURTIS STEAM TURBINE FOR FISK STREET STATION, CHICAGO.

All the electrical equipment of this station and of the new sub-stations, as well as the steam turbines, will be furnished by the General Electric Company, with the exception of the high-tension switches, which are of the General Incandescent Arc Light Company's manufacture.

COMMONWEALTH SUB-STATIONS.

West Twenty-Second Street Sub-Station.

The West Twenty-second Street sub-station of the Commonwealth company is located on the north end of the Fisk Street property, this being about 500 feet from the north end of the main generating station, as shown in Fig. 5. This sub-station was established for the distribution of direct current to the Edison three-wire system, from which is also supplied current for all lighting and general power in the Fisk Street station. This location being in the border line dividing the territory supplied by the Edison three-wire system and the 60-cycle overhead system, it was found advantageous to distribute both direct and alternating current from this point.

A one-story and basement building, 50 by 65 feet in area, is being designed. The basement will contain a storage battery consisting of 150 H-41 tanks.

On the first floor there will be located ultimately two 1,000-kilowatt rotary converters with accessories and switchboards and two 1,000-kilowatt frequency-changing motor-generator sets with the necessary switching apparatus. Direct current will be fed into this portion of the Edison system, and there will also be some special emergency connections to the Fisk Street station so as to secure the greatest possible coefficient of reliability for a continuous supply of current for lighting and general power, which is of very great importance in connection with this particular station. Sixty-cycle alternating current at 2,400-4,150 volts will be distributed to the extended territory west and south of the sub-station.

West Madison Street Sub-Station.

The alternating service of the Western District of the Commonwealth Electric Company is supplied from the West Madison Street sub-station. This station forms a part of a building comprising the offices of the Western District of the Commonwealth Company, the repair and sales department, and living rooms for one operator and one night troubleman. The building, illustrated in Fig. 14, is a thoroughly modern one, being fireproof and of brick and steel construction. The front of the building, which is three stories in height, is finished in red sand-mold faced brick and terra cotta.

The sub-station proper contains two 500-kilowatt frequency-changing motor-generator sets and two 50-kilowatt induction-motor exciter sets. These machines, together with the switchboards and the line switches, are on the first floor of the sub-station, as shown in Fig. 16. The basement, which extends the full length of the sub-station, contains 60-cycle and 25-cycle oil-switch buses. A 10-ton crane is also provided and so placed that all machinery can be easily handled. One of the 500-kilowatt frequency-changing sets will very soon be replaced with a 1,000-kilowatt set. The building can be extended to

accommodate two more 1,000-kilowatt sets, making an ultimate capacity of 3,500 kilowatts.

The function of the motor-generators is to convert the current which is supplied as 9,000-volt, 25-cycle, three-phase energy by transmission lines about three miles in length from the Harrison Street generating station of the Edison company, and eventually from the new Fisk Street station of the Commonwealth company, to 2,300-4,000-volt, 60-cycle energy for distribution. These frequency-changing sets are of the revolving-field type and each consists of two machines mounted on a common shaft with two bearings. The field of the motor has 10 poles and the field of the generator has 24 poles. The speed of these machines is 300 revolutions per minute.

FIG. 13. ELECTRIC LAUNCH ROTARY IN FRONT OF FISK STREET STATION.

Two transmission lines are brought into the station—one a No. 0000 and the other No. 00, the transmission being entirely underground from the Harrison Street station to this point. One of these lines is continued from the station, supplying the Lake Street Elevated Railway sub-station (described in the Western Electrician of May 17, 1902) a short distance away. At the point where these three lines meet, in the station, two 9,000-volt buses are provided and all transmission-line ends are equipped with double-blade transfer knife switches, so that complete commutability is secured. The line feeding the sub-station is provided with a high-tension oil switch and is usually run on a separate bus.

All motor-generator sets are fed through three-pole double-throw oil switches installed in the basement.

The method of starting these sets is as follows: The first bus is made alive from the transmission line and the second, or starting bus, is fed from the first bus through a starting compensator which reduces the pressure from 9,000 volts to about 4,000 volts, three phase. The oil switch on the motor to be started is then thrown from the open position to the starting bus, and after the motor attains the highest speed possible on this bus it is thrown over to the 9,000-volt bus. The compensator supplying this bus is then cut out by an oil switch provided for this purpose. This method of starting has been adopted for both the larger synchronous motors of the frequency-changing sets and the smaller induction motors of the exciter sets. The double-throw oil switches which are used in this operation were built especially for this purpose, being of the double-break type and provided with two sets of solenoids, or operating mechanisms, one of which carries the switch from the open position to the starting, the other carrying it from the open position to the running, both being used when the transfer is made from the starting to the running. In the case of the motors of the frequency-changing sets the 9,000 volts is impressed directly on the armature but the armatures of the exciter sets are fed through three-phase transformers, which reduce the voltage from 9,000 volts to 230 volts, three-phase delta.

The method of synchronizing the motor-generators is perhaps an entirely new one, a special synchronizer being provided for this purpose. Briefly, this synchronizer consists of two parts, one of which indicates 25-cycle synchronism and the other 60-cycle synchronism. It is obvious that these machines must operate in synchronism on both the 25 and 60-cycle ends and, since the numbers of pairs of poles of the revolving field of the 25 and 60-cycle machines are not the same, the 25-cycle machines or motors may be in synchronism while the 60-cycle machines would be out of phase. This relation cannot be previously determined; therefore it became necessary to adopt a scheme, which, though it savors of the cut-and-try method, is rendered exact by the synchronizer. If one motor-generator is running and it be desired to start another, the machine is brought up to speed by the method previously described, and the field of the motor is closed, thus making the motor synchronous; and then the phase relation of the two 60-cycle machines is determined by the synchronizer. If the 60-cycle machines are not in phase the motor is slipped one pair of poles or as many pair of poles as is necessary to bring the 60-cycle machines into their proper relation, a marked dial indicating the number of poles to be slipped.

The generators are star-wound with a neutral tap brought out and connected to the bus of the three-phase system, the 60-cycle current being at a pressure of 4,000 volts between phases and 2,300 volts between any phase and neutral. The neutral on this system is grounded solidly, and single-phase feeders from one phase to neutral and three-phase four-wire feeders distribute the energy from the buses. The single-phase feeders supply the incandescent lighting circuits and the four-wire feeders carry a mixed load of light and power, the power load being tapped off from the three phases and the lighting load being connected between one phase to neutral. This is the well-known three-phase four-wire system that has been generally adopted by the Commonwealth company, and which was described in detail in the Western Electrician of April 12, 1902.

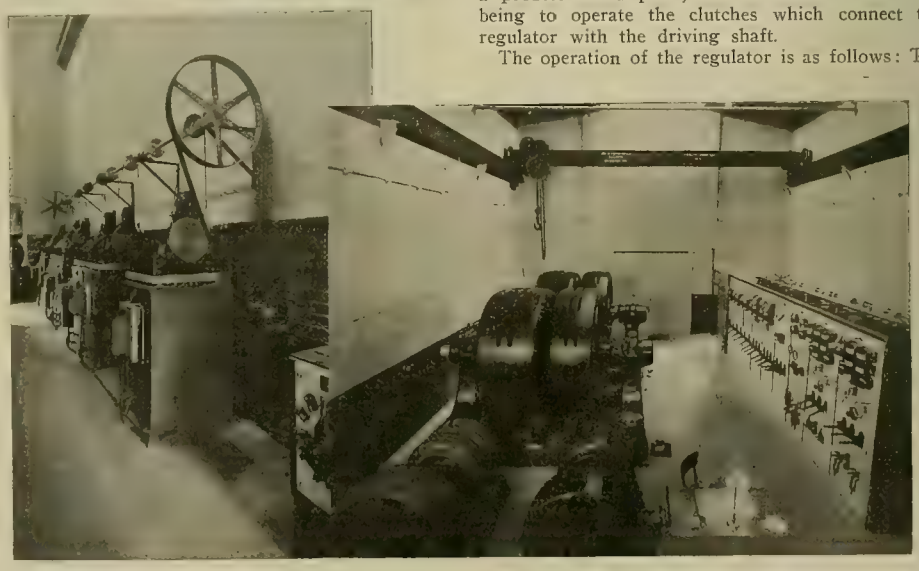


Fig. 15. Automatic Regulators. Fig. 16. General View.

INTERIOR VIEWS OF WEST MADISON STREET SUB-STATION.

The oil switch used on the generators deserves special mention. It consists of three independent elements, each or all of which can be connected by means of magnetic clutches either automatically, as in the case of overload, or at the will of the operator, to a motor-driven shaft placed just before the switch. This arrangement obviates fuses and allows the machine to operate as a two-phase machine or a single-phase machine in case of a heavy overload on one phase only or on two phases of the machine, since only the element on the phase on which the overload occurs is opened by the overload.

Tie lines in the shape of four-wire feeders are brought in from two other 60-cycle stations of the Commonwealth company. All the 60-cycle feeders are provided with single-pole double-throw oil switches, and two buses are provided for the purpose of better balancing the load and for additional safety. One pole of each feeder is connected directly to the neutral bus without the intervention of fuses or switches of any kind. All instruments on these feeders are taken from the secondaries of pressure and current transformers provided for the purpose. The four-wire three-phase feeders are each provided with three spring-expulsion fuses and lightning arresters, as the 60-cycle distribution is an overhead system. The single-phase feeders are each similarly provided with one fuse block and lightning arresters and have in addition pressure compensators and automatic potential regulators. These regulators, shown in Fig. 15, have a capacity of 7½ kilowatts each and are very interesting mechanisms. They consist primarily of the regulator proper, which is really an auto-transformer with adjustable secondary, coils being cut in and out by a movable knife blade on a dial. The power to move this blade is furnished by a shaft driven by a motor. The other essential part of the regulator is a relay, which operates as the pressure rises and falls from a predetermined point, the function of this relay being to operate the clutches which connect the regulator with the driving shaft.

FIG. 14. WEST MADISON STREET SUB-STATION.

The operation of the regulator is as follows: The pressure compensators, arranged for ohmic and inductive drop, are so set as to give a reading on the feeder voltmeters which is equal to the pressure at the center of distribution, thus obviating pressure wires. A standard voltage having been predetermined, it is necessary to maintain this voltage, and any departure therefrom is taken account of

by the relay, which is connected in multiple with the voltmeter. The variation of pressure causes the relay to energize a direct or reverse clutch, which connects the dial switch with the driving shaft. The knife blade on this dial switch is then carried around the dial, cutting in or cutting out coils of the secondary of the auto-transformer, thus raising or lowering the pressure according to the direction of its travel.

This sub-station has been in operation for about six months, and while a great deal of this apparatus was gotten out on development orders, the purpose of the apparatus seems to have been admirably ful-

FIG. 17. SEDGWICK STREET SUB-STATION.

filled and no serious difficulties have been encountered, notwithstanding anticipated possibilities of trouble.

Induction-motor sets were chosen for exciting purposes because it was thought that in case of transmission-line disturbances the effect on the source producing exciting current would be a minimum, since these machines do not follow up the line fluctuations as closely as do synchronous motors; and this idea has been fully borne out by the experiences of the past year of operation.

LAKE VIEW SUB-STATION.

The Lake View plant of the Commonwealth Electric Company is located about four miles north and one mile west of the Harrison Street station. This plant was originally a two-phase 1,100-volt alternating station with a total load of about 150 kilowatts of series arcs and 50 kilowatts of 500-volt power, and supplied the territory north of the northern limits of the Edison direct-current service.

Two years ago the first motor-generator set was installed and the service changed over to 60-cycle four-wire, three-phase. The same standard was adopted as that in the Southern and Western Districts of the same company and described elsewhere.

The series arc and 500-volt power machines were belted to the motor of this motor-generator set and the pressure from the two-phase machines raised to 2,000 volts by means of transformers on the lighting circuits. These old machines then supplied the single-phase feeders in part and were left in service until a 500-kilowatt motor-generator set and a 500-kilowatt 60-cycle belted generator, readily convertible to a motor-generator set by replacing the engine pulley with a motor, displaced them. The series arc and 500-volt power service is still maintained but is on the decrease, as all efforts are directed toward developing the three-phase power. The series arcs are gradually being displaced by low-tension alternating arcs.

The present equipment, therefore, consists of one 250-kilowatt, 9,000-4,000-volt, 25-60, four-wire, three-phase motor-generator set, one 500-kilowatt set, and one 500-kilowatt belted generator identical with the generator of the larger motor-generator set, and miscellaneous series arc and 500-volt power machines. The 500-kilowatt belted machine was installed for the purpose of utilizing a 600-horsepower cross-compound engine as peak capacity.

The auxiliary apparatus is the same as that used in the West Madison Street sub-station, except that belted exciter sets are used at present. These, however, will be displaced by induction-motor-driven sets in the near future. The methods employed in starting up and synchronizing are also the same.

Two transmission lines, equipped with oil switches, one No. 0000 and one No. 00, feeding into the sectional 9,000-volt bus, supply this sub-station with 25-cycle current from the transmission lines running from the Harrison Street station via intermediate sub-stations, and a great flexibility in the transmission system is thus secured.

It will be seen, therefore, that although the old site and building have been retained, there has been a complete transformation in the service supplied to customers, and a great increase in business has accompanied this transformation.

EDISON SUB-STATIONS.

WEST DIVISION STREET SUB-STATION.

In the northwestern part of the Chicago Edison Company's territory and very close to the Western District of the Commonwealth company, which is all supplied by standard 60-cycle, four-wire, three-phase system, the West Division Street sub-station was erected about nine months ago. This is a modern brick and steel fireproof building about 47 by 65 feet in size with two stories and basement.

The basement extends under the entire building and contains a storage battery of 150 G-49 cells with the necessary end-cell switches. A portion of the basement contains the 60-cycle bus fed by the motor-generator and the rest is devoted to cable runs and miscellaneous purposes.

On the main floor of the sub-station there are, at present, one 500-kilowatt motor-generator set, one 500-kilowatt rotary-converter outfit and one 500-ampere three-unit booster set for charging, with their respective alternating-current operating board and direct-current board.

Above the first floor in the front part of the sub-station is the high-tension gallery which contains the high-tension buses and line switches of the transmission lines. The floor above is divided into two living apartments for one operator and one troubleman of the district.

Two transmission lines, equipped with oil switches, supply the 25-cycle 9,000-volt energy to sectional buses, which may be tied together. These lines run from the Harrison Street station via other Edison sub-stations.

The motor-generator equipment is identical with that of the other two motor-generator installations. The rotary converter with its appurtenances is installed and provided as those in other Edison sub-stations. Three single-phase transformers, delta-connected, are used on the present installation but a three-phase transformer will be substituted in the next outfit.

A compensator, which is really a Y-connected inductive resistance, furnishes a neutral for the rotary converter. On account of the mixed character of the load on the sub-station and 60-cycle tie lines, considerable flexibility is secured. For instance, a feed could be taken from the 60-cycle tie line which would operate the motor-generators conversely and furnish 9,000-volt, 25-cycle energy to the 9,000-volt bus of the sub-station, which could operate the rotary converters. Or the battery could supply direct current to the rotary converters which, running conversely, would operate the motor-generators.

This sub-station was installed with the idea of relieving other sub-stations of load, this fact accounting for the initial capacity necessary.

SEDGWICK STREET SUB-STATION.

The sub-station of the Chicago Edison Company at 444 Sedgwick Street, near North Avenue, known as the Sedgwick Street sub-station and illustrated in Fig. 17, is one of the smaller installations on the 25-cycle system, but it contains several distinctive features of design and is an example of what can be done on a narrow lot in a locality where real-estate values are moderate.

The equipment consists at present of one 500-kilowatt rotary-converter outfit, a 350-kilowatt bat-

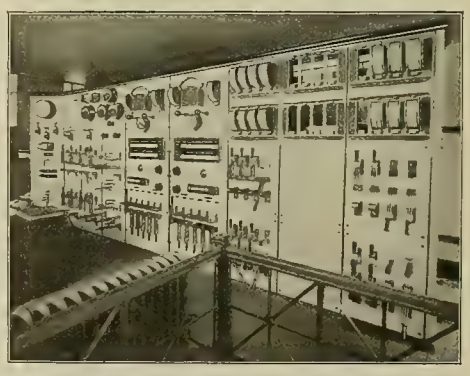


FIG. 18. SWITCHBOARD AT SEDGWICK STREET SUB-STATION.

tery at one-hour-rate of discharge (G-49 tanks) and a 500-ampere three-unit booster set. Two additional rotaries of 1,000 kilowatts each can be accommodated in the present building. Front and rear views of the switchboard are given in Figs. 18 and 19.

The battery occupies the two-story section of the building at the rear of the lot and is arranged with positive cells on the second floor and negative cells on the first floor. A fire wall with one connecting door separates this section from the rotary-converter section.

The following are briefly the principal features of the sub-station:

First—All heavy apparatus is on the main floor and is accessible from one crane.

Second—Air-blast equipment in basement, hence no platforms required for transformers and regulators.

Third—Basement space for rheostats, cabling and heating plant is provided, thereby relieving the sub-station space.

Fourth—High-tension switches and buses isolated upon the gallery.

Fifth—Buses in separate brick compartments located under switch terminals; divided in sections, one line and one rotary on each section.

Sixth—Oil switches (Fig. 20) have auxiliary knife-switch contacts to cut out oil wells for inspection and cleaning; also oak and plate-glass doors, front and back, to facilitate inspection.

Seventh—From transformer secondaries to rotary there are no fuses or switches.

Fig. 19. Rear of Switchboard.

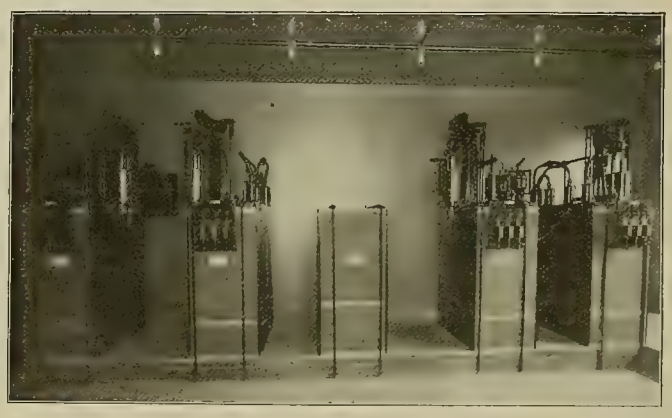


Fig. 20. Automatic High-tension Oil Switches.

VIEWS IN SEDGWICK STREET SUB-STATION OF CHICAGO EDISON COMPANY.

[illegible] STREET SUB-STATION.

[illegible] sub-station of the Chicago [illegible] to provide service [illegible] before it was possible [illegible] a permanent sub-station [illegible] building large enough to accommodate [illegible] was erected on the lot at 141 West Lake Street and [illegible] put in service on May 1, 1902, just 30 days from the time the wreckers began to demolish the old building. Footings, foundations and basement steel work were then put in for a six-story building, on the front portion of the lot, and a basement battery room was finished up with a [illegible] battery to take the full peak. Only a one-story building, providing room for 2,500 kilowatts in rotary converters, is being put up on the front portion of the lot, as shown in cross-section in Fig. 21.

The ultimate equipment of the sub-station contemplates the following principal distinctive features:

First—A six-story building with battery and heat [illegible] plant in basement. The first floor and gallery [illegible] to be occupied by the sub-station proper. The

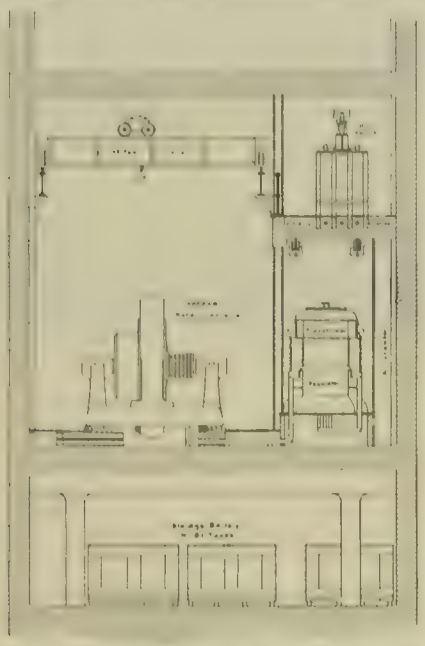


FIG. 21. SECTIONAL DRAWING OF LYDIA STREET SUB-STATION.

remaining floors can be used for storage or rental for manufacturing purposes.

Second—A 9,000-volt line feeding to sectional buses, each section feeding one rotary; sections tied into continuous bus by switches, all switches used being brick-compartment oil switches.

Third—Three-phase transformers of 1,100-kilowatt capacity used with 88-kilowatt induction regulators and 1,000-kilowatt rotary converters.

On all rotary-converter installations for the current year the company has adopted the use of one three-phase transformer, instead of three single-phase transformers for each rotary converter, the line current being brought in at 9,000 volts, 25-cycle, three-phase, and the secondaries being six-phase diametrically connected. The design of the transformer is such that it consists essentially of three single-phase transformers effectively isolated from each other, but mounted in a single iron case in a very compact manner. So effective is this isolation that it would be possible to continue a transformer in operation even after one section had been damaged by accident. All the advantages of the three single-phase transformers are thus secured, and the additional advantage of a great saving in weight and floor space is obtained. A connection is made to the common point of the diametrically connected secondary, which connection is taken direct to the neutral of the system. Each 250-volt rotary converter thus equipped is treated, as far as instruments and switches go, the same as two 125-volt machines.

Fourth—Ultimate capacity of five units, or 5,000 kilowatts.

Fifth—Designed to accommodate two direct-current switchboards, one at each end, if necessary.

Sixth—On account of basement battery room, space on the sub-station floor for machine pits and cables is provided by a false floor of slate supported upon brick walls, which also serve to isolate cable work.

Seventh—Blower equipment in duplicate for transformers and regulators, with additional capacity and devices for supplying air to rotaries under overload condition.

Eighth—Three-unit booster outfit of 2,000-ampere capacity, also arranged so that it can be used as balancer. Each of the boosters used for charging storage batteries is also equipped with some special switches so that two 70-volt boosters can be operated in series and connected to the side of the three-wire system that may have low-pressure, due to heavy unbalance.

Ninth—Rheostats motor controlled and mounted on gallery away from switchboard.

Tenth—Five-thousand-ampere circuit-breakers with reverse-current attachments on both direct-current leads of rotaries.

MARKET STREET SUB-STATION.

The Market Street sub-station of the Chicago Edison Company, located at 84-86 Market Street, is designed to enable the shutting down eventually of the Washington Street generating station, now known as station No. 5, during the greater part of the year. The present building is only a small part of the very extensive block which will ultimately be erected on the property at the corner of Market and Washington Streets.

The principal features of this installation are as follows:

First—An eight-story modern steel building, supported upon concrete caissons, extending to bedrock, a distance of approximately 90 feet.

Second—The ultimate sub-station will occupy three bays on the main floor of the present building and will consist of eight 1,000-kilowatt rotary converters in two rows of four each, with a 20-ton crane in each of the three bays.

Third—The first installation will consist of four 1,000-kilowatt rotaries, with three-phase transformers, occupying about one bay and a half, the remaining space to be utilized for storage purposes for the present, or until needed for rotary converters.

Fourth—In this station the high-tension buses will be located in an air chamber in the basement. The scheme of sectional buses, with brick compartment oil switches, will be followed throughout. The rotary switch, however, will be located on the main floor, near the high-tension side of the transformer.

Fifth—The layout is such that, in case it is desirable, two 2,000-kilowatt machines can be installed in the same space as three 1,000-kilowatt machines, thereby increasing the ultimate capacity of the station 33⅓ per cent. All the heavy apparatus in this station is easily accessible from the cranes.

Sixth—The direct-current switchboard will be protected from above by a gallery which will accommodate the starting resistances and motor-controlled rheostats.

Seventh—The battery room and end-cell switch room will occupy the floor immediately above the sub-station.

Eighth—Transformers and regulators of such capacity will be used so that the battery may be charged direct, thus avoiding the use of a booster, the principal object of this arrangement being to save valuable floor space.

MORGAN STREET SUB-STATION.

This sub-station is located on Morgan Street, between Monroe and Adams Streets. It is a two-story and basement building, and will, when extended ultimately, contain five 1,000-kilowatt rotary converters on the first floor and a storage battery consisting of 150 H-33 tanks, on the second floor. The basement will be used for air chambers, bus-bar and cable connections, heating plant, etc. A portion of the present building will also be used, temporarily, as a central distribution for the 9,000-volt transmission system. Lines will be amply protected and isolated in fireproof compartments. The establishment of this temporary center means a very great reduction in the cost of transmission-line capacity between this point and the Fisk Street station, particularly during the development period of the latter. Ample room on the property is provided for extension.

OHIO STREET SUB-STATION.

This sub-station is located on the north side of Ohio Street, about 215 feet west of Orleans Street. It will consist ultimately of five 1,000-kilowatt rotary converters, with all accessories and switchboards, located on the first floor, and a storage battery of 150 H-49 tanks on the second floor. The basement is reserved for air chambers, bus-bar and cable connections, heating plant, etc.

The ultimate floor plan of this sub-station will be 50 by 100 feet in size, only a part of which is being put up at present. The width of the lot is such that a very safe and economical arrangement of machinery was possibile, and, when completed, it is expected this will be one of the model sub-stations of its kind in Chicago. The basement allows ample room for the safest cabling, and there will be absolutely no high-tension connections inside of the rotary room, as the connections to the oil switches are all made at the bottom.

A booster will be used for charging the storage battery and will be so arranged that the two generators can be kept in series on the low side of the Edison three-wire system, and the booster set will be used as a balancer set.

The low-tension switchboards on all rotary-converter sub-stations of the Chicago Edison Company for this year will be of the company's standard design, which is very similar to that used in the Randolph Street sub-station, described in detail in the Western Electrician of November 29, 1902.

There are also a number of minor improvements in the company's sub-station design, one of these being two direct-current meters and circuit-breakers installed on each rotary, instead of one, as the connection of the neutral point of the three-phase transformer to the neutral of the Edison system makes this necessary.

CONCLUSION.

Mention has now been made of the more important work that has just been completed or is now in progress for some of the generating and sub-stations of the Chicago Edison and Commonwealth Companies. In all there are 26 such stations and sub-stations, as shown by the general map (Fig. 4. In the stations and sub-stations not specifically mentioned improvements and construction work of more or less importance are also in progress, planned with the view of taking care of the rapidly increasing load and keeping the system up to the highest standard of central-station practice.

During the last year the Edison company has installed new storage batteries as follows: Harrison Street, 160 H-61 elements; Lydia Street, 150 H-81 elements; West Division Street, 150 G-49 elements; State Street, 150 G-33 elements, besides increasing the number of plates to full capacity of the tanks in the Sedgwick and West Fourteenth Street sub-stations.

The two companies are at present installing five 1,000-kilowatt rotary-converter outfits, 12 500-kilowatt rotary-converter outfits, two 1,000-kilowatt and two 500-kilowatt motor-generator frequency-changing equipments, 12 auto-potential regulators, besides a large quantity of miscellaneous switching and regulating apparatus, involving six new sub-station buildings for this year. This is in addition to

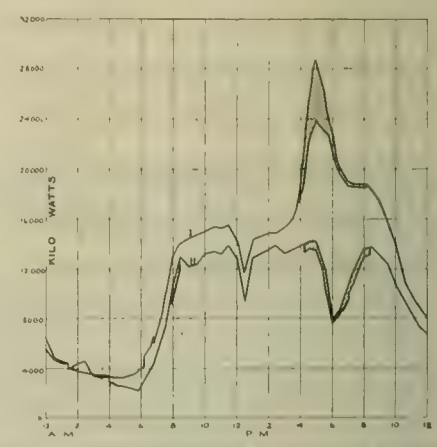


FIG. 22. TYPICAL WINTER AND SUMMER LOAD CURVES OF CHICAGO EDISON AND COMMONWEALTH COMPANIES.

the generating equipment installed or being installed in the Harrison and Fisk Street stations, and previously mentioned.

The Edison and Commonwealth companies together furnish current at present to a total connected 16-candlepower-lamp load of 1,651,700 lamps, divided as follows: Edison, 1,155,200; Commonwealth, 496,500. The total maximum output of the companies to date is 20,000 kilowatts, distributed as direct current 24,000 kilowatts, and as alternating current 5,000 kilowatts. In Fig. 22 is shown a combined load diagram of the two companies, indicating the total generated output for typical winter and summer loads. Curve I. is a curve of the load on December 22, 1902, and curve II. shows the generated load on as recent a date as May 8, 1903. In both curves the storage-battery discharge on the peaks is indicated by the shaded portions.

The present rate of increase gives promise of being equally as good as, if not better than, the phenomenal increase of the last two years. This rapid growth has severely taxed the engineering department of the companies to provide and install the necessary apparatus and likewise the operating department to handle the load.

Stevens Electro-photographic Printer.

The accompanying photographs show an ingenious machine for making photographic prints by electric light. It is the invention of Frank Stevens, one of the experts of the Byrne Photographic Company, official photographer of the Louisiana Purchase Exposition of St. Louis. The main object of the machine is to permit of the rapid printing from a number of negatives varying widely in intensity and general printing quality, these conditions being met with in general job work. Fig. 1 shows the machine with the printing frame open, ready for a piece of the developing paper that is used almost entirely in the exposition work. The paper inserted, the lid to the frame is pressed down with a single movement, the spring catch in front insuring perfect contact. The operator, who may be seated, throws the foot treadle forward about 10 inches, this movement dropping a pair of wings previously covering the front of the printing frame, in a manner similar to the action of a common wing shutter, exposing the paper to the action of a 500-candlepower arc lamp placed in the cabinet below the top of the table. One second is sufficient for the ordinary negative, and the backward movement of the treadle closes the shutter and throws the lid of the printing frame to its original position, at the same time automatically expelling the paper and causing the operation to be recorded on a counter provided for the purpose.

Fig. 2 shows the machine with the lid closed, and gives a good idea of the simplicity of the mechanism. With the majority of negatives, it is only necessary to insert a piece of paper, swing the treadle forward and back, insert another sheet, and repeat. It is doubtful if there has ever been a photographic machine devised having the capacity of Mr. Stevens' printer. The young lady operator who is now running the machine in St. Louis has a record of 1,500 prints in three hours, from nearly 30 negatives, while under the ordinary conditions it would have required four printers and two assistants to turn out the same number of prints. During the rush following the dedication ceremonies, thousands of prints were turned out by this machine that would have been impossible otherwise, averaging as high as 845 an hour while 144 were printed in seven minutes, and not a single print lost. Mr. Stevens had his first machine, a rather crude affair, at work in Colorado last summer, and practically controlled the general job work, owing to the rapidity with which he was able to fill orders for kodak prints. Means are also provided for marking out or vignetting, as well as for "holding back" the weak portions.

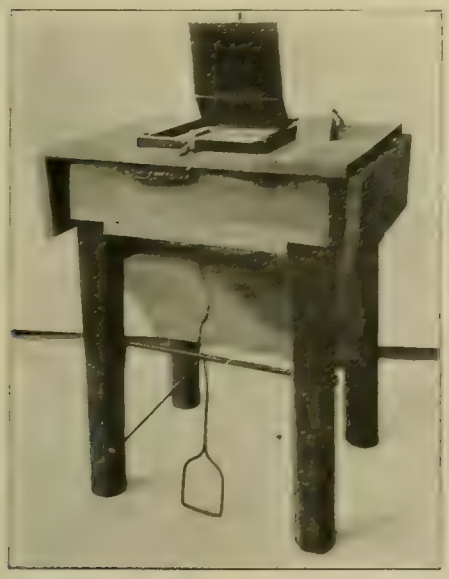


Fig. 1. Machine with Lid Open.

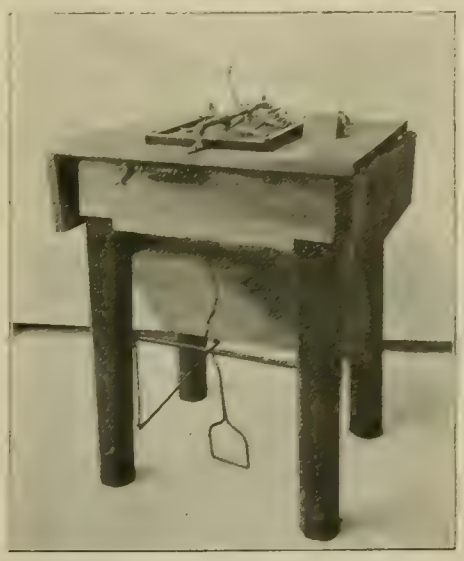


Fig. 2. Machine with Lid Closed.

STEVENS ELECTRO-PHOTOGRAPHIC PRINTER.

Consolidation in Springfield, Ill.

The organization of the Springfield Railway and Light Company of Springfield, Ill., has been completed. The new company has taken over the Springfield Consolidated Railway Company, the Springfield Gas Company, the Springfield Electric Light and Power Company, the Central Electric Company, and the People's Hot Water Heating and Electric Company. Plans for a new power house are now being prepared and many improvements and economies are being introduced. The officers are Anson G. Hodenpyl of New York, president; C. M. Clark of Philadelphia, vice-president; G. L. Bradbrook of Philadelphia, secretary-treasurer.

Electrical Features of the Claypool Hotel.

Indianapolis thinks that it has in the Claypool a model hotel in every respect, without a superior in the United States. The Claypool represents an investment of nearly $1,500,000. It has 450 rooms, 350 of which are bedrooms, and a grand lobby, said to be the largest hotel lobby in this country, 72 by 98 feet in dimension, with a 33-foot ceiling supported by 16 great pillars. The architecture is Greek and the exterior walls are of marble.

The electrical equipment of the hotel is complete. The generating plant consists of three engine type generators built by the Jenney Electric Manufacturing Company of Indianapolis, each machine having a nominal rating of 150 kilowatts and run at a speed of 300 revolutions per minute. These machines are of the latest design of the Jenney company and have six poles. The details of brush-holder rigging are very complete. Any one of the carbons on either set can be easily lifted from the commutator while the machine is in operation; the tension on each set of brushes can be varied as desired, and the entire set can be lifted from commutator by means of a worm gear mechanism provided for each set of brushes.

In addition to the generating plant, the Jenney company has also equipped numerous machines throughout the building with individual motors. Among the interesting equipments of this line are the motors attached to the ice cream freezer, dish-washing machine, ice machine and crumbing machine. In applying the motors to these machines supports of special design have been made which make each equipment extremely compact and self-contained, there being no countershafts or jack shafts required in transmitting power from motor to its respective machine. The extensive laundry equipment is operated by means of a 20-horsepower Jenney universal motor, driving to line shaft in the usual manner. The building is equipped with 12,000 incandescent electric lights and globes. Electricity hoists the elevators, washes the dishes and scours the silverware.

The hotel is equipped with a complete telephone exchange, with a telephone in each of the 450 guest rooms, as well as in the parlors and offices. The instruments and switchboard were furnished by the International Telephone Manufacturing Company of Chicago and installed by the Sanborn-Marsh Electric Company of Indianapolis. The telephone service will be under the direction of the hotel management and will be almost entirely for the convenience of the guests. The hotel system is connected with the city exchanges and state toll-line systems, and long-distance connections can be made with New York, San Francisco and intermediate points. The equipment embodies all of the latest improvements, with a full central-energy lamp-signal, double-supervisory switchboard equipment, with long-distance instruments. The switchboard cabinet work and the telephone woodwork are of solid mahogany for the parlor floors and of white walnut for the ladies' parlors, to match the fittings throughout the house. The system has been tested and found excellent satisfaction, the working of the system being similar to a public exchange connection and is regarded by electricians as one of the most modern and complete hotel telephone systems now installed in this country.

Apparatus for Comparing the Speed of Three-phase Alternators Connected in Parallel.

In paralleling three-phase alternators it is desirable to know if the machine which is to be synchronized is running too fast or too slow. The lamps or voltmeter generally employed for synchronizing generators are of no use for this purpose, because, while they indicate when a machine is in synchronism, or how far it is away from it, they do not show whether it is in advance or behind synchronism.

Dr. G. Benischke of Berlin has constructed the new instrument (shown in Fig. 1) which indicates whether a machine has to be run faster or slower

FIG. 1. [illegible]

in order to reach the same frequency prevailing in another machine or in the network. Translating the German lettering on the dial, the "schnell" is the faster side, and the "langsam" the slower. Fig. 2 is the diagram of connections and shows the general scheme of the apparatus. Six iron cores, with winding to suit the conditions, are arranged in circular form and fastened upon a ground plate which is wound spirally with band iron. The windings of each pair of opposite cores are connected in series, and these three groups of coils are connected on one side to the network and on the other side to the machine to be put in parallel, as shown in Fig. 2. Case apparatus is adapted for a central station, consisting of several machines; each machine to be added can be connected by means of a switch, to the apparatus. A piece of sheet iron with a pointer and having the form of a double T is placed above the iron cores so that it can turn freely. If now the network and machine have the same frequency, the different magnetic fields of the apparatus neutralize each other and the pointer does not move. If the frequency of the network differs from that of the machine, the pointer turns one way, in the opposite case in the other way, as it is marked upon the instrument.

The apparatus can be used for low tension only; for high-tension installations it must be connected [illegible] to see by this apparatus if there is identity of frequency, [illegible] incandescent lamps or a voltmeter as a phase indicator.

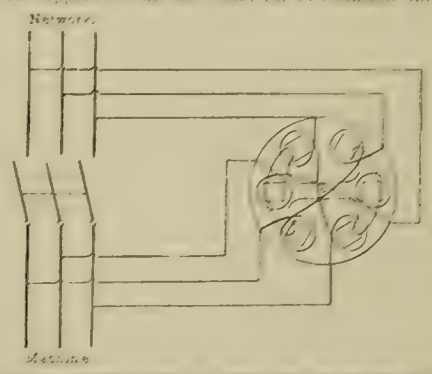


FIG. 2. [illegible]

Electrical Register for Baseball Fields.

A novel apparatus has been recently been devised [illegible] connected with the umpire's station behind the [illegible] hand.

Fessenden Space-telegraph Inventions.

Prof. Reginald A. Fessenden is one of the most [illegible] many who are endeavoring to develop space telegraphy to a commercial basis. His work for the government has been mentioned in these columns and a detailed description of his system, based on an issue of 13 United States patents, was given in the Western Electrician of August 23, 1902. That Professor Fessenden has been carrying on his work of development since that time is indicated by a series of seven patents issued this month, most of the applications being of quite recent

Of the accompanying illustrations, Figs. 1 and 2 are diagrammatic views of his improved system of generating and receiving electromagnetic waves.

The object of this invention is to provide for the generation at the sending station in varying order of two or more series of magnetic waves or electrical impulses, the waves of each of the series differing from those of the other series, the selective reception and transformation or utilization of each of the different series, and, finally, the recording at each receiving station of only such series of waves as are sent in a particular order. The selective reception of the differing series is obviously necessary and in the apparatus shown is secured by tuning or harmonizing various parts of the receiving system to the characteristic period of the particular series of energy fluctuations whereby they are designed to be actuated.

A series of two or more vertical generating wires or generating surfaces (5a), (5b), etc., are connected at the sending station (A) to a series of two or more terminals or knobs (4a), (4b), etc., of a series of two or more induction coils (1a), (1b), etc. The secondary coils are connected, as usual, to both discharge terminals or knobs of the inductions and

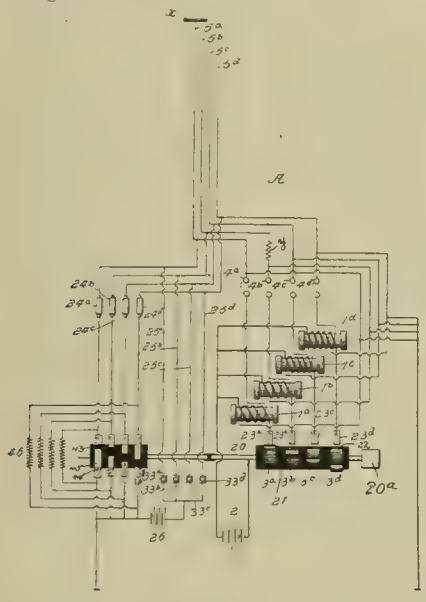


FIG. 1. FESSENDEN SPACE-TELEGRAPH INVENTIONS.—GENERATING STATION.

also to ground. The primary coils of the inductions are each included in circuits of a generator or series of generators (2, and in each such circuit is included a circuit make-and-break mechanism. A convenient form of make-and-break mechanism consists of metal disks (3a) (3b), etc., dependent upon the number of generating or sending wires employed, mounted upon a shaft (20), but preferably insulated from each other by disks (21) of insulating material. By the rotation of the shaft the circuits of the generator will be made and broken in any desired order or interval of time, dependent on the adjustment of the disks around the shaft and the speed of rotation of the shaft. The rate of rotation is not important provided it be constant and not too low. It must be constant in order to avoid various objectionable, if not insuperable, complications in the receiving apparatus, for the rate must bear a fixed ratio to the rate of movement of the tape at the receiving station. As the periodicity of magnetic waves is dependent upon the $\sqrt{\text{self-induction}} \times \sqrt{\text{capacity}}$, and as self-induction and capacity of the sending wires vary with the length and the diameter of the wires, the latter are so proportioned relative to each other, as by varying their lengths, that the periodicity of the waves generated by one wire will differ from that of the waves generated by the other wires. By adjusting the disks (3a) (3b), etc., on the shaft the series of waves may be sent out in any desired order.

The receiver (Fig. 2) comprises a series of selective collecting wires or other suitable surfaces (6a), (6b), (6c) and (6d), etc., projecting upward preferably vertically, though they may be somewhat inclined. Corresponding radiating and receiving or collecting wires forming a pair are electrically tuned to each other, and the tuning or equality of time period of free electrical oscillation may be brought about by making the electrical constants of the two either equal or equivalent, as by changing the length or surface of one of them. The mechanisms controlled by the voltages or currents induced in the receiving wires, or operated directly thereby, are also tuned to the period characteristic of the energy fluctuations to which they are subjected.

Any suitable form or construction of mechanism may be employed for recording the signals or electrical impulses received—as, for example, in Fig 2 coherers (24a), (24b), etc., are arranged in the circuits of the receiving wires, which are grounded. These coherers are also included, as is customary, in circuits (25a), (25b), etc., from a generator or generators (26), these circuits also including portions of the recording mechanism. Generally stated, the recording mechanism consists of a series of two or more electrically actuated devices which by their

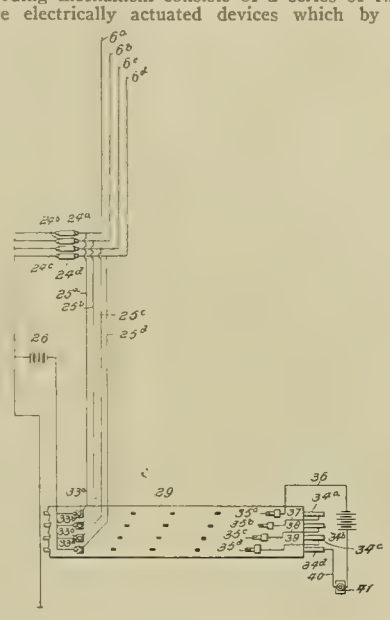


FIG. 2. FESSENDEN SPACE-TELEGRAPH INVENTIONS.—RECEIVING STATION.

combined action will give an audible or visible indication, these devices being either controlled or operated by the voltages or currents induced by the magnetic waves, either directly or by being included in a circuit or circuits that is controlled by such induced voltages or currents, so that all such devices must be operated or the circuits completed in a certain predetermined order corresponding to the order in which the circuits of the generator at the sending station are made and broken to produce an indication or signal by the indicating instrument. Tuning of the coherers has not been attempted; but in lieu of coherers mechanism may be employed for transforming the current or voltages induced by the magnetic waves into energy of motion.

A convenient form of mechanism for receiving indications is illustrated in Fig. 2. This mechanism consists of a bed over which is drawn a band or strip (29) of paper or other flexible non-conducting material. The strip is drawn from a spool by a drum, driven at a regular speed by clockwork or other suit-

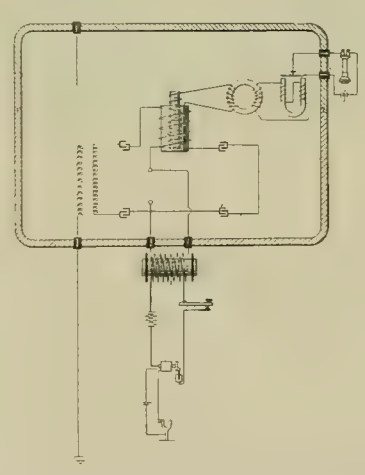


FIG. 3. FESSENDEN SPACE-TELEGRAPH INVENTIONS. SIMULTANEOUS SENDING AND RECEIVING STATION.

able driving mechanism. A series of perforating mechanisms dependent on the number of receiving-wires (6a), (6b), etc., are arranged in such relation to the strip of paper that when actuated the paper will be perforated. Each of these mechanisms consists of a lever having a punch at one end and having its opposite end attached to the armature of an electromagnet (33), which is included in the circuit controlled by the coherer or by the circuit of a generator. As each of the coherers is rendered conductive the perforating mechanism included in the circuit therewith will be operated and a hole formed through the strip. As the operation of the perforator corresponds in succession to the successive operations of the circuit make-and-break mechanism at the sending station and as the strip is in constant uniform motion, it follows that the relative positions of the perforations in the strip will correspond to the relative times of operation of the make-and-break mechanisms. As the paper strip moves along the bed it will pass over metal bands (34a), (34b), etc., and under contact springs or brushes (35a), (35b), etc., in line with the bands. These bands are arranged in the several paths of movement of the perforations, so that the springs or brushes will contact with the bands as the perforated portions pass between them. These brushes are adjustably supported so that they can be positioned in accordance with the consecutive operation of the make-and-break mechanisms at the sending station. When so adjusted, they will all be in contact with their respective bands (34a), (34b), etc., at the same time completing an electric circuit formed as follows: Wire (36), brush (35a), band (34a), wire (37), brush (35b), band (34b), wire (38), brush (35c, band (34c), wire (39), brush (35d), band (34d), wire (40), indicating instrument (41) to battery.

It is characteristic of Professor Fessenden's improvement that only such receiving station or stations as have their receiving mechanisms properly tuned and adjusted can receive intelligible indications. It is also necessary that the sequence of operation of the receiving mechanism should correspond to that of the sending mechanism and also that the time interval between the operations of the elements of the receiving mechanism should correspond to the time interval between the successive operations of the elements of the sending mechanism. In other words, to produce a dot or dash or any other signal or indication at the receiving station requires the conjoint action of waves from all the sending wires and consequent operation of each and all the receiving mechanisms.

Fig. 3 is a diagrammatic view showing a sending and receiving apparatus for a station adapted to the simultaneous sending and receiving of messages. In the method described this is accomplished by so connecting the receiving and sending circuits to the vertical wire that the receiving mechanism will

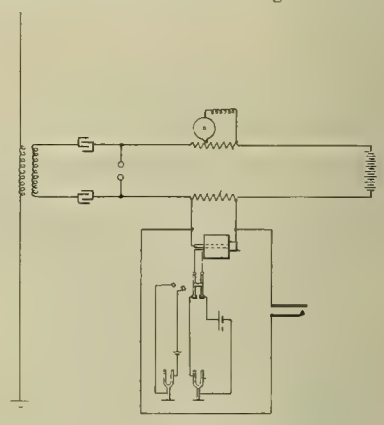


FIG. 4. FESSENDEN SPACE-TELEGRAPH INVENTIONS.—SELECTIVE SIGNALING SYSTEM.

respond faintly or not at all to waves generated by the sending apparatus, but will be operated by waves generated at other stations. This is accomplished by so connecting the circuits that the effects produced by the operation of the sending apparatus on the receiving apparatus will tend to neutralize each other, while the effects produced by electromagnetic waves from another station will not neutralize each other. This may be conveniently accomplished by the use of two circuits, which act in parallel when sending and in series when receiving. The receiver is preferably arranged in inductive relation to these circuits in such a way that when sending the inductive effects will oppose each other, but will aid each other when receiving.

A selective method of signaling which consists in varying the character of the radiations from the sending station at a rate independent of the natural periodicities of the system is shown in Fig. 4. The primary of a transformer is arranged in series with the vertical conductor which is grounded. The secondary of the transformer is included in a circuit consisting of two condensers and a gap, which is normally non-conducting—as, for example, an air-gap, a Wehnelt interrupter, or similar device. The local circuit, including the secondary of the transformer, the condensers, and the non-conducting gap, is preferably tuned to the periodicity of the sending conductor. A generator, preferably of the continuous-current kind and preferably a storage battery, is arranged in a series with the condenser and secondary of the transformer, and resistances are included in the circuit of the generator, preferably, but not necessarily, in opposite legs of the circuit. The generator may be arranged to give any desired potential, a voltage of 1,000 being the suitable one, though a voltage as low as 50 may be used, depending, among other things, upon the nature of the gap. Very high voltages may be suitably obtained, if desired, by using a continuous-current generator with revolving field and making the sections of the winding of the armature primaries of transformers whose secondaries are connected to a

commutator and commutated by revolving brushes. In this way any desired amount of insulation can be obtained, and there is no need for heavy insulation on the generator itself, but merely on the transformers and the commutator where there is no difficulty in using it. The resistances govern the rate at which the condensers are charged.

A motor carrying on its armature shaft a commutator and regulated as to speed by a tuning-fork in the circuit of a small battery, is employed for short-circuiting the retarding means or resistance, thereby varying the number of discharges per second at every revolution of the armature of the motor. A second tuning-fork and local battery may be employed for regulating the motor, though the same local battery may be used for both forks. When using the second tuning-fork and battery, they are adapted to be connected to the motor by means of a switch. These tuning-forks have different rates of vibration, and hence when one or the other is connected to the motor the latter will rotate at different rates per second, causing a corresponding change in the number of times per second that the discharge frequency is changed. As, for example, the circuits may be so arranged that the local circuit, including the secondary of the transformer, the condensers and gap, has a natural period of 2,000,000 per second, and the retarding means may be so arranged that there will be 2,000 discharges per second when the resistance is in circuit and 10,000 discharges per second when it is short-circuited. Then the commutator, governed by the tuning-fork, may be so arranged as to effect a change in the rate of discharge (and hence a change in the amount of energy radiated) 500 times per second. It will thus be seen that one may have three different frequencies—first, the electrical wave frequency, which is determined by the local circuit; second, the discharge frequency, which is governed by the generator and the retarding means for a given value of the capacity; third, the independent frequency, which is determined by the tuning-fork controlling the motor.

In the operation of this method it is preferred to tune the receiving station electrically to the wave frequency and to tune the receiver mechanically or

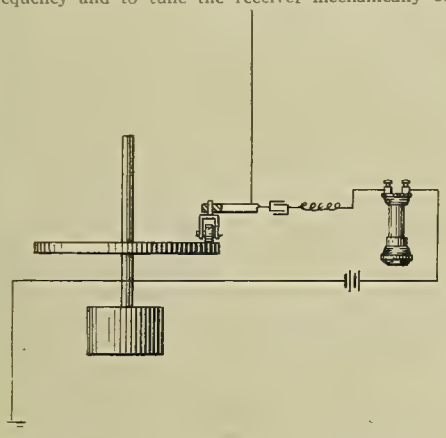


FIG. 5. FESSENDEN SPACE-TELEGRAPH INVENTIONS.—IMPERFECT-CONTACT TYPE OF RECEIVER.

electrically, or both, to the independent frequency. In the case illustrated the receiving circuit would be tuned electrically to the wave frequency of 2,000,000 and the receiver tuned mechanically or electrically, or both, to a frequency of 500. The distinct feature of this method is that there is not only electrical tuning to the wave frequency, but also tuning either mechanically or electrically, or both, to another frequency which is independent of the discharge or group frequency.

The object of another invention is to insure uniformity and reliability of action of receivers of the imperfect-contact type and to insure their freedom from the effects of electrical or mechanical disturbances. Fig. 5 is a diagrammatic view illustrative of the improved receiving apparatus. The contact receiver of the self-restoring type consists of parts so constructed that one shall have movement relative to the other, so that the contacting surfaces can be changed with sufficient frequency to give operative uniformity. Convenient forms for these parts consist of a disk and a second member stationary relative to the direction of movement of the disk. The disk is mounted upon a spindle which may be rotated by any convenient means, such as clockwork. This disk may be formed of carbon or carbonized structured material, such as carbonized velvet, or metal, such as an alloy of gold and bismuth, the latter forming five per cent. of the alloy, or aluminum or mercury or osmium or iron. The other part or member of the coherer may be formed of carbon or metal. Both parts or members may be formed of similar material. When one part is formed of carbon, the other part is made by preference in the form of a roller mounted so as to bear upon the face of the disk and to be rotated by contact therewith. When using this construction, the disk is preferably constantly rotated by any suitable mechanism. As an indicating mechanism a telephone in the local circuit may be used.

Various forms of receivers have also been invented by Professor Fessenden, one form consisting of a small quantity of nitric acid, the terminals formed of platinum being immersed in the liquid.

Outside Construction in Boston.

Patrick J. Kennedy, commissioner of wires for the city of Boston, reports that the work of placing electric wires underground in that city is progressing steadily. However, the total number of poles still standing on the streets of the city, not including iron trolley poles, is 14,747. A neat form of aerial construction, used by the New England Telephone and Telegraph Company, is shown in Fig. 1. It is employed for service distribution in residential sections. It consists of one strong supporting wire attached to poles or buildings and equipped with

FIG. 1. AERIAL CONSTRUCTION FOR TELEPHONE WIRES IN A BOSTON ALLEY.

rings, through which insulated pairs of wires are drawn as wanted, making, in effect, a cable of insulated wires, instead of open wires on cross-arms, which removes, in a considerable measure, the objectionable appearance of many single wires and cross-arms, reduces the liability of accidents by wires breaking, due to snow and sleet storms and other causes, and the danger from contact with high-tensioned wires, to a minimum. It also makes it possible to use smaller poles and to distribute in

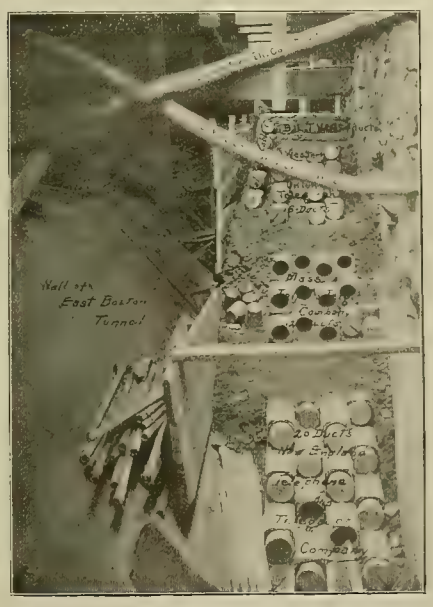


FIG. 2. CRAMPED UNDERGROUND WORK IN STATE STREET, BOSTON.

residential sections without injury to trees and without the necessity of climbing or trimming the trees to clear the wires, as the wires may be drawn into this aerial conduit by a line left in the conduit for that purpose, or by drawing in an additional pair with an existing pair. During the past year this system has been quite extensively introduced in the public alleys in the Back Bay district.

Fig. 2 is a reproduction of a photograph taken during the construction of the conduits for the low-tension companies on State Street, on the route of the East Boston tunnel, and gives an idea of the small space left in which to lay ducts to provide for all the low-tension wires, after the walls of the tunnel were in place. The low-tension conduits lie one above the other, separated by three inches of concrete, and considerable ingenuity had to be exercised at street crossings and at manholes, where each conduit swings out of the main line into its own manhole. These conduits were kept below the general level of the gas and water pipes and conduits, as far as was possible, and manholes were left uncompleted until the old pipes over them could be taken out from service and removed. Where it was absolutely necessary, pipes were relocated to allow room for the main conduit to pass, and in some cases portions of the conduits interfering with new ones were removed and the old cables looped up out of the way.

The summary of the work of wire-burying by all the electrical companies, both high and low-tension, for the year, is as follows: 102,338 feet of conduit completed; 557,879 feet of single duct laid; 784,032 feet of cable drawn into the ducts; 1,000 service connections made; 327 manholes built; 42 distribution boxes set.

The Third Power Tunnel at Niagara Falls.

The contract for driving the tunnel tailrace for the Toronto and Niagara Power Company has been awarded to Anthony C. Douglass of Niagara Falls, N. Y. This will be the third tunnel to be constructed for the development of the energy of the Falls of Niagara. It will be located on the Canadian side of the river, and will extend from the wheel-pit, which is yet to be commenced, to the lower river. In length it will be about 2,100 feet, in height 25 feet and in width about 18 feet. Thus its section will be slightly higher than any tunnel yet built at Niagara, but in width it will be about the same as the other tunnels. It will afford tailrace facilities for the development of about 125,000 horsepower. It will be lined from the portal to the pit.

The power house of the Toronto and Niagara Power Company will be located up the river a short distance above the station of the Canadian Niagara Power Company, but it will be down stream from the forebay of the Ontario Power Company. Thus its intake will be between these other intakes. In extending from the wheel-pit to the gorge, the new tunnel will run in a direct line, and this will carry it right under the river bed. The outlet or portal of the tunnel will be behind the sheet of water of the Horseshoe or Canadian Fall, and the water that will pour out of the tunnel when the turbines in the pit are running will flow with great force right into the boiling waters at the base of the precipice, where the foam-lashed waters toss in tumultuous fury.

In the fact that the route of this new tunnel carries it under the river, there will exist a slight difficulty in its construction. In the driving of the present tunnels the plan has been to sink a shaft along the middle of the route and then drive headings in both directions from the base of the shaft. As the line of the tunnel will be right under the fierce current of the upper rapids, it will be impossible to get over it to sink such a shaft. Under these circumstances, however, a shaft will be sunk close to shore to the tunnel depth and a lateral tunnel will be driven out to the line of the main tunnel. From this point one heading will be driven toward the wheel-pit, and another heading toward the gorge, all the excavated material to be raised up the shaft so sunk.

Anthony C. Douglass, who has received the contract, has had considerable experience in rock work at Niagara. He aided in sinking the first wheel-pit of the Niagara Falls Power Company and he is now building the tunnel of the Canadian Niagara Power Company. The work of lining this latter tunnel is now in progress. As Mr. Douglass has completed the excavation of the Canadian Niagara Power tunnel, he can transfer his plant to the work of driving this new tunnel for the Toronto and Niagara Power Company, both of which works are right side by side in Victoria Park. It will take about two years to construct this new tunnel, but the work will be shoved with great vigor. It is understood that the contract price of the new tunnel was about $575,000.

The Destructive Match.

Who says that no danger resides in little, innocent-looking Mr. Match? By official showing an average of over 800 conflagrations a year are caused by "matches and rats," "matches and children" and "careless use of matches," in the borough of Brooklyn alone! Rather startling statistics, these, to the man who uses in his home some inferior and antique illuminant, to ignite which matches are indispensable! No telling who will be the next victim! Electricity eliminates the match for all lighting purposes and so reduces this very real danger to a minimum. Eternal vigilance is the price of safety! Don't take chances on the little brimstone-sulphur imps of mischief! Don't be one of the 800 for 1903!—The Brooklyn Edison.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

National Electric Light Association, Auditorium Hotel, Chicago, May 26th to 28th.

New York State Independent Telephone Association, Butterfield House, Utica, N. Y., June 10th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

Independent Telephone Association of the United States of America, Chicago, June 24th and 25th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

THE elaborate article in this issue on the "Latest Developments in Central-station Engineering in Chicago" will prove, we think, a veritable mine of valuable and interesting information to every one who follows the art of generating and distributing electricity for light and power from central stations. Chicago engineers have been noted for their boldness and originality, and in electric-lighting development they have been ever alert to adopt the latest methods, if convinced that they promise to be the best methods, whether devised by themselves or others, and no matter at what sacrifice of old tradition or old equipment, provided always that true ultimate economy is indicated by the innovation. In other words, the Chicago spirit, in electric-lighting supply as in other matters, is not for change or novelty merely because it is new, but rather consists in that evolutionary belief in increasing excellence in men, methods and things which impels one to be constantly on the lookout for the better way, supplemented by firmness of decision to carry out the improved method, no matter how far it departs from the older practice, if once convinced that it is advantageous. A striking example of this fearless adoption of new features, after careful examination and study, of course, is shown in the Fisk Street station of the Commonwealth Electric Company now building and described for the first time in the article under consideration.

It will be noted at once that the new plant is one of magnificent proportions. It is planned for the future as well as the present, as the experience of the past has taught to be so necessary. The site contains over 14 acres of ground and is located on the South Branch of the Chicago River. Thus room for future expansion, coal storage, water supply and both land and water access are secured. The plant will include not one building but four, when the design is carried out. The main power house is 230 feet wide and will be 600 feet long when ultimately completed. At that time it will have a capacity of 70,000 kilowatts in generating machinery. The initial installation is of two-sevenths the total capacity, or 20,000 kilowatts, and is housed in a building about 200 by 230 feet in area. The product of this station will be 9,000-volt, 25-cycle, three-phase alternating current. It will be produced by 5,000-kilowatt units, and these units will each consist of a revolving-field generator vertically mounted on a vertical two-stage steam turbine. In addition to the power house there will be a switch house 50 feet wide and 460 feet long, as planned for ultimate completion. This structure will have a basement and two stories. Here will be placed the bus bars, switchboards, instrument transformers, instruments and other apparatus needed for the handling of the output of the great station. The other two buildings making up the group of four in the plant are an office building, to be built later, and a sub-station to transform and reduce the 9,000-volt alternating current to low-tension direct current for neighborhood consumption, a large portion of which will be the light and power needed in the various buildings of the Fisk Street station itself.

Of course the greatest novelty in the Fisk Street station is the use for the first time of vertical steam turbines of 5,000 kilowatts, the largest in the world. The employment of such a large-sized steam turbine is certainly a most interesting innovation, but the use of this type of prime mover can now hardly be regarded as an experiment. We can see no reason why the great turbine units to be installed at Fisk Street should not be operated successfully, securing thereby the resulting advantages to which allusion is made in the article. Nevertheless, it obviously required no little courage to be the first to decide on so radical a step on such a large scale, and we congratulate President Samuel Insull of the Commonwealth Company and his executive officer, Mr. L. A. Ferguson, on the evidence they have given by their works of the faith that is in them.

The reader will find the picture of the first of the 5,000-kilowatt steam-turbine units, on page 399, of particular interest. The vertical combination of alternator and steam-operated prime mover shown by the picture is certainly unusual, but it is very compact and business-like in appearance.

But, passing the steam turbines and merely alluding to the separate switch house as a very up-to-date development, there are several other features in the Fisk Street station that may be studied with advantage. One is the sectional arrangement. The plan is such that each turbo-alternator, with its own coal conveyor, boilers, piping, condensing plant, bus bars and transmission lines, is practically a separate unit, almost as much as though it constituted a distinct 5,000-kilowatt plant in four walls of its own located perhaps miles away from its fellows. But, instead of being scattered, 14 of such plant-units are to be united in one great station. Thus is secured the great economy in labor, coal handling, real estate, etc., of the one large plant, with the safety and reliability of a number of small plants, each independent of the other in the event of breakdown. It will be noted, too, with approbation, that generous provision is made for the comfort of the men employed. Baths, lockers, a refrigerator for lunches and a reading room for lounging when off duty are provided. By this means the company shows that it takes more than a human-machine interest in its employes. Reciprocally, the men will naturally take a greater interest in the affairs of the company and will be more warmly attached to it.

Fisk Street station is so interesting that we find we have little space left for comment on the remaining portions of the article, which show the virtual passing of the historic Washington Street station, the pressed-down and running-over condition of the Harrison Street station, which, at the time of its erection, only 10 years ago, was regarded as one of the electrical marvels of the West, and which give a general idea of the improvements, connections and operation of the 26 stations and sub-stations of the Chicago Edison Company and Commonwealth Electric Company. We must refer the reader to the article itself. We are sure he will thank us for an opportunity to study the "Latest Developments in Central-station Engineering in Chicago."

"Now will you be good!" In effect that is what Chicago, triumphantly waving the Mueller municipal-ownership law, is now enabled to say to the street-railway companies seeking franchise renewals. Governor Yates, much against his real inclination, signed the Mueller bill on Monday last, and now any city in this state has a legal right to own and operate street railways. But municipal operation of street railways is still far from being an accomplished fact. Nevertheless the companies must "watch out"—although it is whispered that, as finally passed, the companies do not regard the law as so very dreadful, after all. The full text of this important law is given on another page.

A CONTRIBUTOR discusses in this issue the "gas arc light," so called, from the point of view of the electric central-station man. This incandescent-mantle lamp is put forth by the gas people as furnishing a great amount of illumination for the money charged, and many shopkeepers, allured by the prospect of economy, have installed it. But the light has several disadvantages, such as the amount of heat given out, vitiation of the air, rapid deterioration, fragility, and the inferior character of the light itself. These facts are pointed out in the article referred to, which will be found to contain useful information. The inferiority of the lamp to the electric light is so marked that the attempt to trade on the reputation of the real arc lamp should be resented. An arc light without an arc is simply a ridiculous misnomer, and that is what the "gas arc light" is. It is a jackdaw parading in a peacock's feathers.

WITH an energetic administration, a bright, fresh, unhackneyed programme, a great revival of interest as the result of the last convention, a central meeting point and prosperous times, all the conditions seem to unite to indicate an exceptionally good convention of the National Electric Light Association in Chicago on Tuesday to Thursday, inclusive, of next week. Mr. Louis A. Ferguson, the capable president of the organization, has been unsparing of himself in planning for this gathering in his home city, and there seems to be no room for doubt that his discriminating efforts will be crowned with success. The association renewed its youth at the Cincinnati meeting of last year, and, meeting in bustling Chicago, with a go-ahead Chicago president and with a great influx of new members, we expect to see such a convention as, in the breezy language of the political newspapers, might be styled a rouser.

The Gas "Arc" Light.

By F. L. Pendyllton.

I am asked to say something to the readers of the Western Electrician about the characteristics of the alleged gas "arc light" now so liberally exploited by the gas companies of many cities. But, to begin with, I am in doubt whether we ought not to call the device a "cluster stove" on account of its heat, which, indeed, was a trait not without value during the fuel scarcity of last winter. Of course, to term this lamp an "arc" lamp or an "arc light" is a complete misnomer, for there is no more arc about it than there is about a tallow candle.

The fixture referred to is that known as the Humphrey gas lamp—originally a cluster of five Bunsen burners centered around a pipe, each bearing a Welsbach mantle and the whole surrounded by a clear glass globe, while at a safe distance above is located an opal shade or reflector.

The Bunsen burner depends upon a steady, uniform supply of 30 per cent. of illuminating gas and 70 per cent. of air in order to produce perfect combustion, and the Welsbach mantle depends fundamentally upon perfect combustion in order that it may be heated to incandescence and produce light.

Let us divide illuminating gas into diluents and illuminants. Diluents—viz., hydrogen, marsh-gas and carbonic oxide—are the gases which, without conferring much luminosity when burned, serve the important purpose of diluting the heavy hydrocarbons, or smoke-producers; in combination with the oxygen of the atmosphere these sustain combustion.

The illuminants—viz., ethene, acetylene, and benzine vapor—are the heavy hydrocarbons, or vapors rich in carbon, to the presence of which, the luminosity of gas, when burned, is due. Considering these properties, we realize how even a slight variation in the percentage of either may produce a serious defect, either chemically, mechanically or both.

If either the hydrogen of the gas or the oxygen of the atmosphere be deficient in proportion to produce H_2O, or water vapor, on combustion, combustion is incomplete and the inevitable result is insufficient heat to heat the Welsbach mantles to incandescence, which means poor light or no light.

If the gas be in excess, which is liable to occur several times each day, from varying pressure at the gas works, necessary in order to meet the varying demand, again, the unvarying result is imperfect combustion, a deposit of carbon on the mantles rendering them useless for future illumination and vitiating the atmosphere with gases injurious to health, offensive in odor and chemically destructive. Nor does the ill cease here, for the mantles arrest only sufficient smoke to destroy their value and to give unmistakable warning of its presence, while the continuous production, ladened with the water vapor of combustion, is carried by currents of air, created by the heat, into every crevice and corner, sticking to and begriming both merchandise and man, decorations, furniture and trimmings, casting gloom everywhere but most notably upon the merchant who realizes its cost.

Then, too, the impurities contained in the gas, such as sulphur, etc., which are not destroyed by combustion, produce discoloration, through chemical action, and give a shop-worn, dingy and old appearance to wares of metal, metal surfaces, metallic paints and to whatever they can adhere subject to chemical action.

Nor do these lamps in any way relieve the strain upon the over-delicate mantle, so sensitive to every jar, vibration or breeze which causes them to fall to pieces without perceptible provocation.

It seems needless to mention the well-known rapid shrinkage of the light-giving property of the Welsbach mantle, which the average of repeated tests has shown to be 27 per cent. in 100 hours' burning and 34 per cent. in 200 hours' burning, even in the laboratory where the proportions are carefully adjusted and the pressure not allowed to vary, nor draughts to interpose.

Heat, however, is the quality which the Humphrey gas lamp has always with it and which can never be mistaken nor overlooked, nor can the lamp give any light without it, for the principle on which it produces light is through heat sufficient to raise the temperature of the Welsbach mantle, in the atmosphere, not in a vacuum, to incandescence and to hold that temperature so long as light is required.

The earth metals reach the fusing point at 1,775° C., and the point of incandescence is a close ally. Each lamp of five burners, under normal burning, will produce 14,375 heat units per hour, while the three-ampere electric arc lamp, the light of which is superior in quantity, quality and durability, produces less than 1-12 of this amount of heat, or 1,180 units.

At first the gas "arc" lamp was placed upon the market only at a high rental and largely in the spirit of a favor, while its care was a source of much annoyance to users. Next it was offered during the three summer months without rental. Then it began to be advertised more and more widely as the winter profressed. To-day it is offered for sale everywhere upon the market at a nominal price, the owner having to care for it and be kept constantly conscious of this maintenance cost and the result of neglect or lack of knowledge.

Next Week's Electric-light Convention.

Unless all signs fail, the twenty-sixth convention of the National Electric Light Association at the Auditorium Hotel on May 26th, 27th and 28th will be a very useful and successful affair. President L. A. Ferguson of Chicago, although one of the busiest men in town, has given unsparingly of his time and attention to make the meeting a valuable one, and there is apparently no doubt that his efforts, seconded by those of Secretary J. B. Cahoon and Assistant Secretary H. E. Billings of New York, will

LOUIS A. FERGUSON.

be crowned with success. Under President Ferguson's direction a programme of particular excellence has been prepared. It is as follows:

Tuesday Morning, May 26th—

1. Address of President Ferguson.
2. Report of editor of progress, T. Commerford Martin, New York.
3. Report on "Office Methods and Accounting," by W. M. Anthony, Chicago.

Tuesday Afternoon—

1. Paper on "Advantages Derived from Use of One System of Generation and Transmission of Electrical Energy from All Power Stations in One Locality," by Charles L. Edgar, Boston.
2. Paper on "Standard Ratios for Transformers," by John S. Peck, Pittsburg.
3. Paper on "Boiler and Furnace Efficiencies," by A. Bement, Chicago.
4. Report of committee on "Flue Gases," by Henry L. Doherty of Denver, chairman.

Wednesday Morning, May 27th—

1. Paper by Charles F. Scott of Pittsburg on "The Young Engineer and the Electric Lighting Plant."
2. Paper on "Tactful Relations with Customers," by John W. Ferguson, Chicago.
3. Paper on "Attitude of Employer Toward Benevolent, Insurance and Educational Associations Among Employes," by Arthur Williams, New York.
4. Paper on "First-Aid Appliances," by Dr. J. D. McGowan, Chicago.

Wednesday Afternoon—

1. Paper by Professor Elihu Thomson, Swampscott, Mass.
2. Paper on "Steam Turbines," by Professor William Lispenard Robb, Troy, N. Y.
3. Paper on "District Heating," by John W. Glidden, De Kalb, Ill.
4. Paper on "The Application of Four-Ampere Series Alternating Arc Lamps for Street Lighting," by J. Henry Hallberg, New York.

Thursday Morning—

1. Paper on "Salt As a By-Product," by Alex Dow, Detroit.
2. Paper on "Some Fundamentals of Photometry," by Professor H. E. Clifford, Boston.
3. Report of committee on "Photometric Values of Arc Lamps," by Henry L. Doherty, chairman.
4. Exhibition and description of the Matthews integrating photometer by Professor Charles P. Matthews, Lafayette, Ind.
5. Report on "Decorative and Sign Lighting," by Arthur Williams.

Thursday Afternoon—

1. Paper on "Relative Advantages of Electrical and Mechanical Methods of Variable Speed Control for General Power Service," by William Cooper, Cincinnati.
2. Report of "Theft of Current," by Robert L. Elliott, Chicago.
3. Report on "Unaccounted-For Current," by L. G. Van Ness, Denver.
4. Report of committee on "Standard Electrical Rules," by Captain William Brophy, Boston, chairman.
5. Question Box.
6. Executive session. Reports of secretary and treasurer and executive committee. Election of officers.

The electrical interests of Chicago will tender a reception to the members of the association at the Auditorium on Monday evening, May 25th, from 8:30 to 10 p. m. Mr. James Wolff is the chairman of the local committee on arrangements, while Mr. B. E. Sunny has charge of the finances. Arrangements have been made for a tally-ho party on Tuesday morning for the ladies attending the convention, through the South Side parks. A matinee party at Powers' Theater on Wednesday afternoon is tendered to the visiting ladies by the Chicago committee. The attraction is "The Little Princess."

Arrangements have been made for a special train of Pullman cars for the use of eastern members and delegates attending the convention. The train is scheduled to run by the New York Central and Hudson River Railroad and the Michigan Central Railroad, leaving New York on Sunday, May 24th, at 12:50 p. m., Albany at 3:50 p. m., Buffalo (Central time) at 10:50 p. m., Boston, via Boston and Albany, at 10:45 a. m., arriving at Chicago 2:50 p. m. Monday.

Just before going to press the Western Electrician is informed that, on account of overwork, resulting in impaired health, Mr. James B. Cahoon, the esteemed secretary and treasurer of the National Electric Light Association, has been compelled to tender his resignation as an officer of the association. This retirement will be greatly regretted, as Mr. Cahoon is a very competent official, being especially noted for his researches into the questions of municipal ownership and uniform accounts.

Annual Meeting of the American Institute of Electrical Engineers.

[By telegraph to the Western Electrician.]

New York, May 20.—The American Institute of Electrical Engineers held its annual meeting in this city last evening at the Mechanical Engineers' Club. President Charles F. Scott presided. The board of directors of the Institute reported the assets of the society to be $70,599.69. The reports of the various committees showed the Institute to be in a vigorous and healthy condition; the membership of the society now numbers 2,400 members and associates.

The most interesting feature of the evening was the report of the building committee. Mr. Scott announced the gift of Mr. Carnegie of $1,000,000 for a union engineering building, and stated that it would be necessary for the Institute to raise $200,000 as its share of the $800,000 necessary to purchase the land. The engineering fraternities interested in the project are the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and the Engineers' Club. Various methods were suggested as to the creation of a $200,000 fund for the Institute. The secretary read letters of congratulation from Thomas A. Edison, A. E. Kennelly, Carl Hering, William A. Anthony and others.

Mr. Scott announced the following gift toward the fund: Frank J. Sprague, $2,000; Elihu Thomson, $5,000; J. G. White, $2,500; Westinghouse Electric and Manufacturing Company, $5,000.

The committee of tellers reported the election of officers as follows: President, B. J. Arnold (705 votes); vice-president, C. W. Rice (687); W. S. Barstow (677); R. D. Mershon (663); managers, Samuel Sheldon (683), A. H. Armstrong (672), W. C. L. Eglin (644), G. F. Sever (642).

Mr. Scott called attention to the fact that the increase in membership of the Institute had been 44 per cent. for the last year.

The topic of the evening was the compounding of alternators. The following papers were presented: "The Compounding of Self-excited Alternating-current Generators for Variation in Load and Power Factor," by A. S. Garfield, abstracted by G. S. Bunn; "The Experimental Basis for the Theory of the Regulation of Alternators," by B. A. Behrend, and "A Study of the Heyland Machine as Motor and Generator," by Comfort A. Adams. These papers and the discussion which followed showed that alternating-current generators could be made self-exciting by the construction of a suitable commutator upon the revolving-field structure, the commutator being supplied with current by brushes connected to the current terminals of the stationary armature, transformers being employed to reduce the voltage. Various methods were suggested by the different authors for regulation. Where three-phase is employed the method adopted is to shift the field brushes

[illegible] produced in the armature is equal to the constant angular speed of the revolving-field structure. These machines are satisfactorily compounded to take care of both inductive and non-inductive loads. Mr. Behrend called attention to the fact that the Institute rule regarding the regulation of alternators gave absurd results. In the discussion which ensued Mr. Waters contended that the application of Kapp's diagram for the determination of the regulator at different power factors, as recommended by Mr. Behrend, yielded inaccurate results. A.

Chicago Street-railway Situation.

Governor Yates has signed the Mueller municipal ownership bill, which gives to Chicago authority to own and operate or own and lease street-car properties. The full text of the bill is given elsewhere on this page. With the bill the governor filed a message of nearly 8,000 words, in which he outlines his views on the measure and gives some statistics. From the most reliable data obtainable he finds that the first street-car franchise in Chicago was granted to three private individuals in August, 1858. From that time until January 1, 1890, about [illegible] miles of street was covered by tracks, and in the next eight years, or on January 1, 1898, approximately 420 miles of street was occupied by street railways. In April, 1900, there was 573.59 miles of street occupied by surface railways, including cable, electric and horse cars. The cable first came into use in Chicago in the early eighties and the first permit to operate by electricity was granted in 1892. The governor gives these figures to show that he thoroughly realizes the magnitude and rapid growth of the street-railway systems of Chicago.

No important changes took place in the street-railway situation last week, everything hinging on the fate of the Mueller enabling bill in the hands of the governor. Now that it is a law it is probable that negotiation between the companies and the city looking toward a renewal of franchises will be renewed at once. The Union Traction Company has paid its rent to the West Side company. Receiver Eckels borrowed $200,000 from local banks on the receivers' certificates authorized by Judge Grosscup, and at once began sending out the dividend checks to the stockholders. The surplus will be used to pay the interest accrued on the floating debt of the North and West Chicago lines.

It was given out by stockholders of the Union Traction Company that plans for reorganization of the company are under way. The company proposes to stand firmly on the 99-year act and plans for the installation of sub-surface electric systems on several of the lines are being advanced regardless of the city's claim that the franchises expire in July.

Considerable interest has attached to the appearance of Charles T. Yerkes in Chicago at this time. It is said, however, that Mr. Yerkes is not in the city to take a hand in the traction muddle, and it is further stated that he is out of the Chicago Union Traction Company entirely.

Improvements and extensions to cost several million dollars are to be made on the South Side Elevated system. Englewood will get an elevated road and express service, while a loop will be constructed at the Union Stockyards.

The measure for universal transfers on surface roads has been prepared and the City Council will be asked to pass it in a short time.

Prospective Combination in Columbus.

The Columbus Railway and Light Company of Columbus, Ohio, has been incorporated, with a capital stock of $5,000,000, by P. W. Huntington, Edwin R. Sharp, Emil Keisewetter, Frederick W. Prentiss and Randolph S. Warner. All are Columbus men and prominent in the business affairs of the city. The capital stock of the company has been subscribed to within 10 per cent. of the full amount. The apparent purpose of the new corporation is to take over the Columbus Railway Company on a lease, and it is claimed that it will also take over the Columbus Edison Company, electric-light and power plants, and the Columbus Gas Light and Heating Company, which operates both the artificial and natural gas plants in the city. If this is true, the company will thus gain control of all the public utilities of Columbus, with the exception of the telephone and telegraph service. The directorate of the new company is made up as follows: George Hardy, Frank Stewart, James A. Williams, John Riley, Charles F. Pryor, W. T. McClure and Theodore M. Livesay. The officers chosen are as follows: President, George Hardy; first vice-president, T. M. Livesay; second vice-president, W. T. McClure; secretary, Frank Stewart. Mr. Hardy is cashier of the Deshler National Bank and Messrs. Livesay and McClure are attorneys. Mr. Stewart is connected with the street-railway company. The matter is causing a great deal of speculation in railroad circles through the state, and the success of the movement will be watched with much interest. The Columbus Railway Company gives the people of the capital city, perhaps, the best service of any street railway in the state, without exception. While it will not be possible to change the rate of fares, seven tickets for a quarter and universal transfers, the people fear a decline in the service if there is a change. C.

Mueller Street-railway Ownership Bill Becomes a Law.

After much hesitation and taking the full limit of time set by the constitution for the consideration of bills, Governor Yates has signed the Mueller bill providing for municipal ownership of street railways in the cities of Illinois. The governor does not like the bill, but thinks any harmful results growing out of it may be checked in time to prevent serious injury. His message in approving the bill is very long, but this is the most significant passage: "I believe that this bill should be vetoed, were the General Assembly in session, and that then either this bill should be amended or a new bill passed without the faults of this bill. But the General Assembly is not in session, although I requested it to take recess. The calamity of a special session, with its sensations, and vexations, and delays, and its great expense to the state, probably amounting to a half million dollars, must be avoided if possible. I wish, however, to distinctly state that if in the year 1903 the City Council of the city of Chicago should do wrong in this matter and should pass a grant or ordinance imposing terms so manifestly onerous that neither the city of 1923 nor the grantee of 1923 could take over the property upon the terms imposed, the result consequently being that the grantee of 1903 would have a perpetual occupancy under a legal grant—I wish to announce that in that case upon the passage of the first such ordinance I will not hesitate to act within 24 hours, assemble the Assembly in special session for the purpose of repealing this act and providing an act with necessary restrictions."

In accordance with a promise made in a previous issue, the Western Electrician herewith gives the full text of the Mueller law:

Section 1. That every city in this state shall have the power to own, construct, acquire, purchase, maintain and operate street railways within its corporate limits and to lease the same or any part of the same to any company incorporated under the laws of this state for the purpose of operating street railways for any period not longer than 20 years, on such terms and conditions as the City Council shall deem for the best interests of the public.

But no city shall proceed to operate street railways unless the proposition to operate shall first have been submitted to the electors of such city as a separate proposition and approved by three-fifths of those voting thereon.

It shall be lawful for any such city to incorporate in any grant of the right to construct or operate street railways a reservation of the right on the part of such city to take over all or part of such street railways at or before the expiration of such grant, upon such terms and conditions as may be provided in the grant; it shall also be lawful to provide in any such grant that in case such reserved right be not exercised by the city and it shall grant a right to any company to operate a street railway in the streets and parts of streets occupied by its grantee under the former grant the new grantee shall purchase and take over the street railway of the former grantee upon the terms that the city might have taken it over, and it shall be lawful for the City Council of any city to make a grant containing such a reservation, for either the construction or operation or both the construction and operation of a street railway in, upon and along any of the streets or public ways therein, or portions thereof, in which street-railway tracks are already located at the time of the making of such grant without the petition or consent of any of the owners of the land abutting or fronting upon any street or public way, or portion thereof, covered by such grant.

No ordinance authorizing a lease for a longer period than five years, nor any ordinance renewing any lease, shall go into effect until the expiration of 60 days from and after its passage. And if, within such 60 days, there is filed with the city clerk of such city a petition signed by 10 per cent. of the voters voting at the last preceding election for mayor, in such city, asking that such ordinance be submitted to a popular vote, then such ordinance shall not go into effect unless the question of the adoption of such ordinances shall first be submitted to the electors of such city and approved by a majority of those voting thereon.

The City Council of any city that shall decide by popular vote, as in this act provided, to operate street railways, shall have the power to make all needful rules and regulations respecting the operation of the same, including the power to fix and prescribe rates and charges, but such rates and charges shall be high enough to produce a revenue sufficient to bear all costs of maintenance and operation and to meet interest charges on all bonds or certificates issued on account of such railways, and to permit the accumulation of a surplus or sinking fund that shall be sufficient to meet all such outstanding bonds or certificates at maturity.

Street railways owned and operated by any such city, or owned by the city and leased for operating purposes to a private company, may carry passengers and their ordinary baggage, parcels, packages and United States mail and may be utilized for such other purposes as the City Council of such city may deem proper. Such street railways may be operated by such motive power as the City Council may approve, except steam locomotives.

For the purpose of acquiring street railways, either by purchase or construction, as provided for in this act, or for the equipment of any such street railways, any city may borrow money and issue its negotiable bonds therefor, pledging the faith and credit of the city, but no such bonds shall be issued unless the proposition to issue the same shall first have been submitted to the electors of such city and approved by two-thirds of those voting thereon, nor in an amount in excess of the cost to the city of the property for which said bonds are issued, ascertained as elsewhere provided in this act, and ten (10) per cent. of such cost in addition thereto.

In the exercise of the powers, or any of them, granted by this act, any such city shall have the power to acquire, take and hold any and all necessary property, real, personal or mixed, for the purposes specified in this act, either by public purchase or condemnation in the manner provided by law for the taking and condemning of private property for public use, but in no valuation of street-railway property for the purpose of any such acquisition except of street railways now operated under existing franchises shall any sum be included as the value of any earning power of such property or of the unexpired portion of any franchise granted by said city.

In the case of the leasing by the city of any street railway owned by it, rental reserved shall be based on both the actual value of the tangible property and the franchise contained in such lease and such rental shall not be less than a sufficient sum to meet the annual interest upon all outstanding bonds or street-railway certificates issued by said city on account of such street railway.

Sec. 2. In lieu of issuing bonds pledging the faith and credit of the city, as provided for in section 1 of this act, any city may issue and dispose of interest-bearing certificates, to be known as "street-railway certificates," which shall under no circumstances be or become an obligation or liability of the city or payable out of any general fund thereof, but shall be payable solely out of a specified portion of the revenues or income to be derived from the street-railway property for the acquisition of which they were issued.

Such certificates shall not be issued and secured on any street-railway property in amount in excess of the cost to the city of such property as hereinbefore provided, and ten (10) per cent. of such cost in addition thereto.

In order to secure the payment of any such street-railway certificates and the interest thereon, the city may convey, by way of mortgage or deed of trust, any or all of the street-railway property acquired or to be acquired through the issue thereof, which mortgage or deed of trust shall be executed in such manner as may be directed by the City Council and acknowledged and recorded in the manner provided by law for the acknowledgment and recording of mortgages of real estate, and may contain such provisions and conditions not in conflict with the provisions of this act as may be deemed necessary fully to secure the payment of the street-railway certificates described therein.

Any such mortgage or deed of trust may carry the grant of a privilege or right to maintain or operate the street railway property covered thereby for a period not exceeding 20 years from and after the date such property may come into the possession of any person or corporation as the result of foreclosure proceedings, which privilege or right may fix the rates of fare which the person or corporation securing the same as the result of foreclosure proceedings shall be entitled to charge in the operation of said property for a period not exceeding twenty (20) years.

Whenever and as often as default shall be made in the payment of any street-railway certificates issued and secured by a mortgage or deed of trust as aforesaid, or in the payment of the interest thereon when due, and any such default shall have continued for the space of twelve (12) months, after notice thereof has been given to the mayor and financial officer of the city issuing such certificates, it shall be lawful for any such mortgagee or trustee, upon the request of the holder or holders of a majority in amount of the certificates issued and outstanding under such mortgage or deed of trust, to declare the whole of the principal of all such certificates as may be outstanding to be at once due and payable and to proceed to foreclose such mortgage or deed of trust in any court of competent jurisdiction.

At a foreclosure sale the mortgagee or the holders of such certificates may become the purchaser or purchasers of the property and the rights and privileges sold, if he or they be the highest bidders.

And street railways acquired by any such foreclosure shall be subject to regulation by the corporate authorities of the city to the same extent as if the right to construct, maintain and operate such property had been acquired through a direct grant without the intervention of foreclosure proceedings; provided, however, that no street-railway certificates or mortgage shall ever be issued by any city under the provisions of this act unless and until the question of the adoption of the ordinance of the City Council making provision for the issue thereof shall have first been submitted to popular vote and approved by a majority of the qualified voters of the city voting on such question.

Sec. 3. Every such city owning or owning and operating street railways shall keep the books of account for such street railways distinct from other city accounts, and in such manner as to show the true and complete financial results of such city ownership, or ownership and operation, as the case may be. Such accounts shall be so kept as to show the actual cost to such city of street railways owned; all costs of maintenance, extension and improvement, all operating expenses of every description, in case of such city operation, the amounts set aside for sinking-fund purposes; if water or other service shall be furnished for the use of such street railway without charge, the accounts shall show, as nearly as possible, the value of such service and also the value of such similar service rendered by the street railways to any other city department without charge; such accounts shall also show reasonable allowances for interest, depreciation and insurance, and also estimates of the amount of taxes that would be chargeable against such property if owned by a private corporation.

The City Council shall cause to be printed annually for public distribution a report showing the financial results, in form as aforesaid, of such city ownership, or ownership and operation. The accounts of such street railways kept as aforesaid shall be examined at least once a year by an expert accountant, who shall report to the City Council the results of his examination. Such expert accountant shall be selected in such manner as the City Council may direct, and he shall receive for his services such compensation, to be paid out of the income or revenue from such street railways, as the City Council may prescribe.

Sec. 4. This act shall not be in force in any city until the question of its adoption in such city shall first have been submitted to the electors of such city and approved by a majority of those voting thereon. The City Council of any such city may, by ordinance, direct that the question of the adoption of this act be submitted to popular vote at any general, city or special election in and for the entire city, coming not sooner than 30 days from and after the passage of the ordinance. If the City Council of any city shall incorporate in any grant to appropriate company of the right to construct or operate street railways a provision reserving to such city the right to take over such street railways at or before the expiration of the grant, if the people of such city shall adopt this act as herein provided, provision shall be as valid and effective for all purposes, in case such city shall later adopt this act as herein provided as if the said provision were made a part of such grant after the adoption of this act.

Sec. 5. In all cases provided in this act for the submission of questions or propositions to popular vote the City Council shall pass an ordinance stating the substance of the proposition or question to be voted upon and designating the election at which such question or proposition is to be submitted, which may be any general, city or special election in and for the entire city, not coming sooner than 60 days from and after the passage of said ordinance.

Sec. 6. Nothing in this act contained shall be construed to authorize any city to make any act or grant or to lease any street-railway property for a period exceeding twenty (20) years from the making of such grant.

Provided, That when a right to maintain and operate a street railway for a period not exceeding twenty (20) years is contained in a mortgage or deed of trust to secure street-railway certificates (and no such right shall be implied), such period shall commence as provided in section two (2) of this act.

Union Engineering Building.

A meeting of the representatives of the five organizations named by Mr. Carnegie in his proposition to give to the four national engineering societies and the Engineers' Club a building for their joint use was held pursuant to call, at the Engineers' Club in New York city, on the evening of Friday, May 15th. There were present, on behalf of the American Society of Civil Engineers, President Noble, and Messrs. Wilgus and Pegram; on behalf of the American Institute of Electrical Engineers, President Scott and Mr. Martin; on behalf of the American Society of Mechanical Engineers, President Dodge, Charles Wallace Hunt and Mr. Hutton; on behalf of the Institute of Mining Engineers, President Ledoux, Mr. Dwight and Mr. Kirchhoff; on behalf of the Engineers' Club, President Kafer, Mr. Redding and Mr. Fletcher.

The meeting was called to order by President Kafer of the Engineers' Club, and on motion Charles F. Scott, president of the Institute of Electrical Engineers, was elected chairman of the meeting, and F. R. Hutton, secretary. The chairman opened the meeting by reference to the questions which were to be considered, and called on Mr. Redding for a presentation of some of its legal aspects. After a full and harmonious discussion, the meeting passed the accompanying resolutions:

1. Resolved, That this joint conference committee recommend to the respective governing bodies represented at this conference that the following resolutions be brought before the several organizations to be acted on:

2. Resolved, That (insert name of organization) unite with (insert the names of the other four organizations), or any of them, for the purpose of accepting the sum of $1,000,000 as a gift from Mr. Andrew Carnegie for the purpose of erecting suitable buildings for occupancy by various societies of engineers and the Engineers' Club, on the sites secured for that purpose on the north side of Thirty-ninth Street and south side of Fortieth Street west of Fifth Avenue, in the city of New York, in the state of New York.

3. And resolved further, That (insert name of organization) has a very high appreciation of this generous gift of Mr. Andrew Carnegie, and this additional evidence of his recognition of the engineering profession and his deep interest in the welfare of the national societies of engineers and the Engineers' Club.

4. And resolved further, That a site on the north side of Thirty-ninth Street shall be purchased and held by trustees, or otherwise, as shall be determined by the joint committee hereinafter mentioned, for the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers, or by such of them as shall vote in favor of coming into this enterprise.

5. And resolved further, That a joint committee shall be created, to be composed of three members of each organization that shall unite in accepting said gift of $1,000,000 from Mr. Andrew Carnegie; and that the governing body of (insert name of organization) shall elect three members of this organization to represent it on and be members of such joint committee, and that the governing body of (insert name of organization) shall have the right and power to remove any member of such joint committee who shall be elected by it, and to elect any member of this organization to fill any vacancy that shall occur in such joint committee by reason of the death, resignation, refusal to act or removal of any member who shall have been elected by the governing body of this organization as a member of such joint committee.

6. And resolved further, that the character and internal arrangement of the building to be erected on the site of Thirty-ninth Street shall be determined upon by the affirmative vote of at least two-thirds of all of such of the members of said joint committee as shall represent all of the organizations other than the Engineers' Club, on such joint committee; and that the character and internal arrangement of the club building to be erected on the site on Fortieth Street shall be determined upon by the affirmative vote of all of the three members of such joint committee, who shall represent the Engineers' Club on such joint committee.

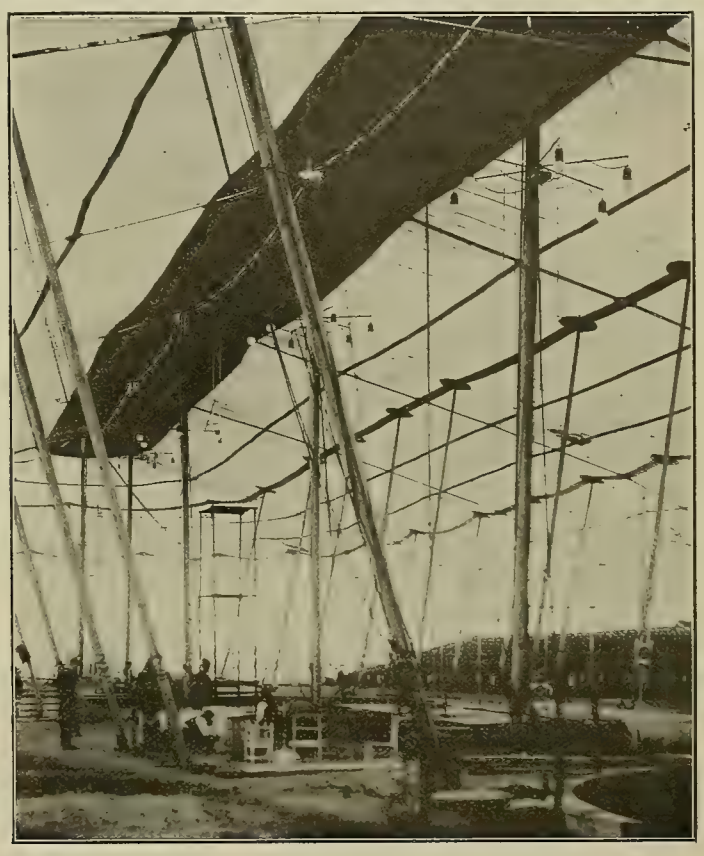
7. And resolved further, That said joint committee shall, by the affirmative vote of at least two-thirds of all the members thereof, select and employ an architect to prepare the plans and specifications for the club building, to be erected on the site on Thirty-ninth Street, and for the club building to be erected on the site on Fortieth Street; and shall also obtain proposals for the erection of both of such buildings; and shall have power to make and enter into such contract or contracts as shall be approved and authorized by the affirmative vote of at least two-thirds of all the members of said joint committee, for the erection of both of such buildings; and shall have charge of the erection of both of such buildings.

8. And resolved further, That said joint committee shall continue in existence until all of the purpose set forth in these resolutions shall have been fully accomplished.

The meeting adjourned subject to the call of the chair.

Large Circus Tent Lighted by Nernst Lamps.

While the idea of lighting the tents of circuses and other traveling shows with portable electric lighting plants is not a new one, the application of the Nernst lamp for the illumination of one of the largest circus tents in the world is certainly an innovation. The accompanying photographs of the interior of Ringling Brothers' largest tent were taken at St. Louis by the Commercial Electrical Supply Company, agent for the Nernst lamp, and show the arrangement of the lamps for the illumination of the circus. The installation consists of 60 six-glower Nernst lamps. A 30-horsepower gasoline engine, driving an 18-kilowatt alternator, supplies the current. A duplicate set is also provided. These sets are mounted on separate trucks and are independent of each other. The operating voltage is 220.



LARGE CIRCUS TENT LIGHTED BY NERNST LAMPS.

The requirement of a circus is a soft, steady, natural light, as a glaring, unsteady or unnatural light might cause the aerial performers to make a mistake and result fatally. The new lamp is said to be highly satisfactory to Ringling Brothers, not alone for its excellent light-giving qualities but for the ease with which the portable plant can be put up and taken down and also for the lessened fire risk as compared with the gasoline method of lighting.

Steam Turbines in Massachusetts.

Under date of May 15th the Boston correspondent of the Western Electrician writes: "The Old Colony Street Railway Company has installed a steam turbine and electrical generator of 500 kilowatts' capacity at Newport, R. I. The machine was furnished by the General Electric Company, which has contracted to furnish two more of the same capacity for the same place, three at Quincy, Mass., of 2,000 kilowatts capacity each and four at Fall River, Mass., of 2,000 kilowatts capacity each. The railway company will save about $105,000 in first cost by using these large turbines instead of high-grade steam engines, and it is estimated that the running cost will be no more—possibly a little less. The larger turbines will not be delivered by the General Electric Company until next year."

Annual Reports of Chicago Edison and Commonwealth Electric Companies.

The annual financial reports of the Chicago Edison Company and the Commonwealth Electric Company for the fiscal year ended March 31, 1903, show substantial increases in earnings. The Edison company reported gross income from electric current and merchandise sales of $3,409,577, as compared with $2,806,609 during the previous year. The operating, repairs and renewals, and general expense amounted to $2,195,647, an increase of $474,826, so that the net income from all sources was $1,213,930, as compared with $1,085,789 in 1902, a gain of $128,141. Charged against the income were interest on bonds and debentures of $300,990 and dividends paid of $593,346, leaving a balance of $319,594.

The Edison company reported its assets as follows: Plants, real estate and franchises, $14,230,840.37; material in storeroom and unfinished work not billed, $388,024.94; accounts and notes receivable, $784,465.15; cash, $136,034.90, a total of $15,539,365.36. To offset this, the liabilities include capital stock issued, $7,589,500.; advance payments for new stock authorized, $997,187; fractional scrip, $170; bonds and debentures, $5,508,000; accounts payable, $123,858.99; depreciation reserve, $590,000; insurance fund, $68,000; surplus account, $610,084.04; open account, $52,565.33. The annual meeting of the Chicago Edison Company will be held on June 8th.

The gross earnings of the Commonwealth Electric Company increased to $1,002,085, as compared with $769,666, the previous year. The operating expenses increased to $623,264, so that the net earnings for the year were $378,821, as compared with $271,763 for 1902, a gain of $107,058. The bond interest, $220,705, showed an increase, owing to the bonds put out during the year for the construction of the new Fisk Street power plant. The surplus or undivided profits for the year were $158,116, or 3.16 per cent. on the $5,000,000 capital stock, as compared with $104,502, or 2.09 per cent. on the same capital in 1902.

The Commonwealth company's assets are shown to be as follows: Plants, real estate and franchises, $10,292,882.97; material in storeroom and unfinished work not billed, $159,417.44; accounts and notes receivable, $126,216.23; cash, $164,372.29; open accounts, $11,079.59, making a total of $10,753,968.52. The liabilities to offset this are: Capital stock, $5,000,000; bonds and debentures, $4,950,000; accounts payable, $382,123.74; undivided profits, $421,844.78.

It is said that a Scotchman has invented a new process for tanning pigskin which is so satisfactory that the product may displace rubber for cushion tires for vehicles of all kinds.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Subjects Discussed at Chicago Meeting of the Institute.

An exceptionally interesting and well-attended meeting of the Chicago branch of the American Institute of Electrical Engineers was the telephone meeting held in the rooms of the Western Society of Engineers in the Monadnock Building on the evening of May 19th. The papers presented were prepared at the request of Kempster B. Miller of the Kellogg company and A. S. Hibbard of the Chicago Telephone Company. Unusual interest was manifested in this meeting, every chair in the hall being occupied. Mr. Junkersfeld presided.

The first paper was by S. G. McMeen of the Western Electric Company and was entitled "Concerning the Telephone Engineer." This paper was presented with good effect, Mr. McMeen's delivery being especially pleasing. The broad field of the telephone engineer was clearly outlined and the necessity of being a specialist in numerous branches, any one of which might afford a life study, was shown to be the part of the successful telephone engineer. The discussion which followed indicated general approval of Mr. McMeen's ideas. "Some Features of Telephone Traffic and Their Effect Upon Service" was the next paper, read by J. G. Wray. The necessity of co-operation between the company and the subscriber and the adoption of a system whereby operators would be classified and the different sections placed under supervising operators was urged as essential to perfect service. Mr. Wray gave a comparison of the hours of maximum and minimum load in some of the larger cities which was very interesting.

The paper of W. W. Dean on "A System of Selective Signaling for Telephone Lines" was of much value. The practicability of a four-party-line non-interfering-call system was demonstrated with instruments. Mr. Dean illustrated his paper with diagrams and curves which brought out the workings of the system very clearly. In the discussion Mr. Carl Kinsley of the Chicago University presented some interesting facts concerning the selective signaling system, which were the results of experiments he had made. Other discussion was in form of questions, all of which were readily answered by Mr. Dean. But little business was transacted at the meeting. Secretary Junkersfeld urged the members to make an effort to place the Chicago branch of the Institute at least in second place, as regards membership, instead of third, where it now is. A committee was appointed to arrange for the Chicago delegation to the coming national convention at Niagara Falls. A social hour was spent after the meeting, after which the members dispersed, to meet some time in the fall.

Independent Telephone Association of the United States.

The advisory board of the Independent Telephone Association of the United States of America, consisting of James M. Thomas of New York, Hugh Dougherty of Bluffton, Ind., H. D. Critchfield of Chicago, E. B. Fisher of Grand Rapids, Mich., S. E. Wayland of Scranton, Pa., S. P. Sheerin of Indianapolis, E. E. Webster of Indianapolis and H. C. Young of Columbia, Pa., has selected June 24th and 25th as the date and Chicago as the place of the next annual meeting of the association. As a Chicago committee of local arrangements, the advisory board has requested J. G. Ihmsen, H. D. Critchfield, Henry Shafer, K. B. Miller, C. W. Stiger and others to act. Joseph B. Ware of 536 Ellicott Square, Buffalo, is the secretary of the association.

New York State Independent Telephone Association.

The adjourned annual meeting of the New York State Independent Telephone Association for the purpose of election of officers for the ensuing year, and the transaction of such other business as may properly come before the meeting, will be held at the Butterfield House, Utica, N. Y., on Wednesday, June 10th. An invitation is extended to all who are interested in Independent telephone work. The officers of the association are: President, George R. Fuller, Rochester; first vice-president, Howard Hendrickson, Albany; second vice-president, Boyd McDowell, Elmira; secretary and treasurer, Charles O. Harris, 59 Stone Street, Rochester, N. Y.

The Pittsburg and Allegheny Telephone Company (Independent) may spend over $1,000,000 in perfecting a service to Philadelphia, Baltimore and other eastern points. Its lines will follow the Pennsylvania railroad.

Independent Telephone Traffic Company.

The annual meeting of the stockholders of the Independent Telephone Traffic Company was held in Columbus, Ohio, last week, about 30 persons being present. President W. W. Thompson, Treasurer A. V. Hageman, H. H. Robinson, chairman of the executive committee, and General Manager Walter Green made reports of the business done by the company since it was organized about three months ago. The company purchases material and supplies, such as wire, poles, cross-arms, telephones, batteries, insulators and many other things of that kind for its stockholders. Besides, it has designed a uniform set of blanks and papers of various kinds which are also furnished. A bad-debts bureau and some other things are also in view, but have not been started as yet.

Following the stockholders' meeting there was a gathering of Independent telephone managers at the Chittenden Hotel under the auspices of the company. President Thompson presided and a number of matters of importance were discussed. Papers were read and discussed as follows: "Reduction of Expenses in Exchange Operation," F. L. V. Turner, general manager Cuyahoga Telephone Company, Cleveland; "The Farmer Line Problem," O. F. French, assistant general manager the Federal Telephone Company, Cleveland; "Development of the Small Exchange," Howard Schwartz, general manager the Star Telephone Company, Ashland; "How to Make County Toll-line System Pay," M. M. Herron, general manager the Millersburg, Wooster and Orville Telephone Company, Millersburg; "Economy in Long-distance Operation," H. H. Robinson, general manager the United States Telephone Company, Cleveland; "The Value of Standardizing," H. C. Devin, general manager the Mt. Vernon Telehone Company, Mt. Vernon.

The offices of the Independent Telephone Traffic Company will be in Cleveland, probably in the Electric Building.

Telephone Cable Splicers Strike.

About 30 cable splicers employed by the Chicago Telephone Company quit work last week, thereby forcing 60 cable pullers out of employment. The men demanded an increase in the scale of wages and, upon their demands being refused, left the company's employment. Since then the company has experienced more trouble than it has had in several years. Over a thousand telephones were put out of use on the West and Northwest Sides by the cutting of two cables in one of the large trunk conduits. Business in that district was at a standstill so far as telephonic communication was concerned, and business men were greatly inconvenienced. Several non-union splicers, with the assistance of linemen, were able to restore the service. It is said that the company has been notified that if it continues trying to have the linemen do the work of the cable splicers, a general strike of the linemen employed by the company will be called. At a meeting the linemen voted to support the cable splicers in their strike against the company, and instructed their members to refuse to do the work of the cable splicers and to walk out if necessary in support of this decision.

The Evansville Situation.

The ordinance granting a franchise to the Evansville Municipal Telephone Company provides that at any time after the preferred stock has been redeemed the city may, at its option, purchase all property rights, contracts, franchises and all other assets of the company at a price equal to the par value of the outstanding common stock, and that thereupon it shall distribute the money paid for the same to each of the shareholders of such common stock pro rata. The city is the holder of 7,900 shares of the common stock, that being a large majority. The franchise is for a term of 25 years. The following charges have been decided on. Full metallic long-distance for business houses, not less than $3 nor more than $4 monthly; residences, metallic long-distance, $2; party lines, two on a line, $1.50; four on a line, $1. Mayor Covert says that work will be begun in 10 days on the new plant.

Mexican Telephone Company's Report.

The Mexican Telephone Company's report for the year 1902, dated December 31st, shows total assets of $3,342,566. Among the liabilities are capital stock of $2,000,000 and surplus of $1,181,533. The following is a statement of estimated earnings for the three months ended March 31, 1903: Traffic receipts $115,000, charter of steamship Mexican to Central and South American Telegraph Company $5,700, accrued interest on investment and deposits $13,500, total receipts $134,200; operating expenses $21,000, Mexican government's proportion of earnings $5,000, total expenditures $26,000; net receipts $108,200; dividends payable April 15, 1903, $47,815; surplus, $60,385; previous surplus, $1,181,533; total surplus, $1,241,918.

Telephone News from the Northwest.

The Norwood-Young America Telephone Company has secured a franchise in the village of Waconia, Minn.

The Interstate Telegraph and Telephone Company has been granted a franchise at Austin, Minn., for an Independent telephone exchange.

The Spring Grove (Minn.) Telephone Company has installed a new switchboard of 60 local connections and 16 toll lines.

The North Dakota Telephone Company has been formed at Carpio, N. D., and will establish a local exchange.

The Northeastern Telephone Company will build a line from Milaca, Minn., to Foley, where connection will be made with the Northwestern's line to St. Cloud. The Northeastern company has just installed a new switchboard of 100 connections at Milaca.

A telephone line is to be built at once from Fairview Township to Vermillion, S. D.

The West Wisconsin Telephone Company of Glenwood, Wis., has just completed a line to Boyceville and will build one to Connersville at once.

Clarence E. Cook has been appointed receiver for the Harrison Telephone Company of Deadwood, S. D., with lines covering the Black Hills. The appointment was made on the application of the Royal Trust Company of Chicago, which holds $100,000 bonds on which the company has defaulted interest. Mr. Cook, the receiver, has been general manager of the company for several months. As soon as the foreclosure suit is determined, it is the intention to reorganize.

A telephone exchange has just been completed at Wessington Springs, S. D.

The Union Telephone Company has begun the construction of a telephone line from Bridgewater, S. D., to a Russian settlement 12 miles out.

The Duluth Telephone Company of Duluth, Minn., has declined a proposition from its striking linemen to arbitrate their differences. The men want an eight-hour day and recognition of the union.

The Onawa Telephone Company has been granted a franchise at Salix, Iowa, for a local exchange.

The Iowa Telephone Company has secured a site in Des Moines for the erection of a three-story building for its exchange office. The building will cost $35,000.

The Farmers' Telephone Company of Quimby, Iowa, has been incorporated with a capital stock of $10,000.

The American Electric Telephone Company seeks franchises for local exchanges at Marinette, Wis., and across the river at Menominee, Mich.

Indiana Telephone Items.

The Northern Indiana Telephone Company has filed articles of incorporation. The capital stock is $10,000. The organization is virtually a merger or an allied organization of 25 or more companies operating in Northern Indiana. The purpose is to pool the long-distance business of all the Independent companies. The territory covered by the company includes 47 counties and extends from Lafayette and Winchester on the south and east and from South Bend to Chicago on the north and west. The first move of the new company will be to build a number of toll cables out of Logansport, where the company will maintain headquarters. These improvements the company considers will place the Independent companies on a par with the Bell in the matter of handling business.

The farmers of Monroe Township, Madison County, held a meeting on the 15th in Alexandria and organized a county telephone exchange which will cover a larger part of the township and connect with the Alexandria exchange. It was decided to string over 30 miles of wire. Marshall Walker is at the head of the company.

The theft of 12 miles of copper wire from the Cumberland Telephone Company at Evansville is proving to be a great mystery. The wire taken down from the poles of the company is valued at $500. C. L. Meyers, general agent, Treasurer Webb and Leland Hume, the general manager of the company, are working on the mystery and sensational developments are expected.

A satisfactory agreement has been entered into by the Commercial Telephone Company of Warsaw and the Farmers' Mutual Telephone Company of Silver Lake, Kosciusko County, by which the line of the latter will be connected with the exchange in Warsaw. The Commercial company has also increased its capital stock from $30,000 to $50,000. This was necessary to carry out the improvements and extensions contemplated.

The strike of the Electric Workers' Union against the Delaware and Madison County Telephone Company which began March 1st and spread to the company's exchanges in other cities has been called off. The strikers asked for $3 a day for linemen and the compromise provides for $2.75—an advance of 25 cents over the old scale. The inspectors get a raise from $60 to $65 a month. F.

Ohio Telephone Notes.

The fact that the Independent telephone interests are about to gain a foothold in Cincinnati has caused a great deal of comment among the telephone men of

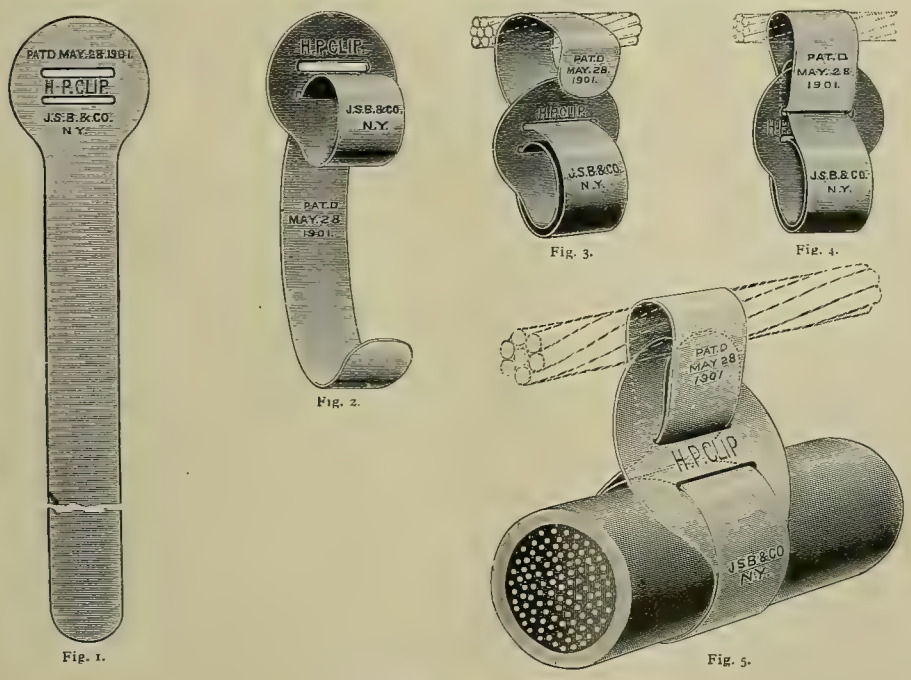
Cleveland, which is the headquarters for the movement in Ohio. They have been watching the trend of events in that city for some time, and they now feel very confident that the way is open. This will not only provide for the extensive development of the Independent plants in the southwestern portion of the state, but it will give the United States Telephone Company a connection with that city which will prove of great advantage to its citizens in a business way, as there are so many houses over the state which use the Independent telephones. It will also give an outlet to the South, where a great deal of the wholesale business of that city is done and will tend to awaken new interest in the Independent movement in West Virginia, Kentucky and Tennessee, as well as in Indiana and the West in general. The fact that there has been no system in Cincinnati has blocked the movement to a very large extent both West and South, as it is the business key to those localities. With this obstruction removed, the movement should be more rapid and general.

The strike of the linemen and cable and conduit men of the City and Suburban Telephone Company of Cincinnati has been settled. The linemen were advanced from $2.35 to $2.50 a day and the cable and conduit men from $2.70 to $2.85. The day for both classes is to be nine instead of 10 hours, while the men will receive pay for overtime and double pay for Sundays and legal holidays.

Citizens of Ottawa have secured control of the Home Telephone Company, and it was reorganized a few days ago by the election of the following-named officers: President, V. J. Duncan; vice-president, H. W. Johnson; treasurer, A. F. Schoch; secretary, William Colwell. They, with the members of the board of directors, own the company in equal shares, something rather new in telephone ownership in this state. O. M. C.

Rustless Cable Hangers.

A one-piece cable hanger which is simple and easily applied is placed on the market by James S. Barron & Co., corner of Broadway and Franklin Streets, New York. The hanger, as herewith illustrated, is made of zinc and is rustless, durable and strong. A special feature is that it will not jump off the suspension wire nor allow the cable to slip, as the grip is tightened with each strain on the hanger. To apply the hanger (Fig. 1) the circular enlargement is held in the left hand against the cable, while the free end is wound once around, passing through the lower slot, as in Fig. 2. The free end is then wound around again, passing through the upper slot and over the suspension wire, as shown in Fig. 3. By bending the free end and hooking into the upper slot, the formation shown in Fig. 4 is secured. The hanger, with cable and suspension wire complete, is shown in Fig. 5. The hangers are thirteen-sixteenths of an inch wide and are made in lengths from 10½ inches long for cables seven-eighths of an inch in diameter or less, up to 18 inches long for cables from two to 2⅛ inches in diameter. They are conveniently packed in boxes of 500 each.



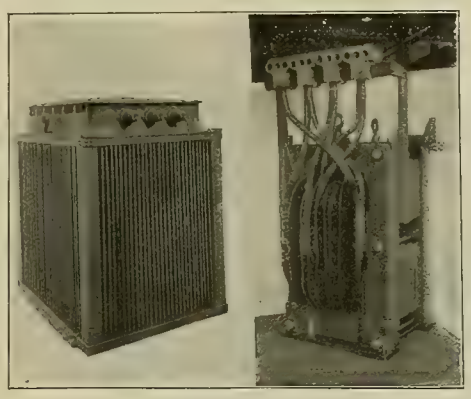
RUSTLESS CABLE HANGERS.

This company is also selling insulated bridle or distributing rings, made of iron and coated with glass enamel. These rings are being used by most of the Bell telephone companies. They are easily screwed into the most difficult and out-of-the-way positions, and the wires are easily inserted and removed. These insulators are made in six sizes and put up in boxes of 500.

The Villard frictionless wheeled and wheelless duct rods sold by James S. Barron & Co. are instantaneous in action, durable and economical. They have all the good qualities of the solid joint, in addition to the advantage of being quickly connected and disconnected and of being easily pushed through the ducts. Both the wheeled and wheelless patterns are made in four sizes and are put up in sets of 200 rods, or 600 feet.

Self-cooling Transformers.

The many advantages of oil insulation have made it almost essential for high-voltage transformers, while the great heat-conducting power of oil also serves to keep down the temperature. In the Westinghouse self-cooling transformers both high-tension and low-tension windings are divided into many flat coils. The high-tension conductor, in all transformers except the very small sizes, is a flat copper ribbon wound concentrically with only one turn per layer. The layers are separated from each other by a specially prepared insulating material in addition to the cotton covering of the conductor, while the coils are insulated individually and are separated by heavy insulating washers. This form of construction is such as to practically eliminate any danger of breakdowns between layers or from turn to turn—one of the most common troubles in transformer operation.



SELF-COOLING TRANSFORMERS.

The low tension is wound in the same way with conductors of rectangular cross section. In the larger transformers many wires are paralleled and are arranged in such a manner as to eliminate eddy currents in the conductors.

The advantages of the improved method of winding employed in the oil-insulated self-cooling transformer are stated as follows: First, the total electromotive force of the transformer is divided among many coils, reducing proportionately the strain within an individual coil; second, the electromotive force between layers is reduced to that of a single turn (ranging from 10 to 25 volts); third, the coils may be spread apart at the ends so that a very large surface is exposed to the oil, thus providing ample radiating facilities; fourth, the regulation of the transformer is greatly improved by the interlacing of coils which is permitted by this method of construction; fifth, in case of damage to a coil another one may be substituted with little trouble and without returning the transformer to the works.

The amount of heat developed in a transformer depends upon its capacity and efficiency. In a 500-kilowatt transformer of 98.5 per cent. efficiency there is a loss at full load of 7½ kilowatts, or 10 horsepower. Since this loss appears as heat, it must be disposed of, to prevent a dangerously high temperature. This heat may be dissipated by simple radiation from the surface of the containing case; by the circulation of water through pipes immersed in oil, or by the constant removal of heated oil and its return after having been cooled. The advantages of the first simple method are obvious.

To dispel the heat generated in a transformer of the self-cooling type, a case with a large surface area exposed to the air is required. The greater the radiating surface, the lower the temperature. The Westinghouse transformers are mounted in heavy sheet-iron cases protected by an outer framework of angle-iron. The surface area of the case is increased by corrugations, and is capable of radiating an immense amount of heat. The high-tension terminals are mounted on a marble slab at one end of the transformer, the leads being brought out through bushings. The low-tension terminals are mounted at the opposite end of the transformer on a steel bar heavily insulated with mica, making an entirely safe construction.

Oil-insulated self-cooling transformers may be wound for practically any voltage desired. The following high-tension voltages, however, have been adopted as standard: 2,200, 6,600, 11,000, 16,500, 22,000, 33,000 and 44,000. Taps are brought out from the high-tension winding for three lower voltages. This provision makes it possible to use duplicate transformers at both ends of the transmission line, the taps on the lowering transformers accommodating them to the reduced line voltage. Transformers of a capacity not exceeding 150 kilowatts may be wound for voltages as low as 50, and the larger transformers for voltages as low as 100.

Oil-insulated self-cooling transformers may be arranged for transforming two-phase currents into three-phase currents and vice versa. Transformers are connected in pairs, and although the two transformers in each pair require slightly different voltages, they are of similar make, with a sufficient number of terminals for procuring the proper electromotive force for either position in the pair. In addition, provision may be made for one other three-phase voltage, five per cent. or 10 per cent. lower than normal. The Westinghouse Electric and Manufacturing Company manufactures a standard line of these transformers in sizes from 10 to 500 kilowatts, and for voltages up to 44,000.

Marconi Criticized in Great Britain.

A London dispatch to the New York World states that the complete cessation, without explanation, of Marconi's promised daily transatlantic service to the London Times by "marconigraph" is causing much unfavorable comment there. When the inventor refused the challenge to demonstrate the practicability of his system to two leading electricians there, he stated that Lord Kelvin was to accompany him to Poldhu for a few days' test of his system. Nothing further having been heard of this test, the World correspondent asked Lord Kelvin if it had been made, and received the reply: "I was obliged to postpone the visit to Poldhu on account of an unexpected engagement. I was not going for the purpose of making any tests, but to see it as a matter of scientific interest."

So far Marconi, says the correspondent, has given no demonstration to independent scientists of the transmission of wireless messages across the Atlantic, but has, in fact, refused to give any to what he calls "unfriendly critics."

Announcement has been made by Eugene H. Lewis, chairman of the finance committee of the Marconi Wireless Telegraph Company of America, that arrangements have been completed for providing the American Company with working capital, not less than a guaranteed amount of $250,000, and, in some contingencies, reaching the sum of $450,000.

Canadian Westinghouse Company to Be Formed.

The firm of Ahearn & Soper, which has represented the Westinghouse Electric and Manufacturing Company in Ottawa, Canada, for many years, is authority for the statement that the Westinghouse officials have taken steps to form a Canadian Westinghouse company for the purpose of manufacturing in Canada the apparatus needed to supply that market. In order that its plant at Hamilton and its real estate there may be utilized, the Westinghouse Air Brake Company will be included. The capital of the company will be $2,500,000, of which the Air Brake company will give $850,000 and the Electric company $950,000, the remainder of the capital stock being taken at par by Canadians. The arrangement provides for a cash working fund of $1,250,000, not including the money already invested in works and real estate. The works will be located at Hamilton and will be on a large scale and of the most modern construction and equipment. The board of directors, it is said, will include some of the most influential and strongest financial men of Canada.

Prometheus Electric-cooking Utensils.

The advantages asserted for the electric heating and cooking devices of the Prometheus Electric Company of 39 Cortlandt Street, New York, is that the appliance is so constructed that the heat is transmitted instantly and directly to the object to be heated, and to that object only. The heater itself consists of a strip of mica on which a layer of metal has been deposited, or more properly speaking, fired. This conducting strip is protected by another piece of mica and the whole is enclosed in a metallic casing. This unit or "heating element" can be painted to any desired resistance. The paint is an alloy composed of non-oxidizable metals, insuring the element's life. The element may be either

FIG. 1. WATER BOILING IN HEATER HELD IN THE HAND.

straight or circular according to its usage and may be inserted into or removed from a piece of apparatus with ease in case of a breakdown—a feature of especial advantage. In the Prometheus system the utensils themselves are equipped with the heater, thus dispensing with a stove, which means not alone the purchase of one piece of apparatus, say a pot or chafing dish, instead of a pot or chafing dish and stove on which to place it, but the inefficiency of the latter device is obliterated. By actual tests, it is said, 87 per cent. of the heat sent into a utensil is shown to be utilized therein for the heating of the food.

Fig. 2. Heaters of Different Sizes.

Fig. 3. Chafing Dish and Accessories.

PROMETHEUS ELECTRIC-COOKING UTENSILS.

This may be illustrated by the fact that a pot in which water is boiling may be held in the palm of one's hand, as shown in Fig. 1.

The Prometheus system was originally developed in Germany, where the parent company is located. A large number of attractively-finished electric-heating and cooking utensils are made. Fig. 2 shows food or water heaters of different sizes and Fig. 3 an electric chafing dish with accessories. The company also supplies plate-warmers, broilers, stoves, laundry irons, laundry machines, pleating machines, curling irons, soldering irons, glue pots, street-car heaters, radiators, sterilizers, medical appliances, motor rheostats, controlling devices, theater dimmers, etc.

McBride Enclosed Fuse.

The accompanying cuts illustrate a new enclosed fuse manufactured by the McBride Manufacturing Company of Detroit, which is said to be something

FIG. 1 M'BRIDE ENCLOSED FUSE COMPLETE.

FIG. 2. M'BRIDE ENCLOSED FUSE.

entirely new in the fuse line. As is clearly shown in Fig. 1, the fuse terminals consist of suitable simple wire of sufficient length to enable one to insert the fuse in an ordinary fuse block, irrespective of the distance of the terminal posts to which it must be connected. The McBride "Arkless" fuse is designed to furnish a perfectly safe and efficient substitute for the open-link fuse, and its long terminals permit of its being used in all forms of cut-outs, knife switches, tablet boards, etc. The manufacturer asserts that it is entirely noiseless and absolutely reliable under all conditions, and it is said to conform strictly with the published requirements of the underwriters.

Double Third-rail System in Liverpool.

[From the London correspondent of the Western Electrician.]

In spite of the negotiations respecting the conversion of the Metropolitan District Railway to electric traction, the Mersey Railway claims the honor of being the first steam railway to be converted to electrical working in Great Britain. The railway ceased to be worked by steam at midnight on Saturday, May 2d, and on Sunday, May 3d, the public of Liverpool and Birkenhead was admitted to enjoy its first electrical ride under the River Mersey.

It was not until July, 1901, that a contract with the British Westinghouse Company was concluded, so that no delay has occurred on the completion of the works. A three-minute service has been adopted.

The generating station has been erected near the Hamilton Square station, and contains nine Stirling water-tube boilers fitted with mechanical stokers. The generating sets are three in number, and each consists of a vertical compound steam engine direct-coupled to a Westinghouse double-current generator. The normal full-load capacity of each engine is approximately 1,650 horsepower. Steam is supplied at 170 pounds' pressure per square inch, the speed being 94 revolutions per minute. The engines operate condensing with 25-inch vacuum, and have an overload capacity of 60 per cent. under these conditions, or 40 per cent. non-condensing. The electric generator of each set is built direct on the shaft between high and low-pressure sides of the engine. Each machine has a rated capacity of 1,250 kilowatts generating direct current at 650 volts, or three-phase alternating current at 25 cycles per second. At present, however, the whole of the railway is worked with direct current. The generators are of the Westinghouse standard multipolar type. A couple of smaller generating sets have also been erected. The battery house has a 320-cell battery.

The track has two electrical conductors, the positive being on the outside of the running rails and the negative between, the former being protected from accidental grounds by means of a wooden guard. The trains will consist of a varying number of coaches, but with always two motor cars, one at each end. At present the company has 24 motor cars and 33 trailers, each 60 feet long. The motor cars are each fitted with four motors coupled to the car axles with the usual single reduction spur gear of the ratio 56:20. The approximate horsepower of each is 100, working at from 550 to 600 volts. The collector shoes are carried on stout wooden beams, there being one beam at each end of every motor car secured to the truck frame, and carrying three collector shoes. The outside two serve for the positive collector, while the center one serves the negative terminal of the car circuit. The Westinghouse electropneumatic system of train control is used. The ventilation of the tunnel is effected by means of electric fans. A.

The Huntsville (Ala.) Railway, Light and Power Company will soon be in need of a 150-kilowatt, direct-connected, three-phase alternating system, with about 100 enclosed-arc lamps.

Space-telegraph Stations in Milwaukee and Chicago.

The practical tests of the De Forest space-telegraph system on the great lakes, reference to which has been made in the Western Electrician previously, are soon to be made. For this purpose the De Forest Wireless Telegraph Company is at work upon the erection of stations at Milwaukee and Chicago, which will form part of the proposed lake system establishing communication between various points along the great lakes and also between lake steamers and the shore.

The stations in course of construction at Milwaukee and Chicago are being built on the same plan. The one in this city is located at the foot of Oak Street, at the northeast extremity of the renowned "District of Lake Michigan." It is nearly completed, and the apparatus for sending and receiving messages will be in readiness within a week, it is said. A large mast 220 feet high has been erected under the supervision of an agent of the company. From this mast the receiving wires lead into a small building in which is being installed the delicate equipment. The Milwaukee station is being similarly equipped, and as soon as completed the first experimental messages will be exchanged between the two stations. According to present plans other stations will soon be installed, and as fast as possible opened for general business. The equipment of lake steamers with the wireless apparatus to establish communication with the shore stations from midlake will not be delayed.

Experts at work on the Chicago station were not inclined to talk of the details, nor are the officials anxious to give out the full extent of the plans of the company until experimental messages have been successfully transmitted, which, it is believed, will be in about a week. Mr. De Forest, who was in Chicago to supervise the construction of the space-telegraph system between the Armour plant at the Stock Yards and the down-town offices has gone East. The Armour system, an account of which was given in the Western Electrician of April 4th, is proving quite successful, although some complaint is made of the slow rate of transmission.

Nernst Street Lighting in Burlingame, Kansas.

What is said to be the only electric street-lighting plant west of the Mississippi River using Nernst lamps was put into service on May 1st at Burlingame, Kan. It is a municipal plant and was installed for the city by F. H. Stanard, consulting electrical and mechanical engineer. It consists of one 100-horsepower Sioux Corliss engine, with suitable boiler capacity and steam auxiliaries, and 160-kilowatt, 133-cycle, 2,200-volt Warren alternator, belt driven at 800 revolutions per minute. The installation is housed in a neat-appearing brick building 44 by 42 feet in ground dimensions and finished and papered inside.

Current for both street and commercial lighting is supplied. The street illumination is accomplished by 44 Nernst lamps, 34 of which are of the two-glower type and 10 three-glower. These lamps are placed on 30-foot poles and placed at street intersections, as in the case of arc lamps. About 12 horsepower is required to operate the 44 Nernst street lights. In addition, about 50 one-glower Nernst lamps are installed in stores and shops. In reference to the street lighting, Mr. Stanard says: "The Nernst lamps light the streets in fine shape. I consider that far better results are obtained by placing one Nernst lamp at every corner all over town than by using arc lamps at every other corner, while the expense for power is only half as much."

Waterpowers in Northern Indiana.

Investigation under the direction of Charles D. Wolcott, as director of the United States Geological Survey, shows that the development and utilization of waterpower facilities in the states north of the Ohio River have not received due attention. In the early history of these states there were developed numerous small power plants which were used principally for grist and lumber purposes; but with the rise of steam power, the utilization of natural gas, and the enormous development of railroad facilities throughout this area, the use of waterpower gradually declined, until, up to the present time, comparatively little advantage has been taken of the available power sites along the river systems tributary to the Ohio.

Now, however, there is a tendency to return to the waterpower facilities afforded at available sites, especially in the northern part of Indiana. This is due in large measure to the improvement that has been made in methods of electrical transmission, to the gradual failure of the natural-gas supply, and to the increased cost of steam power by reason of the unsteadiness in the price of coal and the uncertainties of the coal supply arising from frequent strikes among coal miners.

One of the greatest demands for power in the region north of the Ohio River arises from the development of interurban electric lines. There are few, if any, great power sites in this section, but a large number of small ones may be easily and economically developed, and the transmission of electric power for the use of these lines is a comparatively simple matter.

The United States Geological Survey is now making a study of the Wabash River system, including its larger tributaries above the city of Lafayette, such as Tippecanoe, Eel, Mississinewa and Salamonie Rivers. Current-meter measurement stations have been established at important points, the records obtained at which will show clearly the amount of water that flows in these streams. These data, together with the facts concerning the fall of the water, which are now being investigated, will provide material whereby the power available at different points can be determined.

Not the least important of these investigations is the examination of the watershed of Kankakee River. That part of the Kankakee Basin lying within the state of Indiana is exceedingly flat and marshy, water standing on the surface at considerable depth during all but the dry seasons of the year. The successful draining of this country would serve the purpose of reclaiming large areas for agricultural uses, and the water can, without doubt, be diverted so as to increase the flow of streams whose headwaters adjoin the Kankakee Basin. Tippecanoe River, tributary to the Wabash, is a stream that has considerable fall, but the available power on the stream is disproportionally small because of the comparatively limited drainage area and the consequent small flow of the river. The feasibility of conducting the excess water from the Kankakee Basin to the headwaters of Tippecanoe River through a series of ditches is being considered.

Another similar project under advisement is the diversion of a part of the water from the Kankakee area into St. Joseph River. This investigation is under the direction of Mr. M. O. Leighton, hydrographer, United States Geological Survey, assisted by Mr. Edward Johnson, Jr., assistant engineer, and several engineers and officials of the state of Indiana.

Brooklyn Edison Improvements.

During the last two years the Edison Electric Illuminating Company of Brooklyn has spent $300,000 on its Waterside station, at the foot of Sixty-sixth Street. In addition, contracts already let for work now being done and machinery to be delivered within a year will bring the figures up to considerably over $500,000. Of this sum $200,000 has been invested in two 5,000-horsepower cross-compound engines direct-connected to three-phase alternating-current generators. A third 5,000-horsepower engine and dynamo, similar to the two now in use, has been ordered for the Waterside station. Exclusive of foundation, piping and other accessories, this machine will cost about $125,000. For the newly completed boiler house, with blowers and the six new boilers, the company has paid over $100,000. A new steel coal pocket and basin, with larger intake tunnels in which water from the bay is used for condensing purposes, are now being constructed, at an expense to exceed $125,000.

The half million of dollars thus laid out is for the Waterside station alone, and does not include $250,000 recently expended for four storage batteries and $100,000 for two more now in course of construction. It does not include additions and improvements at the Gold Street station of the company, nor at any of its eight distributing stations, nor the appropriation for the new distributing station to be erected this year on Sumpter Street near Stone Avenue to take care of the development and business growth of upper Broadway and East New York.

The city of Portland, Ore., will receive bids until June 18th for lighting the streets and public buildings with gas or electricity for a term of five years. Address Thomas C. Devlin, city attorney.

New St. Louis Supply Store.

The Ewing-Merkle Electric Company of St. Louis celebrated last month the formal opening of its new store at 1106 Pine Street. Visitors found the new store well worth inspection. On the first floor, near the door, are placed specially designed showcases, in the form of a square, in which are contained samples of nearly all the small material needed in the lighting and telephone industries. Beyond the city counter, with its dumb waiter connected to the seven floors, is the exhibit room, in which are motors, dynamos, arc lamps, switchboards, electric fans, telephone and electric fixtures, and the larger articles used by contractors, electric-light and telephone companies. This floor is divided about midway by a glass partition, back of which is located the shipping and receiving departments.

The basement, which is an especially large and airy one, is filled with carloads of Roebling's telephone wire, cross-arms, glass insulators and iron conduit, all arranged in a most convenient and accessible manner.

EWING-MERKLE COMPANY'S NEW STORE IN ST. LOUIS.

The main or general offices of the company are on the second floor. These offices are extremely handsome, being made of golden oak, and so arranged as to afford the greatest convenience for the transaction of business. On this floor is also placed the private-branch telephone exchange, and the private telegraph instruments.

On the third floor is placed the lighting supplies, and the arrangement of the shelving is such that the greatest amount of space is obtained, the noticeable feature being a place for everything.

The fourth floor contains all the copper wire, rubber-covered, weatherproof, magnet, annunciator and the cables, of all of which the stock is very complete and splendidly arranged. On this floor also the shelving for the glass shades, reflectors and incandescent lamps is placed. The arrangement for taking care of this product is indeed unique, and arranged to facilitate prompt handling.

On the fifth floor is placed all the standard packages, goods that are never unpacked, carloads of electric fans, hundreds of arc lamps, sockets, cutouts, carbons, knobs, porcelain tubes, incandescent lamps, transformers, speaking tubes, in fact, everything ordered out by customers in original packages.

On the sixth floor are the brackets, pins, construction tools, and wood molding, of which they have an immense stock.

The company uses a perpetual inventory, which enables it to answer telephone or telegraph inquiries instantly as to stock; this feature was very favorably commented upon by the many visitors, as promptness in filling orders and answering inquiries seems to be a fundamental aim of this enterprising concern.

Refreshments were served from three to six in the afternoon, and all left with the most cordial wishes for the prosperity of this enterprising company.

Indiana Traction Merger.

The merging of the Union Traction Company of Indiana and the Indianapolis Northern Traction Company is assured, and the papers are to be signed at Anderson on May 27th. Stockholders of both companies will attend the meeting. The Union Traction stock advanced five points on the Indianapolis Stock Exchange immediately upon the announcement of the merger. The deal is the largest interurban-railway deal ever planned in Indiana, the lines and the proposed lines of the two companies forming a network in northern Indiana, connecting all the important points of the northern and eastern part of the state with Indianapolis. The same interests are planning a line to Chicago, and it is believed that the holding company that will later be formed will take charge of all these lines. Until recently the merger has been opposed by Messrs. Marott and Light, who insisted that the merger would injure their stock in the Union Traction Company.

WORLD'S FAIR NOTES.

Lieutenant Godfrey Carden of the Machinery Department, who left for Europe last June, has returned, after a most successful trip, and is now in New York in the interests of his department. Chief Moore of this department states that the influx of foreign exhibits has been so great as to intrude in the space intended for American exhibits.

Cloyd Marshall, superintendent of electrical machinery in the Department of Electricity, who has been engaged in exploitation work in the East, with headquarters in New York city, has met with the hearty co-operation of the electrical people in that section of the country, and reports that in almost every case the greatest enthusiasm exists looking toward working displays.

Large foundations for the Westinghouse generating units are being laid in Machinery Hall, and already the engines for driving the exciters are in place. The temporary power plant containing the Durr and Climax boilers and the Warren and Stanley generators has been in satisfactory operation since the first of the month, and furnishes current for the motor-driven paint pumps, drills, etc., in use on the grounds, as well as for lighting purposes.

The Electricity Building stands complete, with the exception of the sculptural decorations, and, surrounded with rows of beautiful shade trees, it is one of the most conspicuous of the palaces in the main group. Several of the large statues have been completed in the staff shop in Hoboken, N. J., where an abandoned roundhouse has been pressed into service. Two of these, Power and Heat, both by Augusta Lukeman, have just been completed. The great corner towers have, at present, an unfinished look, but the addition of the heroic groups and many smaller pieces will make one of the most ornate of the exhibit palaces.

That the foreign section of the Electricity Building will be one of unusual interest is now assured, as the representatives of the three countries most advanced in the manufacture of electrical apparatus have been allotted large areas in which to exhibit the products of their most representative builders. Hon. Michel Lagrav, commissioner of the French republic to the Louisiana Purchase Exposition, was the first to make a formal demand for space, and his section will occupy a portion of the northern corridor of the building. Dr. Theodor Lewald, imperial commissioner from Germany, has also made requisition for an even larger space, and has promised to fill it with the best that Germany can produce. The great firms of Germany are taking a lively interest in the electrical display, notwithstanding the depressing times, and are preparing to take advantage of the opportunity to exhibit their machines and apparatus before the representatives of the South American, African and Asiatic countries in competition with American firms. Colonel Charles Watson, secretary of the British Royal Commission to the exposition, was also a caller at the Department of Electricity, and has asked that a portion of the foreign section be set aside for the use of British exhibitors, many of whom have already signified their intention to exhibit on a large scale. Taking into account the space required by Swiss, Russian, Swedish and other manufacturers, it is more than probable that the 40 per cent. of the building set aside for foreign exhibits will be required to meet the demand.

CORRESPONDENCE.

London Letter.

London, May 9.—The bill which sought to provide for a tube railway from the city to the north and northeast of London over the route taken up by Mr. Morgan last year, has been rejected by the parliamentary committee before which it was placed. The rejection was due to the want of strength in the financial details of the scheme, notwithstanding the moral support of the Westinghouse company, which paid £5,000 towards the preliminary expenses of the bill. Ever since Messrs. Yerkes and Morgan came here and offered to "plank down the sovereigns" beforehand, nothing short of this will now suit parliamentary committees, and previous experience of other tube railways serves to indicate that this attitude on the part of Parliament is the correct one. As far back as 1893 a railway was authorized, but is not yet completed, owing to failure to raise the capital. Whereas in the early days too little attention was paid to finances, it is now the custom to go to the other extreme.

Apropos of the control which Mr. Yerkes now has over so many tube railways in London, to say nothing of the District Railway Company and the London United Tramways Company, the London County Council has issued a report calling attention to the imminent danger there is of the formation of a monopoly by transferring the individual lines to one company over which Parliament would have no control, thus placing the financiers in a very undesirable position from the public point of view. What the precise object of the London County Council is, it is hard to say, but it has probably some direct bearing upon the proceedings of the London Traffic Commission which is now sitting.

A proposal to introduce a system of trolley motor cars not running on rails has just been sanctioned by a committee of the House of Commons.

The London United Tramways Company has just followed what I believe is an American practice and arranged to hire out its tram cars for the day. The inclusive fee including driver is $25

The third of the series of engineering congresses initiated by the Institution of Civil Engineers will be held on June 17th, 18th and 19th. There will be seven sections for the reading and discussion of papers. Alexander Siemens will be the chairman of the electrical section, and other prominent names in connection with the management of it are James Swinburne, W. H. Preece, Colonel Crompton, Professor Cyrton and Professor Ewing.

The Wolverhampton Town Council has recommended that the borough should take over permanently the 11 miles of surface contact tramways which the Lorain Steel Company has laid down, upon the condition that new and more durable surface plates are laid down. A.

New York Notes.

New York, May 16.—Some interesting figures concerning the Manhattan elevated railroads are given out. The change from steam power to electricity is a success from every point of view and has enormously increased the efficiency of the system and in every way promoted the public convenience. The elevated roads are now maintaining a service representing 165,000 car-miles a day. The magnitude of the problem involved in maintaining such a daily service over only about 110 miles of track is very evident. The number of persons carried daily by the elevated trains now averages about 800,000. They travel on the average about four miles, so that the average fare is about one cent a mile. The electrical horsepower used in train movement is about 45,000 continuously exerted. It would be physically impossible to maintain this service with locomotives.

Contractor McDonald assures the rapid-transit commissioners that the opening of the subway will not be delayed by the strikers, as the labor troubles seemed to be almost at an end. Italian rockmen and excavators, from whose strike the entire tie-up started, made no trouble of consequence at any point. Increasingly large numbers of non-union men have gone to work in squads, and in not a few instances Italians broke away from their comrades and returned to their places. The main power house of the subway at Eleventh Avenue and Fifty-ninth Street will be completed on time, although work has been delayed by the strike of the ironworkers. The striking Italians have created considerable disturbance and the police are having a busy time maintaining order.

Commissioner Woodbury of the Street Cleaning Department has installed a garbage incinerator at North Moore and Varick Streets, where he has conducted experiments and hopes to demonstrate that the rubbish waste of the city which has heretofore been carted away and dumped into the sea at a great expense can be utilized as fuel. Mr. Woodbury has in readiness a machine of great power that will compress this material into bricks thus saving the great item of transporting and storing it in its loose forms. These bricks, he expects, will be as readily handled as sticks of firewood, and can be thrown into the furnaces in the same manner. He says that he is arranging to deliver the first output of fuel bricks to Commissioner Robert Grier Monroe of the Department of Water Supply, Gas and Electricity for use at the reservoir pumping stations. At present he can supply 877,000 cubic yards a year of this material, which used to cost 19 cents a cubic yard to take to sea and dump. He believes that there is a profit in the bricks, for it will be easy to sell the excess over what is required for the city's power plants to private consumers for four cents a cubic yard.

In a communication to Police Commissioner Greene William N. Amory says that ever since he complained of the alleged irregularities in the Metropolitan Street Railway Company he and the members of his family have been dogged by private detectives wherever they go. He alleges also that attempts have been made to corrupt his servants, and that his mail and telephone have also been tampered with in outrageous fashion. Of these matters he has also written letters to Postmaster Van Cott and the officials of the telephone company. O.

New England News.

Boston, May 15.—Ipswich, Mass., has voted to build a municipal electric-light plant.

The workmen employed at the West Lynn, Mass., factory of the General Electric Company, have organized an electrical trades' council, which will consider all grievances and conduct all negotiations with the company.

The H. Wales Lines Company of Meriden, Conn., has obtained the contract to build power plants in New Britain, Waterbury and Meriden, Conn., for the Connecticut Railway and Lighting Company. The contract involves the expenditure of $105,000. Each plant will be of brick and will contain a machinery or transforming room and a storage-battery room. Each machinery room will have a 10-ton traveling crane. These plants will be used in utilizing the power to be generated along the Housatonic River by the New Milford Power Company.

The Eastern Connecticut Electric Power Company has asked the Connecticut Legislature for articles of incorporation. R. E. Hawks of Boston is one of the principal financial backers of the company. The company will have a capital of $100,000, and wants power to increase it to $900,000. The company's main purpose is to open up the promising manufacturing district in the northeastern part of Connecticut, and it proposes to generate electricity by water power and sell it to factories and electric railway companies besides building factories and electric railways.

Interested capitalists have formed a company to build Lombard steam and electric log haulers, and the plant will be located in Waterville, Maine. The machine was invented by G. B. Lombard, of that place. Several have been in successful operation on the Kennebec River, each doing the log hauling work of about 30 horses.

Prof. H. B. Smith of the Worcester (Mass.) Polytechnic Institute, has been requested to loan the Institute's smaller high-potential transformer to the Archbold-Brady Company of Syracuse, N. Y., to be used in the tests of insulators under high voltage at the annual convention of the American Street Railway Association next September.

The Massachusetts Institute of Technology is preparing exhibits for the Louisiana Purchase Exposition at St. Louis, next year, and the National Educational Association, which will hold a meeting in Boston July 6th to 10th.

The Bryant Electric Company has contracted for two additional factories in Bridgeport, Conn. They will be built of brick and connected by a tunnel. One will be three stories high and 160 feet long, and the other will be one story high and 100 feet long.

The Connecticut General Assembly has passed a resolution amending the New London Gas and Electric Company's charter, so that it can issue bonds amounting to $750,000, the proceeds to be used in retiring outstanding bonds, debentures, and floating indebtedness. The company is empowered to maintain and operate an electric railway. Its capital is $425,000. B.

Michigan.

Detroit, May 16.—The new cars recently ordered by the Detroit and Toledo Short Line will be used for the through service, and some of them will be equipped with four 125-horsepower motors each, giving a combined strength of 500 horsepower, which will enable the cars to make the through run between Detroit and Toledo in something like two hours.

The scarcity of teams is somewhat delaying the grading of the Detroit and Toledo Short Line between Trenton and West Detroit. H. A. Everett and William E. Moore were in Detroit a day or so ago and took a ride in one of the new Wyandotte cars. The party went out to Trenton and returned well pleased with the new conveyances, which have been described in detail in the Western Electrician.

The International Construction Company of Detroit has closed a contract for the construction of the Davenport Suburban electric railroad, running from Davenport to Muscatine, Iowa, a distance of 34 miles. The contract price for the construction is $950,000.

George E. Fisher of Detroit has secured the contract for the construction of an Ohio trolley line from Cincinnati to Blanchester, known as the Cincinnati, Milford and Eastern Traction Company. The company expects to have cars running over the entire road before January.

The Peninsular Electric Lighting Company of Detroit has applied for a franchise in the village of Delray. The lighting company proposes to furnish light at the same price charged in Detroit. The trustees, seeming to think the rate too high, have laid the request on the table for further explanation as to rates. C. G. W.

From the Buckeye State.

Cleveland, Ohio, May 16.—The Youngstown and Southern Railway Company of Youngstown has been organized with a capital stock of $1,500,000. Gen. Asa W. Jones of Youngstown is president. The Youngstown and Salem Railway Company has been incorporated by the same people with a capital stock of $300,000. The first company will build a line from Youngstown to the Ohio River at East Liverpool, and the other will build a branch from this line at Leetonia to Salem.

The Fort Wayne and Northwestern, recently incorporated, will build a line from Bryan, Williams County, Ohio, to the state line, where it will connect with the Fort Wayne and Hicksville Ridge road.

The American Magnetic Fire Alarm Company of Toledo has been incorporated with a capital stock of $75,000. Asa C. Cooney, Wright M. Cooney and others are interested.

The Findlay and Southern Railway Company of Cleveland has changed its name to the Columbus and Lake Erie Railway Company.

A movement is on foot in Cleveland to organize an express company to operate exclusively over the trolley lines in this and adjoining states. It may be that the business of the Electric Package Company of Cleveland will be expanded to cover the various lines, but this is not decided upon as yet.

A movement is on foot among the railway telegraphers of Ohio to have a law passed either by the United States Congress or the state Legislature, which will require telegraphers to pass an examination and secure a license to do that kind of work.

The Appleyard syndicate has asked the Belmont County commissioners to grant a franchise for an electric line from Bridgeport along the National Pike to the Guernsey County line. They say that the route of the Bellaire, Zanesville and Cincinnati steam road is impracticable for them in the plan to build an electric line from Pittsburg to Columbus. They also agree to take the Wheeling and Western line, three miles in length, off the hands of the commissioners at a fair price, together with the rights and franchises of the same. The syndicate offers to file a $25,000 bond to insure that the road will be completed within a year.

The capital stock of the Cincinnati, Milford and Eastern Traction Company has been increased from $300,000 to $1,000,000, and the greater part of the additional stock has been subscribed.

The Portsmouth Street Railway Company has prepared to build a line from Portsmouth to Hanging Rock.

The franchise of the Columbus, Newark and Eastern Traction Company has been extended to January 1st next by the Franklin County commissioners. O. M. C.

Information from Indiana.

Indianapolis, May 18.—Two interurban railroads were opened during the week—the Wabash River Traction Company's line running between Peru and Logansport, and the Southern Indiana Interurban Railway Company's line running between New Albany and Jeffersonville. Special cars made trips over both lines with invited guests. Cars will now be run regularly. The latter line parallels the suburban line of the Pennsylvania Company the greater part of the distance. It is the purpose of the company to eventually enter Louisville over the Big Four bridge.

The Indianapolis, Shelbyville and Southeastern Traction Company passed to the ownership and control of Dr. R. C. Light and Fletcher S. Hines, Indianapolis capitalists, on the 14th inst. The company was reorganized by electing R. C. Light, Fletcher Hines, M. B. Wilson, Mortimer Levering, Howard Cole, H. F. Wood and M. B. Dawson, directors. Dr. Light was made president and Mr. Dawson secretary. The new company will carry out the plans of the old to extend the line to Cincinnati, and the Greensburg division will be completed this summer.

The Chicago, Indiana and Michigan Traction Company has incorporated with $200,000 capital stock. The road is to run from Hammond through Michigan City, Porter, Valparaiso and South Bend. Russell B. Harrison is president, Hugh J. McGowan vice-president, L. B. Martindale secretary and E. L. McKee treasurer.

The traction company to build from Hamilton, Ohio, to Richmond, and the Eastern Indiana Company to build from Portland to Richmond, received uniform franchises in Richmond on the 14th inst. They are to run 35 years and call for transfers within the city, and the sale of city tickets.

Morgan & Co., steel railway builders of Toledo, Ohio, have contracted to finance and build the interurban road from Vincennes to Jasper. The company has secured $500,000 for construction work. The following were present at the meeting and signed the contract: J. Morgan, Toledo; S. W. Chambers, Indianapolis; T. F. Rice, Sol. Frank, F. T. Chappel, Petersburg and Mayor Roush of Vincennes. F.

West Virginia and Kentucky.

Lexington, Ky., May 16.—The Glasgow, Burkesville and Cumberland Valley Traction Company of Burkesville, Ky., has been incorporated, with a capital stock of $500,000, to build an electric railway from Glasgow to Burkesville by way of Edmonton. It is thought the road may be extended from Burkesville south to some point in Tennessee.

It is reported that the Illinois Central Railway Company is seeking the right-of-way for an electric road from Cincinnati to New Orleans to parallel the Louisville and Nashville road and thus become a competitor of that road.

Wade Cushing of Cincinnati, who is at the head of a movement to build the Owensburg and Hartford interurban railway from Owensburg to Hartford by way of Curdsville and Calhoun in Kentucky, states that an Ohio syndicate will finance the company and that work on the line will be commenced in a short time. The line will be 53 miles in length and the capital stock is $600,000.

Senator Stephen B. Elkins has made a personal inspection of the routes of the proposed electric-railway system to connect Grafton, W. Va., with several other towns in that vicinity. The plan also contemplates a lighting system for that and neighboring towns and an electric power plant.

The Fairmont and Clarksburg Traction Company of Fairmont, W. Va., has been incorporated with a capital stock of $2,000,000 for the purpose of building an electric line from Clarksburg to Burnsville, Marion County. M. L. Hutchinson, S. L. Watson, Walton Miller, L. L. Malone and other citizens of Fairmont are the incorporators.

The Southern Indiana Interurban Railway Company has secured a 20-year lease on the Big Four bridge between Jeffersonville and Louisville, thus giving Jeffersonville and New Albany connection with Louisville and the Kentucky towns.

The Tennis Construction Company of Cincinnati has taken the contract to build the Louisville and Mt. Washington electric railway. C.

Southern Developments.

Charlotte, N. C., May 16.—The charter of the Piedmont Electric Railway Company, which desires to build an electric railway between Atlanta, Ga., and Cummings, Ga., has been held up by the secretary of state because of the fact that the company desired, in addition, the privilege of operating telephone lines, etc. The capital stock of the company is placed at $500,000, with privilege of increasing to $1,000,000. Charles S. Kinsbery of Atlanta is interested.

The Thornton Light and Power Company is installing a $27,000 lighting plant in Hickory, N. C. M. E. Thornton is president of the company.

The W. T. Weaver Power Company of Asheville, N. C., has let the contract to C. R. Willis for a dam across the French Broad River, five miles from Asheville, where a large electric plant is being erected. The dam will be 532 feet long.

It is given out on good authority that definite announcement will shortly be made of the merger of the street-railway companies of Chattanooga, Tenn. The new company, it is stated, will build a 10-mile suburban line. L.

Northwestern Notations.

Minneapolis, Minn., May 16.—The city of Winona, Minn., has concluded not to fight the case to prevent the construction of a municipal electric-light plant. The temporary injunction will be allowed to be made permanent without contest.

The Keokuk Electric Railway and Power Company has arranged for the construction of an electric interurban line to Warsaw, Ill. It is hoped to rush work and have the line in operation by July 4th.

Fosston, Minn., is taking bids for the construction of a municipal electric-light plant.

The fight at New Ulm, Minn., between the municipal electric-light plant and the private lighting company has been brought to an end by the city purchasing the poles and wiring of the private company for $5,500. The contest has been waging for a year, and rates for lighting were reduced to eight cents per thousand watts. It will probably be increased to 12½ cents.

Stillwater people are trying to induce the Twin City Rapid Transit Company to extend its line to South Stillwater. The company is willing to do so if allowed to discontinue the Wilkin Street line, which is claimed to be a losing venture.

The Duluth-Superior Traction Company contemplates extending the Woodland line in Duluth to the Jewish and Roman Catholic cemeteries, and if it does so, may put on funeral trains.

The Fox River Electric, Street Railway and Power Company has started work on the extension of its line in DePere, Wis., and will rush work to have it in operation by July 4th.

It is understood the Des Moines Interurban Company will push work on an extension of its interurban line to Indianola, Iowa. Arrangements are being made to continue the Colfax line to Newton.

The projected electric line from Fort Madison, Iowa, to Nauvoo and Carthage, Ill., has been revived. An option has been secured on the local car line in Fort Madison for the purpose of merging it with the interurban.

Reinbeck, Iowa is arranging for the construction of an electric-light plant.

The council of Dawson, Minn., is negotiating for the purchase of the local electric-light plant.

The new light and water commission of Detroit, Minn., has formulated a new schedule of rates for lighting on a basis of 75 cents per light per month for commercial lighting and 50 cents per light per month for dwellings. Meter rates are 12½ cents per thousand watts.

The Western Union has ended the strike of its messenger boys at Duluth, having secured sufficient help outside the ranks of the strikers, together with those who returned to work.

Ed. Hughes, general manager of the Northern Electric Company has bought of the company its lighting plant at Dickinson, N. D.

The Devils Lake Rapid Transit Company will be formed at Devils Lake, N. D., to build a line to the Chautauqua grounds. The capitalization will be $50,000 and the line will be 5½ miles long. A. B. Kerlin of Devils Lake and others are interested in the deal.

The Mesaba Electric Company has sold its business at Hibbing, Minn., to the Hibbing Electric Company.

Members of the Electrical Workers unions of St. Paul and Minneapolis have protested against Charles L. Pillsbury as a member of the State Board of Electrical Examiners. Mr. Pillsbury was originally appointed as a municipal inspector, but when his term expired he no longer held the position. The unions were invited to nominate someone to succeed him, but failed to do so, and he was reappointed. Now the unions claim he has no right to serve.

The Twin City Rapid Transit Company has taken out a permit for the erection of an office building and sub-station in Minneapolis, at Eleventh Street and Hennepin Avenue, to cost $150,000. C.

Among the Rockies.

Salt Lake City, Utah, May 14.—As a result of the boom now in progress at the rich group of mines at Hillsboro, N. M., a large electric power plant will be installed in that vicinity in the near future. The power will be utilized in the operation of the mines throughout Sierra County.

The first pipe organ to be operated by electricity ever installed in Utah was recently placed in the residence of M. H. Walker, a millionaire of Salt Lake City, at an expense of $10,000.

The plant and holdings of the Denver Tramway Power Company of Denver, Colo., have been mortgaged as security for $1,500,000. This sum, it is announced, will be used in making improvements and extensions, including the construction of a road to Golden.

A survey of the toll road for the Clear Creek Development Company near Grangeville, Idaho, has been made, and the company will shortly install on Clear Creek an electric-light and power plant.

The Burlington Railroad Company is installing two electric motors at Billings, Mont., to furnish power for running the baling machine this season.

The construction of an electric railway connecting Salt Lake City and Ogden, Utah, a distance of 35 miles, is contemplated, and it is reported that active work will be commenced in the near future. Mr. Simon Bamberger, a prominent business man of Salt Lake, is at the head of the project. A system covering the same distance will be in operation in a few months between Spokane and Cœur d'Alene, Wash. A contract for the grading has been let. The line will be placed in operation at an expense of a quarter of a million dollars. G.

On the Pacific Slope.

San Francisco, May 14.—Sealed proposals will be received by Walter E. Butler, city clerk of Whittier, Cal., up to June 1st for the sale of an electric street-railway franchise in that place.

It is stated that the White Swan Mines Company of Baker City, Ore., will install an electric plant on one of the adjacent mountain streams near the mines.

The San Francisco branch of the Westinghouse Electric and Manufacturing Company has closed a contract with the American River Electric Company for two 1,500-kilowatt, three-phase engine-type generators. Each generator will be directly connected with an impulse wheel operating under a head of 590 feet, and will be installed in the plant of the company on the American River, near Placerville. A ditch, 3½ miles long, will be constructed and 2,000,000 feet of lumber has already been purchased to construct the flume. The company will also have a pole line extending to Stockton, via the Mother Lode, capable of transmitting 40,000 volts at first, with the possibility of increasing to 60,000 volts later on. Mortimer Fleishhacker is manager of the American River Electric Company.

The Eureka Electric Railroad of Eureka, Cal., will erect a temporary 500-horsepower plant near the Bayside mill. Later the power will be brought from the Klamath River, where the company will install a plant to cost about $300,000.

Superintendent Petch of the Eureka Light Company of Eureka, Cal., is contemplating the construction of a power plant on the Trinity River, to cost in the neighborhood of $600,000.

H. E. Huntington has purchased the electric-light works of Fresno, Cal. This purchase on the part of Huntington gives him an absolute monopoly of the electric-light and power situation in Fresno.

The United Electric, Gas and Power Company of Santa Barbara and of which J. J. Davis is general superintendent, will erect a power plant on the Kern River. Work has commenced on the construction of a tunnel at the headwaters of the river and a fall will be secured capable of developing extensive horsepower. A.

PERSONAL.

Mr. Gibbs, an American electrical engineer, has been appointed by the government of Mysore electrical engineer in connection with the electric power undertaking at Cauvery Falls, at a salary of 1,500 rupees a month.

Eugene H. Abadie, a well-known and popular electrical man, has been made general manager of the Elblight Company of America. Mr. Abadie was for several years connected with the Wagner Electric Manufacturing Company of St. Louis. His friends will be disposed to congratulate the Elblight company on securing his valuable services.

Mr. Clarence W. Whitney, for nearly four years associate editor of the Western Electrician, took leave of his associates on May 16th, having resigned to act as editorial representative on the Pacific Coast of the four technical journals of the McGraw Publishing Company. Gifted with a pleasing address and exhibiting an unfailing courtesy toward all, Mr. Whitney adds to his merits as a technical writer personal characteristics that have made him exceedingly well liked in Chicago. His friends on the Western Electrician join many other friends in the hope that his future career may be a prosperous and happy one.

Ezra T. Gilliland, a pioneer telegraph operator and telephone inventor, died of heart failure at his home in Pelham Manor, N. Y., on May 13th, aged 56 years. Mr. Gilliland began life as a telegraph operator, at which he became an expert. His early inventions were important in the development of the telephone, and he was associated with Edison in several enterprises. Mr. Gilliland organized and constructed the first telephone exchange in Indianapolis, Ind., which was afterwards sold to a syndicate which organized the Central Union Telephone Company. Besides a wife and several relatives, who survive him, he leaves a wide circle of electrical friends.

Walter B. Spellmire has been appointed district manager of the Atlanta office of the Bullock Electric Manufacturing Company. He will assume his duties at once, with headquarters in the Empire Building of that city. Mr. Spellmire has been with the Bullock company some seven or eight years, during which time he filled the position of chief of the testing department, after which he was sent to London and Paris by the company to look after some important installations at those places. After being abroad one year, he returned to the United States, to fill the position of sales engineer in the New York office, from which position he has just been appointed district manager. Mr. Spellmire's friends predict success for him in his broader field.

ELECTRIC LIGHTING.

The electric-light plant at Alta, Iowa, is to be enlarged and improved.

Garretson, S. D., is contemplating the erection of an electric-light plant this summer.

The Pekin (Ill.) Gas and Electric Light Company intends to install new machinery and improve its plant at a cost of about $30,000.

A new electric-light plant is being installed west of Promontory Point, on the Ogden-Lucin cut-off near Salt Lake, Utah, thus enabling the company to run night shifts there, and when it is completed all camps on the work will be running day and night shifts. There will then be employed on the work between 700 and 800 men. There is now a 30-kilowatt dynamo at the point, also three smaller ones at different places along the work, supplying about 500 lights.

The Woman's Magazine of St. Louis has given the General Electric Company an order to build an electric searchlight which shall excel in size and illuminating power any heretofore constructed. This searchlight will be placed on the dome of the new building which the publishers of this magazine are erecting on University Heights, just out of the city limits, and in full view of the exposition grounds. This searchlight promises to be one of the most striking advertisements yet employed by any publishing house.

The streets of the city of Madison, Wis., are being illuminated with Nernst lamps. Some of the business men in one of the blocks on East Main Street put in five of these lamps, independent of the city arc lights, at each end of the block, making that section of the city a blaze of electric lights. The occupants of the adjoining block to the west were not slow in seeing the benefits of having their block better illuminated, and also made arrangements for five of the lights. The movement is spreading, and it is highly probable that the other blocks in this vicinity will adopt the same plan. The public library at Waterbury, Conn., is to be lighted with Nernst lamps.

ELECTRIC RAILWAYS.

A special meeting of the stockholders of the Havana electric railway is called for June 4th at Jersey City, N. J., to consider the question of authorizing the sale, for purposes of construction, equipment or improvements, of $250,000 out of $2,500,000 consolidated-mortgage bonds reserved for future corporate improvements.

The Pascagoula Railway and Power Company has been incorporated in Kentucky, with headquarters at Louisville. The company is capitalized at $400,000 and intends to build electric railways in Mississippi and control the light and power plants in a number of Mississippi towns. T. Sanders of Moss Point, Miss., is the manager.

In a suit filed against the Union Elevated Railroad Company of Chicago, damages in the sum of $150,000 are asked by Francis N. Carr, Edgar F. Reeve and Joseph L. Hudson, owners of the leasehold in the Clifton House property at Monroe Street and Wabash Avenue. The construction and maintenance of the Union Loop in front of the hotel premises is given as the basis of the action.

The Logansport, Hammond and Chicago Traction Company filed articles of incorporation at Indianapolis, on May 4th, with a capital stock of $1,000,000. The directors are: George F. McCulloch, Horace C. Stillwell, A. L. Drum, Harry E. Guthrie, and Arthur W. Brady. This line will be an extension of the one now being built from Indianapolis to Logansport, and when completed, it is said, will connect Indianapolis with Chicago.

An electric tramway is to connect the Naples traction system with the small incline which is located on the slope of Vesuvius. This will be of great convenience to tourists, as at present they are obliged to climb part way up the mountain in carriages or on horseback. The new traction line is to start from the outskirts of the city and ascend by an easy grade to the observatory, then reaching the lower station of the incline. The line will have a total length of 4½ miles.

It is reported from St. Louis that officials of the Terminal Association claim that when plans which have been in preparation for some time shall be carried out, a double-track belt line will carry passengers with ease and rapidity from the city proper to the World's Fair grounds, six miles from the city's center, and St. Louis will excel all other cities in street-car transportation facilities. It is estimated that the cost of the double belt-line track and improvement will be in the neighborhood of $6,500,000.

SOCIETIES AND SCHOOLS.

The C. M. Schwab Free Industrial School, which was built and will be maintained by Charles M. Schwab at Homestead, Pa., was dedicated last week. The building is three stories high and is 98 by 62 feet in dimensions. Electric power is used throughout.

The new engineering hall of the Iowa State College of Agriculture and Mechanic Art at Ames, Iowa, was dedicated on May 22d. Addresses were delivered by Dr. R. H. Thurston of Cornell University, W. Clyde Jones of Chicago and M. J. Riggs of Toledo, Ohio. In the evening a reception was held.

A meeting of managers of a large number of fire-insurance companies was held in Chicago on May 13th to consider a plan for a joint inspection of street-railway properties in the West. The introduction of electricity has increased the hazards and the values involved. It was proposed that an expert in that line go over all the properties for the benefit of the contributing companies.

PUBLICATIONS.

The Dielectric Manufacturing Company of St. Louis, Mo., has issued a booklet which contains some data on insulating materials. The data is presented graphically by curves.

The American Air Compressor Works, 26 Cortlandt Street, New York city, is distributing a new catalogue descriptive of the American air compressors, air receivers, vacuum pumps, air-lift pumping system, pneumatic tools, etc.

The merits of the Hornsby-Akroyd oil engine are set forth in a catalogue just issued by the De La Vergne Refrigerating Machine Company of New York. The catalogue is profusely illustrated, and besides explaining why the Hornsby-Akroyd oil engine can be used to advantage in most instances, gives some valuable information for engineers and machinists.

The Norton Emery Wheel Company of Worcester, Mass., has published, and is sending out copies to anyone interested, a 16-page booklet containing "a few points on grinding." The booklet contains an article written by Charles H. Norton and treats on grinding and its possibilities when used in conjunction with proper grinding machines and grinding wheels. The booklet is of especial interest to the metal-working manufacturer.

The Storey Motor and Electric Company of 135 Broadway, New York, has issued Section A of its catalogue, relating to motor-driven buffers and grinders. Machines of this type mounted on columns or adapted for bench use are attractively illustrated and clearly described. Direct-current dustproof motors, with bearings of ample proportions, are provided, and the whole combination is neat and workmanlike in appearance. The motors are entirely enclosed, and the grinding disks or buffers are mounted direct on the armature shaft.

The first number of The Electric Light, a small monthly paper published in Lynn, Mass., in the interests of the employes of the General Electric Company, has made its appearance. It is attractively printed and has as a frontispiece a picture of the appearance of Federal Street, Lynn, at noon as the workers are leaving the big factory for lunch. Many personal and other items of interest to the men and women in the works are printed, as well as information about the various "G E" athletic associations and social organizations. The Electric Light appears to be well up to candlepower in its first number, and should have a long life if it receives the support it appears to deserve.

TRADE NEWS.

Cuthbert & Black, electrical engineers and contractors, have removed to new quarters at 324 Dearborn Street, Chicago, rooms 170-185. The company's factory is at 63 Custom House Place.

Norman W. Bingham, Jr., of Boston, Mass., and Edward Davis of Phiadelphia, Pa., the receivers of the Helios-Upton Company, will receive all claims of creditors and others against the company up to August 10th.

Among recent contracts for installations of the Chloride accumulator in railway service, the Electric Storage Battery Company has closed two with the Portland Railroad Company, located at Yarmouth and Underwood Park, Maine. Contracts have also been closed with the Seattle Electric Company, Seattle, Wash., for a battery of 288 cells, having a capacity of 628 kilowatt-hours, and with other street-railway companies.

The Loomis-Pettibone Company, 52 and 54 Williams Street, New York, has recently increased its capital to $2,000,000, and is about to begin the construction of a large plant for the manufacture of gas engines in large units, in addition to the Loomis-Pettibone gas apparatus. A new company has been formed, to be known as the Loomis-Pettibone Gas Machinery Company, which is now prepared to enter into contracts for the equipment of complete plants, gas generators, gas engines, electric generators and motors.

Sealed proposals will be received as follows for construction work (including plumbing, heating apparatus, electric wiring and conduits): Until June 18th for the United States postoffice at Boone, Iowa; until June 16th for the United States customhouse and postoffice at Alexandria, Va., and until June 22d for the United States postoffice at Stillwater, Minn. Copies of drawings and specifications can be had by addressing respectively the postmaster at Boone, the custodian at Alexandria and the postmaster at Stillwater, or by addressing James Knox Taylor, supervising architect, Treasury department, Washington, D. C.

An Indianapolis correspondent to the Western Electrician writes: "A syndicate composed of Mortimer Levering and A. A. Barnes of Indianapolis, G. M. Conner of Detroit, and William Greif, G. W. Barnes and E. C. Kenney of Cleveland, has obtained control of the Jenney Electric Manufacturing Company of Indianapolis. It will at once expend $150,000 in new buildings and machinery and develop the company to a leading position among electric manufacturing companies. The capital stock has been increased from $80,000 to $450,000. Mr. Jenney is president of the new company and head of the technical work. Mr. Conner is secretary and business manager."

The Benjamin Electric Manufacturing Company of Chicago has recently moved its office and factory from the former location on Van Buren Street to 141 South Clinton Street, where greater facilities will enable it to meet the rapidly increasing demand for Benjamin wireless clusters and other goods of its manufacture. This company wishes to call attention to its exhibit at the Auditorium Hotel, Chicago, during the convention of the National Electric Light Association, to be held on May 26th, 27th and 28th. Many interesting features are promised. The Benjamin company also reports a large increase in business through its eastern office, located at 27 Thames Street, New York city.

The Christensen Engineering Company of Milwaukee issues this self-explanatory announcement: "The constantly increasing demand for Christensen air brakes and Ceco electrical machinery has made a change of our organization necessary. To accomplish this result, the owners of the stock of this company have organized the National Electric Company, and the assets, good will, etc., of this company have this day [May 16th] been transferred to the National Electric Company. The purposes, ownership, management and control of the new company are identical with those of the old. We desire and solicit a continuance under our new name of the satisfactory relations which have heretofore existed between us and the trade."

BUSINESS.

Much interest is manifested by users of insulator pins in the new pin produced by the E. J. Noblett Company of Chicago. This is the "Calpa" pin, a substitute for locust, and it is said to be giving the utmost satisfaction.

The Shelby Electric Company of Shelby, Ohio, has contracted for a large brick building to be finished by July 15th. The building will be constructed as a wing to the present plant, and will double the capacity. "We think this speaks well of the Shelby useful-light lamp," says a member of the company, not without reason.

J. Holt Gates & Co., 1436 Monadnock Block, Chicago, have taken the agency of the Skinner Engine Company of Erie, Pa. They are also acting as representatives of the Quincy Engine Company of Quincy, Ill., for large Williams vertical cross-compound engines. This firm is now in a position to erect complete steam and electric plants.

The Great Western Smelting and Refining Company of Chicago states that it is doing an excellent business with the electric-light and street-railway companies. Its copper hard babbitt, which it says is the best for electrical work, is now widely used by electric-railway companies in the bearings of car boxes. The company will be pleased to give full information of its products to street-railway managers or other users of babbitt metal.

The Banner Electric Company of Youngstown, Ohio, reports that its business has shown a very decided increase in the amount of business done over last year. It has a thoroughly up-to-date factory equipment, employs only skilled workmen, and produces a complete line of high-grade lamps. It has recently added a department for the manufacture of electrical specialties, including combined entrance switches and plug cut-outs, automatic time switches, main-line fuse blocks, terminal lugs, tablet boards, etc., and it finds its trade in this line steadily increasing.

A. C. Leslie & Co. of Montreal are meeting with a large and increasing demand throughout the United States for the Remy brand of tungsten permanent-magnet steel. This steel has been used for many years by leading manufacturers of electrical instruments, whose requirements are very severe, as their magnets not only require to be strong, but must be absolutely permanent, as a variation in the strength makes the measuring instruments worse than useless. This brand is also used by many of the manufacturers of the best grade of telephone apparatus in Europe, and is rapidly coming into use for this purpose in the United States.

The Christensen Engineering Company's (National Electric Company's) constantly growing business has made it necessary for the company to provide increased office facilities in Chicago; consequently a large office, fully equipped with every convenience, has just been opened in the Old Colony Building, where representatives of both the air-brake and electrical sales departments will be pleased to welcome the customers and friends of the company. Charles G. Burton, manager of the Chicago agency for the sale of the company's Ceco electrical machinery, has removed from the Merchants' Loan and Trust Building into the new office. The air-brake department is in charge of J. E. Eldred, Jr., who is well known in the electric-railway field, having for a considerable time represented the company in the sale of air-brake equipments.

The Albany Lubricating Compound and Cup Company, of which Adam Cook's Sons, 313 West Street, New York city, are the proprietors, has been for 30 years the sole manufacturer of the original Albany grease, which is unlike any other lubricating compound made, and which, it asserts, has become the standard of excellence and the best lubricating compound ever introduced for general machinery. The manufacturer states that there have always been many imitations of this very successful lubricating compound on the market, and that many engineers have the impression that "Albany grease" is simply a name and may be applied to any high-grade lubricant. For this reason the company continues to offer samples of its compound free for testing, so that every engineer may have the fullest opportunity to investigate in a practical way the claims made for the only original Albany grease.

The Standard Vitrified Conduit Company of New York is to have an exhibit of its conduit at the Auditorium Hotel, Chicago, Ill., during the National Electric Light Association convention, in charge of Mr. B. S. Barnard, vice-president and secretary of the company. The new factories of this company at South River, N. J., are now in full operation, in addition to the old factories, and are said to have a daily capacity of multiple and single-duct conduit equal to the entire demand of the United States; and after July 1st they can supply the world, it is asserted. The company says that it has secured practically all of the orders for conduit in the New England states this season, and the greater part of the orders east of the Ohio River. It is likewise doing a great business in third-rail insulators. The company says that it is not affiliated in any way with any trust or combination.

Electric letters and signs should be fire and water proof, light in weight, but strong and durable. They should not warp, shrink or crack, and their letter surface should have a large and lasting capacity

for reflecting light. All these conditions are filled when using sheet-metal letters with white enameled (or gold-leaf covered) face. The sides of the letters are usually bright red or colored otherwise, and the background black or blue smaltz. Letters with a highly reflecting surface need less lamps and of smaller candlepower than letters with less reflecting capacity. The running expense can be still more reduced by using flashers or dimmers in connection with the sign, making the sign at the same time more attractive. The Haller Machine Company, 127-129 Fulton Street, Chicago, which manufactures, as one of its specialties, "all-metal" letters and signs, has brought out also an automatic dimmer, with which a sign or one part of a sign, or different parts of a sign, may be made dark and light in rotation, without breaking the current, as is necessary with flashers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 12, 1903.

727,563. Electric Switchboard and Circuits. Vincent G. Apple, Dayton, Ohio. Application filed August 24, 1901.

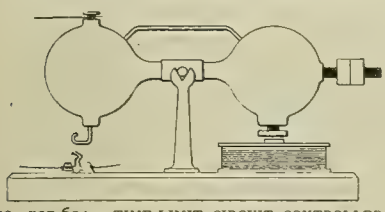
A storage battery, spark coil and circuit breaker are arranged in single series, and are also connected in series parallel with the dynamo and resistance.

727,564. Regulator for Gas Engines. Vincent G. Apple, Dayton, Ohio. Application filed October 16, 1901.

An electromagnetic device is described.

727,565. Electric Governor for Gas Engines. Vincent G. Apple, Dayton, Ohio. Application filed November 23, 1901.

In the governor combined with a fuel-supply pipe are a fuel valve and an air valve arranged in the pipe, electromagnetic means for simultaneously moving both of the valves to regulate the quantity of fuel in the supply pipe.



NO. 727,624.—TIME-LIMIT CIRCUIT CONTROLLER.

727,566. Igniting System. Vincent G. Apple, Dayton Ohio. Application filed May 16, 1902.

An electrical igniting system for gas engines is described.

727,567. Electric Switch. Vincent G. Apple, Dayton, Ohio. Application filed June 16, 1902.

A current time-responsive device is adapted to be operated by an abnormally prolonged flow of current, and means are actuated thereby for opening the switch.

727,568. Dynamo-electric Machine. Vincent G. Apple, Dayton, Ohio. Application filed October 20, 1902.

In the machine, combined with an inclosing casing comprising a body and a hollow, movable door, are suitable dynamo elements disposed within the casing comprising an armature shaft arranged within the casing to project into the hollow door at one end, means secured to the casing body independently of the door to support the end, and a commutator mounted upon the end of the shaft to project beyond the casing body when the door is opened

727,569. Shunt-wound Series Arc Lamp. Malcolm H. Baker, East Liberty, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed March 11, 1902.

In the lamp are an upper carbon carrier, means normally tending to raise the same and strike the arc, means for restraining the arc-striking means, in combination with means for removing the restraining means when the lamp is operated.

727,571. Brush Holder. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 3, 1901.

The holder has attaching means comprising a plate having a bolt hole, and a sleeve integral with the plate and located with its axis oblique to the axis of the bolt-hole.

727,573. Electromagnetic Clutch. Erl V. Beals, Boston, Mass. Application filed October 8, 1900.

In a clutching mechanism are a relatively fixed electromagnet, and a clutch operated thereby and having a rotary armature member constituting a clutch member and a complemental rotary clutch member interposed between the magnet and the armature member and provided with magnetic portions in the path of the magnetic lines of force passing between magnet and armature member.

727,578. Electric Time Switch. William C. Blundell and Cady F. Brower, Kansas City, Mo.; Brower, assignor to Mary R. Blundell, Kansas City, Mo. Application filed August 19, 1902.

The mechanism comprises an electric switch, a lever for automatic operation when unresisted, a slide bar connected to the lever, means to hold the slide bar advanced and the lever with one end elevated, means for tripping the slide bar from the means which holds it advanced, and a connection whereby the operation of the lever operates the switch.

727,590. Lamp Socket. William H. Cole, Watertown, Mass., assignor of one-half to Welles E. Holmes, Newton, Mass. Application filed August 19, 1902.

An incandescent lamp socket is described.

727,596. Electric Arc Lamp. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 16, 1901.

A source of current of constant potential is combined with an arc-lamp, and means forming a portion of the mechanism of the lamp for maintaining a constant current in the lamp irrespective of the length of the arc.

727,601. Synchronizing Apparatus for Alternators. Fred T. Dow, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 19, 1900.

The means comprise distributing conductors, a synchronizing circuit containing a plurality of normally closed break-points, and plug-sockets for throwing potential derived from any machine upon the circuit at the break-points in series with potential derived from the bus-bars.

727,605. Anti-hunting Device for Dynamo-electric Machines. Hermann F. T. Erben, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 8, 1901.

Combined with a dynamo-electric machine are a bridge of conducting material located between adjacent poles of the machine, and conductors embracing each of the poles and separably and electrically connected to the bridge.

727,606. Meter. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 24, 1902.

The meter has a casing or support, a shaft mounted therein, pressure-relieving means for the shaft comprising a magnetic flux-directing member having two pole-pieces, and a current-carrying coil member located between the pole-pieces of the flux-directing member, one of the members being carried by the casing and the other by the shaft.

727,608. Contact Device for Trolleys. Charles L. Fitch, Grand Rapids, Mich. Application filed July 1, 1902.

A device for trolley wheel is described.

727,611. Apparatus for Maintaining Uniform Resistance in Electric Circuits. Frederick A. Gilbert, Brookline, and Emil O. Lundin, Beachmont, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed November 22, 1897.

Means for compensating change of resistance of an electric circuit due to heating comprise a normally open short-circuit around a part of the circuit, an adjustable thermostat for predetermining the point of action, and a circuit-controller operated thereby at a definite temperature for which the device is set to close the short-circuit.

727,624. Time-limit Circuit-controller. Caryl D. Haskins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 30, 1901.

The circuit-controller comprises a pivoted liquid reservoir containing two chambers connected by a duct, an operating magnet to effect transfer of liquid from one chamber to the other upon a determinate current strength in the magnet circuit, contacts in a controlled circuit closed by the transferred liquid after a determinate quantity has been transferred, and contacts closed instantly by the reservoir when a predetermined maximum current flows through the magnet. (See cut.)

727,625. Periodic Circuit-closer. Caryl D. Haskins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 9, 1901.

A periodic circuit controller comprises a pivoted reservoir provided with two chambers, a fine duct between them, circuit terminals sealed into the walls of the chamber, a conducting liquid adapted to be transferred through the duct from one chamber to another, and electromagnetic means for tilting the reservoir when the circuit is closed, whereby continuous operation is effected.

727,633. Electric Baseball Register. John M. Humphreys, Trenton, Canada. Application filed June 21, 1902.

One claim reads: In a base-ball field, the combination of a base having a pair of insulated electric plates, an electric circuit connected to the respective plates, and a signal apparatus located in the circuit, whereby the electric connection of the plates is adapted to operate the signaling apparatus.

727,634. Telephone. Miller R. Hutchison, New York, N. Y., assignor to the Hutchison Acoustic Company. Application filed November 15, 1901.

Parts of the invention are a diaphragm adapted to respond to sound waves, a case or frame in which the rim of the diaphragm is clamped, a binding of insulating material around the edge of the diaphragm and metallic clips extending under the binding to make contact with the diaphragm and thence leading into contact with the clamping surfaces of the case or frame.

727,640. Electric Meter. Elton J. King, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 11, 1901.

In an induction meter are branch magnetic circuits excited by the shunt-circuit of the meter, a gap or gaps in one of the branch magnetic circuits, a rotating member for the meter arranged to be acted upon by flux in the gap or gaps, and means for either advancing or retarding the phase of the flux in the gap or gaps.

727,641. Magnetic Clutch. Edgar Knowlton, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 3, 1902.

In the clutch are a pair of clutch members, means for drawing them together, a magnetizing coil for the members normally open-circuited, and automatic means for closing the circuit of the coil when the clutch members are drawn together.

727,662. Induction Motor for Variable Speeds. August Meuschel, Montreal, Canada, assignor of one-half to George Wetmore, Colles, Montreal, Canada. Application filed October 5, 1901.

The motor has a pair of fields rotatably supported in the plane of rotation of the armature, a bar extending radially from each of the fields on opposite sides of the armature, and means attached to the bars for reciprocating the same, whereby the relative positions of the fields may be adjusted. (See cut.)

727,684. Electric-motor System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 31, 1900.

Combined with an electric motor are a main source of supply therefor, a storage battery, and a controller constructed and arranged to start the motor from the storage battery alone, then to throw the motor in circuit with the main source in series with the storage battery, and finally to cut the storage battery out of circuit.

727,685. Cooling Dynamo-electric Machines. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 2, 1900.

Combined with an inclosed electric motor having a rotating element provided with air-passages, whereby it operates as a centrifugal blower, the rotating element being journaled in the end of the motor inclosure, are an inlet opening in the side of the inclosure, and communications between the inlet and the air passages alone.

727,686. Means for Cooling Dynamo-electric Machines. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 8, 1902.

This invention is similar to the above.

727,687. Lightning Arrester. Henry E. Raymond, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 22, 1899.

Combined with a cup-shaped electrode is a second cup-shaped electrode of smaller dimensions, arranged within the first and separated therefrom by an air-gap between the bases and sides of the electrodes, the upper parts of the cups facing the same direction so that the surfaces are exposed for radiation.

727,688. Lightning Arrester. Henry E. Raymond, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 22, 1899.

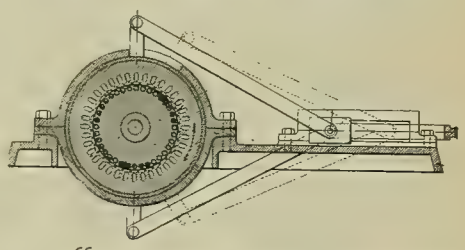
Dischargers are separated from each other by an air-gap, and a metallic strip or projection of metal is carried by one discharger and extends toward but not into contact with an adjacent discharger for facilitating a discharge of lightning across the air-gap.

727,689. Magnetic Clutch. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 3, 1902.

In the magnetic clutch are a pair of clutch members formed of magnetic material, and a plurality of magnetizing coils therefor, the reluctance of the magnetic circuit for one of the coils being considerably greater than that of the magnetic circuit for another coil.

727,690. Electric Arc Lamp. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 26, 1901.

The lamp has a by-pass around the regulating coil, and a magnet of shorter time constant than the regulating coil responsive to the lamp-current to control the same.



NO. 727,662.—INDUCTION MOTOR FOR VARIABLE SPEEDS.

727,701. Telephone System. Charles B. Smith, New York, N. Y. Application filed December 31, 1897.

A signaling system comprises a circuit having a battery and a magnet, a local circuit adapted to be closed by the magnet, a local circuit including a battery and a signaling instrument, a normally open circuit having a magnet to be connected therewith to close the signaling-instrument circuit, and electrically operating devices connected with the first-mentioned local circuit for closing the normally open circuit to enable the magnet on the latter circuit to close the signaling-instrument circuit. (See cut on next page.)

727,702. Electrical Signaling or Calling System. Charles B. Smith, New York, N. Y. Application filed December 13, 1899. Renewed October 22, 1902.

In the system are a conductor to which a plurality of relays are connected, combined with a plurality of selector conductors, a signaling instrument connected with each of the selector conductors and each associated with one of the relays, and means to operate the relays to close the circuits of all the signaling instruments.

727,703. Electrical Signaling or Calling System. Charles B. Smith, New York, N. Y. Application filed December 13, 1899. Renewed October 22, 1902.

In the system are a conductor to which a plurality of polarized relays are connected, combined with a plurality of selector conductors, one for each pair of polarized relays, and a pair of signaling instruments respectively connected with a conductor of the selector conductors, the circuits of the signaling instruments being arranged to be controlled by the relays.

727,704. Electrical Signaling or Calling System. Charles B. Smith, New York, N. Y. Application filed March 8, 1900. Renewed October 22, 1902.

A similar signaling system is described.

727,713. Means for Accentuating Electrical Contacts. Elihu Thomson, Swampscott, Mass., assignor to

the General Electric Company, Schenectady, N. Y. Application filed September 29, 1900.

Combined with co-operating electric contacts are mechanical means for urging them together, magnetic means for urging them apart, and means for decreasing the opposing force of the magnetic means when the contacts come together and for increasing it when they separate.

727,714. Electric Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 26, 1901.

In a regulating mechanism for an electric-arc lamp are combined an inductance coil provided with a nearly closed magnetic circuit, a movable coil mounted so as to be acted upon by the field in the open portion of the magnetic circuit, electrical connections joining in parallel the movable coil and the winding of the inductance coil, and a clutch mechanism operatively connected to the movable coil. (See cut.)

727,756. Device for Reinsulating Electric and Aerial Telephone or Other Cables. John Daggett, Elyria, Ohio, assignor of one-half to Morgan H. Landers, Elyria, Ohio. Application filed November 14, 1902.

In a device for insulating aerial cable wires a trough is combined with a heating receptacle, and supports for attaching the trough to the messenger or supporting cable.

727,763. Electrical Switchboard. Edward B. Ellicott, Chicago, Ill. Application filed April 26, 1901.

The switchboard has a number of battery terminal blocks, each connected with one electrode of a separate battery, a plurality of terminal blocks, each connected with the other electrode of the respective battery, a plurality of contact blocks connected with electrical circuits, and contact plugs adapted for insertion between the terminal blocks and the contact blocks, whereby either one or more sets at a time, or all batteries at once, may be connected with the circuits.

727,764. Electrical Protective Device. Edward B. Ellicott, Chicago, Ill. Application filed December 17, 1901.

In the device are a reciprocable plunger, spring means tending to hold the same in retracted position, means for engaging the plunger so as to hold it in projected position, and an electromagnetic device having a movable part adapted to strike against the plunger when such device is energized, and thereby disengage the plunger and allow the same to become retracted.

727,813. Electrolytic Manufacture of Chlorates and Perchlorates. Pierre Lederlin, Chedde, France. Application filed July 11, 1902.

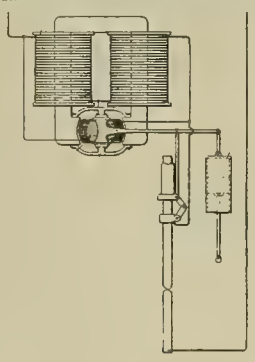
A method for the manufacture at a high constant yield of chlorates and perchlorates by the electrolysis of a chloride solution with the previous addition of a corresponding neutral chromate, consists in maintaining the electrolyte during the electrolysis in a non-alkaline state by the addition of hydrochloric acid.

727,828. Electric Time Switch. Myron A. Nickerson, Canton, N. Y. Application filed January 28, 1903.

Combined with a clock-train, including a revoluble arbor are a revoluble switch member carried by the arbor, a disk and a sleeve both formed of insulating material and surrounding a portion of the arbor, contacts carried by the disk and sleeve and having portions of their length curved to conform to the contour of the sleeve, these portions being engaged successively by the revolving switch member, and electric circuits of which the contact plates and the revolving switch members form terminals.

727,829. Cable Terminal. Joseph J. O'Connell, Chicago, Ill., assignor to the American Telephone and Telegraph Company. Application filed October 13, 1902.

Combined with a cable composed of a sheath and insulated conductors which are extended or returned upon the outside of the sheath are a cap inclosing the cable end and the returned conductors, the space between the cable end and the cap being hermetically sealed with suitable liquid insulation.



NO. 727,714.—ARC LAMP.

727,848. Apparatus for Boiling by Electricity. Robert C. Sayer, Bristol, England. Application filed June 25, 1900.

One claim reads: An evaporating apparatus or boiler consisting of a closed vessel, an open vessel in the closed vessel, a means for heating the open vessel, a water supply, a receiver or trap connected on top to a water-tank open at its top to the atmosphere and to the closed vessel, and at its bottom to the open vessel, three cocks for simultaneously closing the receiver to the water supply and opening it to the open and closed vessels or vice versa, and a float in the open vessel operating the cocks so that water is supplied when the float falls below a certain level and is cut off when the float rises above that level.

727,865. Ground-detector for Electric Circuits. Thomas W. Varley, New York, N. Y. Application filed December 7, 1901.

Combined with a supply circuit of an electric distribution system and the generators therefor are exciters for the generators, means for deriving a local high-resistance ground-circuit from the exciters, a shunt-circuit around the high-resistance ground-circuit, and a means for connecting the same with the supply circuit, and an indicating or signaling device in the high-resistance grounded circuit responsive to a predetermined shunting effect of the shunt-circuit.

727,870. Intermittent Automatic Switch. Henry Wolf, Jr., Cincinnati, Ohio, assignor to Emil Bloch, Cincinnati, Ohio. Application filed December 22, 1902.

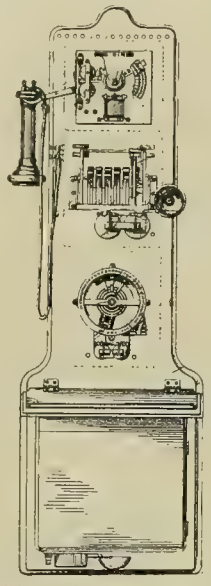
A T-lever is pivoted between two electrodes connected to the armature piston, whereby the T ends of the lever are alternately rocked in contact with spring catches, releasing the same.

727,889. Electrolytic Apparatus. Frank J. Briggs, Everett, Mass., assignor of one-third to George F. Tarbell and Henry A. Locke, Cambridge, Mass. Application filed May 21, 1902.

In the apparatus are a cell, a dialyzer floating therein, a cathode, and mechanism intermediate of the dialyzer and cathode, whereby they are sustained on opposite sides of a pivotal point.

727,996. Electric Push-button. John Y. Parke, Philadelphia, Pa. Application filed January 27, 1903.

The push-button comprises a base or supporting plate having pairs of openings therein, buttons in the openings, contact-arms located so as to co-operate with the buttons to close electric circuits, and a single post or stud located adjacent to each pair of buttons to support and fix the arms.



NO. 727,701.—TELEPHONE.

728,023. Method of Electric Welding. Joseph Schurek and Franklin B. Giesler, Milwaukee, Wis. Application filed March 31, 1900. Renewed September 19, 1902.

The method of welding together pieces of metal which present different areas of surface at different welding points, consists in bringing and holding the pieces together between a pair of electrodes, and with the larger welding points in contact and the smaller welding points kept out of contact; sending an electric current through the pieces of metal until they are welded together at the larger welding points, and then bringing the smaller welding points of the pieces of metal into contact and holding them together until the pieces of metal are welded together at the smaller welding points.

728,034. Regulator for Electric Currents. Thomas Spencer, Philadelphia, Pa., assignor to the Helios-Upton Company, Philadelphia, Pa. Application filed December 16, 1901.

In a reactance regulator for an alternating current circuit are a core, a tubular coil included in the circuit to be regulated and adapted to inclose more or less of the core within it, in accordance with variations in the magnetic stress between the core and coil and a pendulum supporting the coil so that the weight of the latter is opposed to the magnetic stress which affects its movement.

728,038. Alternating-current Electric Motor. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed July 12, 1902.

A translating device adapted to be actuated by alternating currents comprises two coils or helices connected in series and disposed in inductive relation to each other, and a constantly closed circuit of low resistance connecting the terminals of one of the coils or helices.

728,039. Electric Motor. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed July 24, 1902.

A fan motor, with field magnets secured to the frame, an armature, a shaft secured to the armature and mounted in carried by the nut in position to receive the end thrust of with the shaft, and an anti-friction ball mounted in and the bearing sleeves, a nut screwed into the frame in line the shaft is described

728,060. Switchboard Incandescent Lamp. Allen D. Whipple, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed January 27, 1902.

The lamp has a bulb, contact strips secured thereto and forming the terminals of the lamp, an insulating cap fitting over the terminals, and cement within the cap to secure it in place.

728,076. Galvanometer. André Blondel, Paris, France. Application filed January 3, 1901. Renewed January 10, 1903.

A reflecting galvanometer has means for producing a fixed field, one or more coils traversed by the current to be measured and producing a variable field perpendicular to the fixed field, and a band of thin, narrow magnetic material stretched in the fixed field which magnetizes it in the direction of its greater breadth, the band carrying a mirror at a point near its middle.

728,092. Connector for Electrical Batteries. William R. Edwards, Weybridge, England. Application filed March 17, 1903.

A terminal or binding screw for electric batteries and connections is described.

728,119. Automatic Electric Chain-welding Machine. Carl A. Leuenberger, Biel, Switzerland, assignor to The Frm of "Union," Biél, Switzerland. Application filed August 28, 1902.

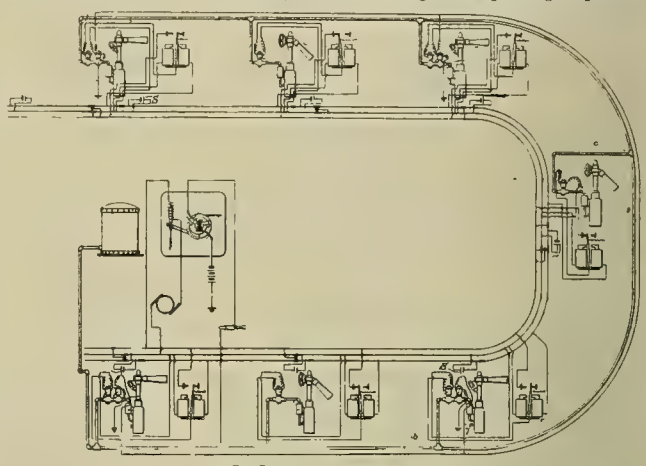
The machine, comprises means for holding the chain-link to be welded in position for welding, movable welding electrodes, automatic means for conveying these latter into contact with the positioned link, means for setting this link under pressure so as to press together the link contact ends, and automatic means controlled by the yielding of the metal of the link when sufficiently softened by the welding heat for causing the electrodes to move out of their contact position as soon as the glowing link contact ends are duly amalgamated together.

728,134. Lock. Christopher J. Roach, Hartford, Conn. Application filed October 2, 1901.

An electric lock is described.

728,147. Telephone Selecting Device. William D. Watkins, San Jose, Cal., assignor to Watkins Manufacturing Company, San Jose, Cal. Application filed December 2, 1901.

The device has a movable member, a locking dog movable into and out of engagement therewith, a pair of eccentrically mounted toothed disks having notches for the reception of the locking dog, a pawl common to both disks, and an electromagnet for operating the pawl.



NO. 728,164.—RAILWAY SIGNALING.

728,152. Insulating Means for Electrical Apparatus. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed September 3, 1901. Divided and this application filed September 17, 1902.

Means for supporting and insulating electrical apparatus, comprises a metal portion provided with a socket, a metal stud adapted to enter the socket, insulation between the stud and the socket, and an expansible metal lining between the stud and the insulation.

728,161. Combined Telephone and Fire-alarm System. William L. Denio, Rochester, N. Y., assignor of one-half to Hobart F. Atkinson, Rochester, N. Y. Application filed May 9, 1902.

Combined with a normally open telephone circuit are a subscriber's call bell therefor, an automatic fire-alarm transmitter in the telephone circuit, and a signal receiving lamp at the central station adapted to receive the signals from the telephone or fire-alarm circuits, the telephone call bell being energized in the operation of the fire-alarm circuit to vary the fire signal at the central exchange from the telephone signal.

728,162. Telephone. William L. Denio, Rochester, N. Y., assignor of one-half to Hobart F. Atkinson, Rochester, N. Y. Application filed February 6, 1903.

The telephone has a vibrating diaphragm, and combined with the diaphragm of the corrugated washer are the magnet and the supporting case.

728,164. Signal-controlling System for Electric Railways. George Gibbs, New York, N. Y. Application filed May 22, 1902.

In the system are a signal and means for moving it to safety-indicating position, an auxiliary control circuit, an opening and closing device for the circuit, means for operating the device and a governor for the operating means that is connected to the power circuit and insures the movement of the operating device to open the auxiliary circuit when the load on the power station reaches a predetermined limit. (See cut.)

728,165. Signaling Apparatus for Telephone Lines. Fred E. Green, Newburyport, Mass., assignor of forty-nine one-hundredths to H. Russell Perkins, Newburyport, Mass. Application filed January 2, 1902.

In the apparatus are the battery, the call bell, the main working circuit for the call bell, a shunt-circuit for the battery, a normally open circuit-closer for the main working circuit, a normally closed circuit-closer for the shunt-circuit, and a step-by-step circuit-controlling mechanism including a member comprising means for holding the main circuit-closer open when in an at-rest position and also for opening the other of the circuit-closers after leaving such position.

728,183. Process of Winding Electrical Coils. Richard Varley, Providence, R. I., assignor to the Varley Duplex Magnet Company. Application filed February 4, 1903.

The process of winding and insulating electrical coils consists in simultaneously winding a conductor and a separating medium for the turns thereof, then removing the separating medium and substituting permanent insulating material therefor.

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The Greatest Hydro-electric Plant in the World.

By Orrin E. Dunlap.

Six of the new type of generators made by the General Electric Company for the Niagara Falls Power Company have been installed in Power House No. 2. It will be remembered that the installation of this magnificent new power house is to consist of 11 generators, each of 5,000 horsepower. Of the total of 11 generators to be placed in the station, there will be six of one type and five of another, both different from the generators in Power House No. 1, so that when the installation of the power house is completed the Niagara Falls Power Company will have three types of generators in operation and service. Fig. 1 shows the interior of Power House No. 2, with six of the new type of generators installed.

The generators first installed in Power House No. 2 are somewhat similar in outline to the generators in Power House No. 1, so familiar to all who have kept in touch with the great Niagara development, but they differ in appearance from the fact that the bridge over the generators in Power House No. 1 has been omitted in the generators of the new power house. This omission results from the collector rings being placed at the bottom, instead of at the top of the dynamo shaft. However, the six new generators now in place are of the external-field type, with the nickel-steel revolving magnet ring. They are wound for 2,300 volts, two-phase, 25 cycles, at 250 revolutions per minute. This gives an exact interchangeability with Power House No. 1.

In its exterior appearance, Power House No. 2 (Fig. 2) closely resembles Power House No. 1, but the long stretch of roof has been broken by gables at the ends and center, and these add to the general beauty of the superb stone structure. This new power house is located on the opposite side of the inlet canal to Power House No. 1, and it stands closer to the river. It is about 560 feet long and 70 feet wide. It stands over a wheel-pit that is 178½ feet deep, 18½ feet wide and 463 feet eight inches long. Between wheel-pit No. 1 and wheel-pit No. 2 there is a connecting tunnel having an approximate length of 310 feet. This tunnel starts from the turbine deck in each pit, the depth from the surface being about 130 feet. It passes under the inlet canal, and its purpose is to allow employes of the company to pass from pit to pit without the necessity of ascending to the surface.

When it is completed, visitors to Power House No. 2 will find that it contains many improvements over Power House No. 1. The front end will be devoted to office quarters, and will be fitted up in magnificent style. In front of the main entrance a broad stairway, of easy ascent and turns, leads to the upper floors and to the observation gallery. This gallery is narrower than in Power House No. 1, but nicely located for view purposes.

A new feature that will command the attention of engineers is the covered forebay that has been erected along the canal side of the new power house. An interior view is shown in Fig. 3. This building is of stone, the style corresponding to that of the power house. It is 40 feet wide and extends nearly the full length of the power house. It is in this building that the racks are located, as shown very clearly in the picture. The water supply from the inlet canal passes to the forebay through a series of arches in the outer wall below the water level, and flows straight up to the racks. In all there are 24 arches. It is expected that this style of construction will afford material relief from the ice annoyances of winter time. At either end of the forebay structure a stairway leads to the top, where a fine view is obtainable.

The turbines of wheel-pit No. 2 are of the Francis or inward-discharge type. They were designed by Escher, Wyss & Co. of Zurich, Switzerland, and made by the I. P. Morris Company of Philadelphia. Being of the internal-discharge type, the discharge water is carried off through draft tubes, which are said to add about 10 per cent. to the efficient head. As compared with Power House No. 1, this gives about 10 per cent. more power for the water used, and so 55,000 horsepower is to be developed in the station instead of 50,000 horsepower of station No. 1. The governors are of the oil-pump-operated type, designed by Escher, Wyss & Co., but built by A. Falkenau of Philadelphia.

The five generators next to be installed in Power House No. 2 will be of the internal revolving-field type. Each will be of 5,000-horsepower capacity, wound for 2,300 volts, two-phase, 25 cycles, and operate at a speed of 250 revolutions per minute. Thus, as stated, there will be three types of machines in the two plants, but it will be possible to operate all the machines in parallel. The idea is to operate the 21 generators in four groups, but the connections will be such that any one of the generators may be thrown into service on any group. The new generators are of much closer regulation than those in power station No. 1, and this matter of regulation, and the fact that the entire installation is operated from one switchboard, and that the feeders are protected by automatic oil circuit-breakers, form the main points of difference between the two notable installations. The single switchboard in Power House No. 2 is located about the center of the gen-

FIG. 1. INTERIOR OF POWER HOUSE NO. 2 OF THE NIAGARA FALLS POWER COMPANY, SHOWING SIX OF THE NEW-TYPE GENERATORS.

ceiling room. It is a gallery, and on it are 36 separate controlling panels—11 generator, 22 feeder, two interconnecting and one exciter panel. All switching is done by relay switches. The exciter plant of Power House No. 2 is located in a chamber in one side of the wheel-pit. The plant consists of four 150-kilowatt, compound-wound, vertical-shaft, 220-volt exciters, each of which has its independent turbine placed directly underneath it. The speed is 750 revolutions per minute. Each exciter turbine has its own governor.

Fig. 4 is an interesting picture. It shows, in one view, the two great power houses of the Niagara Falls Power Company. Power House No. 1 is at the right and Power House No. 2 is on the left. The enlarged transformer station is between them. These plants have, or will have, when Power House No. 2 is completed, a combined capacity of 105,000 horsepower, and constitute the largest hydro-electric plant in the world.

Fig. 2. Power House No. 2 of the Niagara Falls Power Company.

Fig. 3. Covered Forebay of Power House No. 2.

THE GREATEST HYDRO-ELECTRIC PLANT IN THE WORLD.

The installation of the electrical equipment of the new power house is being made under the careful supervision of Mr. H. W. Buck, electrical director of the Niagara Falls Power Company, while Mr. William A. Brackenridge, resident engineer of the company, has charge of the engineering features.

Theft of Current.[1]

By Robert L. Elliott.

With the rapid growth of electric-lighting companies throughout the country during the past decade and the consequent ever-increasing network of wires emanating from them and running through all kinds of buildings and places, there has also grown the temptation to unscrupulous persons to devise and attempt to carry into execution means and methods whereby to obtain fraudulently, for their places of business or abode, the light or power which they find so conveniently at hand in the wires in their premises.

Methods Adopted by Offenders.

The methods adopted by offenders may be classed under general heads, as follows:

Tapping the wires before they reach the meter, and connecting to them, in a more or less concealed manner, other wires whereby to draw off current.

Attaching wires, usually in a temporary manner, to the bare metal parts of service switch or cut-out boxes.

After meter is removed, by connecting meter loops together.

Where customer pays a higher rate for light than for power, by tapping the power wires on the house side of meter for light.

Tampering with wires on the Edison three-wire system before they reach the meter, by disconnecting one of the outer wires at the service switch and connecting the same to the other outer wire, thereby throwing all the lights on one side of the three-wire system, the meter registering the out-of-balance only.

Cutting or pulling out armature wire of meter, so that it will not make electrical connection. In several instances of this nature the armature wire was tapped up at the original tap in such a manner as to conceal the opening.

Removing fuse from switch or cut-out, thus opening meter armature circuit.

Tampering with the meter in various ways, as follows: Inserting wires or other articles under the case of the meter, so as to strike the disk and retard or stop it; drilling a hole in the meter case and inserting an article in a similar manner; inserting articles through screw holes of name-plate on meter case; forcing dust or dirt or insects, such as cockroaches, into the works; inserting short wires or iron filings into the meter, which cling to the magnets, and by dragging on the disk, retard its rotation; lowering jewel screws, so as to allow the disk to rest on magnets; breaking seals or seal wires of a meter, or pulling seal wires out of lead seal, so as to take off the meter case and gain access to the dials; breaking window protecting the dials, or removing glass by prying the glass guard open and slipping glass out; unscrewing the meter from the wall sufficiently to throw it out of level.

Where a customer has his own plant, causing the meter to run backward by charging the consumer's current through the meter into company's mains.

Bridging the meter in various ways, as follows: Putting a jumper on the wires, one end connecting to mains ahead of meter, the other to mains back of meter, or between meter and branch cut-outs; temporarily connecting a wire from bare contacts of the knife service switch, to the bare contacts on the branch cut-out; bridging the meter on the back of the meter board with a switch connection; taking insulation off of leads running in and out of meter to such an extent that the bare wires come in contact with the meter frame, or by placing a wire across the bare leads.

Discovery and Punishment.

Constant and careful inspection by employes is, of course, the great necessity. Meter and inspection department employes, and all others whose duties bring them into contact with the company's service wire and meters, should be instructed to be constantly on the lookout and to report to the office at once any suspicious or unusual circumstances. Some companies have a system of giving a reward in money to such employes as discover a case of theft; but your committee would not advocate this practice, as it would seem to be poor policy, for obvious reasons. In the smaller companies employes should, from time to time, be specially detailed to make systematic and general inspection of wires, meters and meter connections. In the larger companies inspectors can be steadily employed for the same purpose.

Some companies, especially those that have not had much experience in dealing with theft of current, seem to consider it practically impossible to bring about a conviction unless the accused person is seen, in the presence of witnesses, in the very act of tampering with the wires or meters. It is true that much diligence is required, on the part of the company, to prove guilty intent on the part of the accused, but not at all to the extent indicated above. Circumstantial evidence of intent sufficient to convict can be obtained in most cases. As a matter of fact, it is only rarely that the offender can be caught in the act, so it may as well be realized at once that if the company is to refrain from prosecution except when it can get this kind of evidence, it will be able to accomplish little or nothing. The actions of the parties, the statements made by them when confronted, and the other facts and circumstances surrounding the case, constituting circumstantial evidence serving to indicate the guilty intent or knowledge of the parties, will make up as good a case in court as though the evidence were direct. Direct evidence is, of course, always to be preferred to circumstantial, but every crime on the calendar, in the great majority of cases, has to be proved by evidence that is more or less circumstantial, and thus it is in prosecuting the crime with which we are here concerned.

Laws of the Various States.

Although, so far as the writer has been able to ascertain, it has never been decided by any of the higher courts of this country that the diverting of electricity fraudulently is not larceny, still, that is the consensus of opinion among the legal fraternity, such opinion being based upon certain technical legal considerations, the chief of which being that, as electricity is incorporeal, it cannot be regarded as something that one can take and carry away and convert to one's own use, like money or valuables. Therefore, it has been thought necessary to have laws passed by the different state Legislatures covering the offense, and providing for the punishment of those found guilty. Your committee has spent considerable time in looking over the statute books of the different states to find out how many states have special laws on the subject, and what those laws are. As a consequence, it has at hand copies of the laws of those states having special laws on the subject, but as the law of each state is, with few exceptions, couched in language different from that of any of the others, your committee is confronted with the difficulty of commenting on each, or pointing out wherein one differs from the other, which would take up too much time and space. We will therefore be obliged to confine ourselves to referring to these laws in a very general and brief way.

The following states are those having special laws that would seem to cover the subject more or less acceptably: Massachusetts, Rhode Island, Kentucky, Oregon, Ohio, Connecticut, Washington, Montana, New York, District of Columbia, North Carolina, New Hampshire, New Jersey, Pennsylvania, Michigan, Indiana, Illinois, Minnesota, California, Georgia, Virginia, Maryland, Utah, Louisiana, Colo-

Power House No. 2. Power House No. 1.
Enlarged Transformer Station.

FIG. 4. GREATEST HYDRO-ELECTRIC PLANT IN THE WORLD (NIAGARA FALLS POWER COMPANY).

1. Abstract of paper read as a committee report before the National Electric Light Association in Chicago May 28, 1903. Mr. Elliott, chairman of the committee, is attorney and assistant secretary of the Chicago Edison Company.

rado, Vermont and Wisconsin. With the exception that the laws of North Carolina and Oregon are the same as that of New York, the laws of Virginia, New Hampshire and Georgia worded practically the same, and those of Pennsylvania and Maryland identical, it would appear that each state has its law drafted without reference to the laws of any of the other states, and often without proper regard to all the points that should be covered.

So far as your committee has been able to ascertain from the authorities at hand, the following states have no special laws bearing on the subject: Iowa, Maine, Idaho, Missouri, South Carolina, Tennessee, Kansas, Nebraska, North and South Dakota, Wyoming, New Mexico, Alabama, Arkansas, Texas, West Virginia, Florida, Oklahoma, Delaware, Indian Territory, Arizona, Nevada and Mississippi. Companies in the above states should appreciate the advisability of urging upon their state Legislatures the passage of special laws as soon as possible.

After a perusal of the laws in force in the states first named, it would seem to your committee that the following points should be covered in any new law:

First—Fraudulently making any connection with any electrical conductor, so as to supply electricity without the consent of the company or without its passing through a meter set by the company.

Second—Fraudulently preventing any meter from duly registering, or altering its index, or interfering in any manner with its proper action or just registration.

Third—Fraudulently diverting electricity in any other manner whatsoever so as to use or waste it, without the consent of the company or without its passing through a meter set by the company.

Fourth—Anyone aiding or abetting or counseling the above acts to be equally guilty with the principals.

Fifth—A penalty of a fine not exceeding $500, or imprisonment not exceeding one year, or both. (In many states the penalty is less.)

Sixth—Proof that any of the above acts were done on the premises of the accused, or that he received the benefit of such electricity, shall be prima facie evidence of his guilt.

In connection with this matter of circumstantial evidence, your committee would call your attention to the last-named provision, being that contained in the laws of two of the states, namely, Michigan and Montana. Such a provision as this should, if possible, be incorporated into all laws, as by putting, in some measure, the burden of proof on the accused person, it simplifies matters in court in cases where there is no direct evidence of the act of tapping the wire or tampering with the meter.

Prevention.

It is of more importance to all concerned to hinder or prevent the commission of these offenses than to punish those guilty. Therefore, let us now consider what measures can be taken by companies to hinder or prevent such persons from attempting to defraud.

Constant and careful inspection by employes detailed for that purpose is of the utmost importance. They should be instructed to take a certain district at a time, and go through it, following every line from service connection until they see it pass through the meter, and see that the meter and its connections are in proper condition. These inspections, by being made openly and at irregular intervals and unusual hours (and if possible by different employes each time), will do much toward preventing the evil-disposed from attempting to defraud the company, by warning them that the company's inspectors are likely to come in at unexpected times.

Meters should be placed as near as possible to the point where wires enter building, and said wires should be constructed in a clear and open manner, the feed wires being placed as far as possible from the house wires, and switches or cut-outs having exposed metal parts should be arranged in such a way as to make more evident any connections on them.

The meters used should have strong outside and tight-fitting cases, so as to make it as difficult as possible to get inside and tamper with the works. Meter seals of a particular kind may be used. One company has a system of sealing tools by which a number is stamped on the seal, the number identifying the employe who last sealed it, and anyone breaking the seal would require a special seal made, bearing the same number, in order to reseal it without discovery. Meter employes should be disciplined to exercise care while using sealing tools, to place seals on well and properly, and in such a way as to prevent wires being pulled out of lead seal. Seal wires should perhaps, be passed through the lead seal several times so as to prevent their being pulled out.

It seems to your committee that meter manufacturers should discontinue the practice of screwing their name-plates on the front of the meters. Cases have occurred where these screws have been taken out and wires or other articles inserted through the screw-holes. Name-plates should at least be soldered or riveted on to the meter case.

One company suggests the advisability of installing cabinets to which employes only have the key, these cabinets to be large enough to hold meter, service switch and cut-outs.

Another company uses a glass case on all its meters, and considers this a check on tampering, because it can be readily seen whether or not there is anything inserted in the meter or retarding its action.

Companies should avail themselves as much as possible of the special laws of their respective states covering these offenses, and, if possible, make an example of each offender. It seems to your committee, from what has been received in response to its circular letter, that most companies are too anxious to stop the source of loss as soon as it is discovered, and to hasten to confront the offender with a demand for compensation for the quantity of electricity stolen, without proper regard as to whether or not, at the time of so doing, they have done all they could to gather evidence that will serve to bring about a conviction. There is too much of a spirit of being willing to let the matter drop if payment be made. The company that is content with payment for the quantity of electricity stolen is doing itself an injustice and an injustice to other electric-lighting companies. If this matter of theft of current is to be stopped, each company should, by constant inspection and diligent prosecution, establish a reputation with the public that will warn those who are so disposed that any attempt to defraud the company will lead to early discovery and their disaster.

The Properties and Applications of Selenium.[1]

By William J. Hammer.

The extraordinary property which selenium possesses of varying its electrical resistance on exposure to light is a phenomenon which has been known for a long time; but the commercial applications of this peculiar property possessed by selenium have not been properly appreciated up to the present time. It is my purpose to invite your attention this evening to a number of applications of selenium which the writer believes will prove of no small interest to the electrical-engineering profession, and perhaps stimulate investigations in this most promising field.

The Swedish scientist, Berzelius, discovered selenium in 1817, as a by-product from the distillation of sulphuric acid from iron pyrites. The proximity of the earth and moon suggested to Berzelius the name "selenium," after the Greek "selene" (moon), this being the result also of the striking similarity of the properties of selenium with those of tellurium, which is a term derived from the Latin "tellus" (earth). Its atomic weight is 79.5; specific gravity when crystallized, 4.788; its observed vapor specific gravity at 2,588° F., 5.68. It is a non-metallic element, which possesses characteristics similar to phosphorus, sulphur and tellurium. When melted at 212° Centigrade and allowed to cool rapidly, it forms a brown amorphous mass of conchoidal fracture. In this condition it is a high-class insulator. It has been said that a small piece of it would represent the resistance of a wire stretched from the earth to the sun. When heated for quite a time at a temperature of 100° Centigrade, selenium becomes a conductor of electricity to a limited degree, this increasing with an increase of current and varying according to the direction. Selenium has neither taste nor smell.

The red vapor arising from selenium when subject to intense heat is exceedingly poisonous, and care should therefore be taken when experimenting with selenium in liquid form.

Selenium is usually supplied commercially in a vitreous form, and it is as structureless as glass and resembles black sealing wax. Amorphous selenium, which is a finely divided brick-red powder, changes into vitreous selenium when exposed to a temperature of from 80° to 100° Centigrade. In order to obtain crystalline selenium, in which form it is useful for selenium cells, it must be kept, as already stated, at from 100° to 200° Centigrade for some time, the black mass being changed into a hard, slate-colored metallic-looking substance. In this form even the thinnest films are opaque to light, whereas in the vitreous form the film would be transparent and ruby red in color. Selenium is to-day employed to a considerable extent for the coloration of glass.

The most successful and most extensive experiments which have been made with the speaking arc are those of Mr. Ernest Ruhmer of Berlin, Germany, who has employed it in conjunction with his selenium cells for wireless telephony and with remarkable success. Mr. Ruhmer has succeeded in transmitting speech over a beam of light 4¼ miles in length. In his experiments he employed an arc lamp with a flaring arc six to 10 millimeters long,

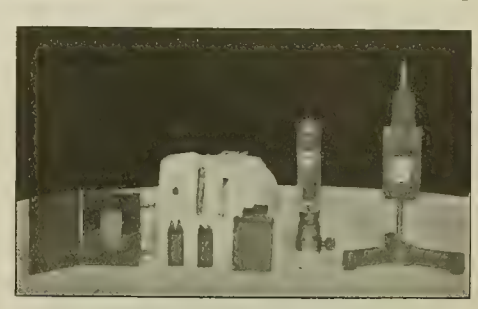

FIG. 1. PROPERTIES AND APPLICATIONS OF SELENIUM.—TYPES OF SELENIUM CELLS.

using an electromotive force of 220 volts; the current varied from four to five amperes at one to two kilometers, eight to 10 amperes for three to four kilometers, and 12 to 16 amperes for five to seven kilometers, and the resistance of his selenium cell was 120,000 ohms in the dark, this falling to 600 ohms in full sunlight. For the transmitting end, Mr. Ruhmer employs a carbon transmitter and a battery, superimposing waves on the arc-light circuit; and the beam of light is reflected to some distant point, where it is received by a parabolic reflector, in the focus of which is placed a selenium cell connected with a battery and a pair of very sensitive telephone receivers. Mr. Ruhmer has conducted extensive experiments both by night and by day, and even during fog and rain on the Wannsee, near Berlin.

Selenium cells may vary in resistance from 2,000 ohms to 500,000 ohms or more in the dark, and certain cells may be five to 20 times as good conductors of electricity in light as in the dark, and in the case of other cells, notably that of the Fritts' cell, which I have here this evening, and that of the Ruhmer cell used in his Wannsee experiments, will have 200 times the conductivity in light that it has in the darkness, and the ratio may be even higher. They are usually made by winding carefully two separate lengths of wire, either of copper, brass, german silver or platinum, equidistant throughout their entire length upon such substances as slate, glass, mica or porcelain. The selenium is then spread thinly over the wires, forming an insulation between the two windings. No small amount of skill is necessary to wind these fine wires evenly and equidistant, and to cover successfully these wires with the selenium coating. One way of coating frequently employed is to warm the cell on a metal plate or sand bath heated by a Bunsen burner. When the stick of selenium laid on the plate shows evidence of melting, which takes place at about 120° Centigrade, it is drawn slowly over the wires, coat-

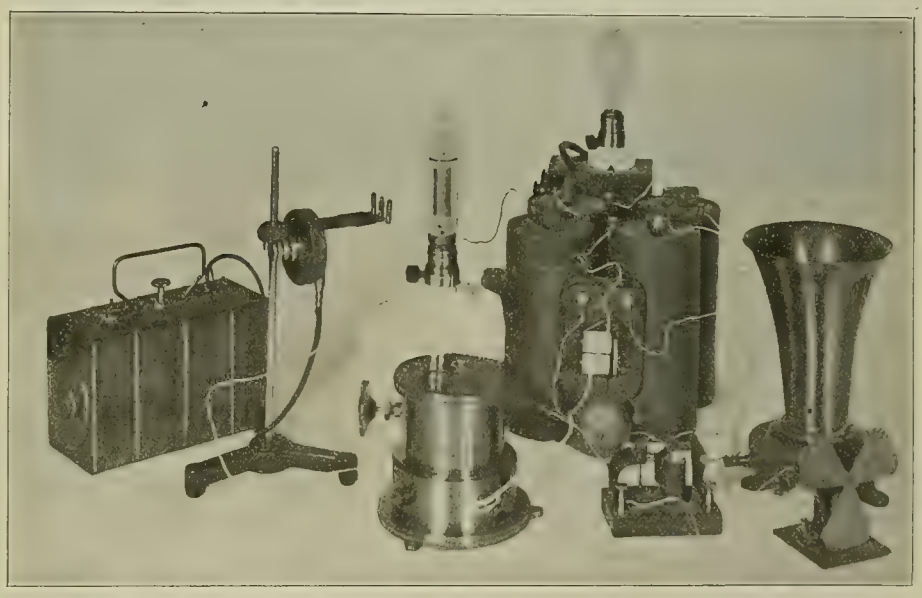

FIG. 2. PROPERTIES AND APPLICATIONS OF SELENIUM.—APPARATUS OPERATED BY MEANS OF THE SELENIUM CELL.

1. Abstract of one portion of a paper presented at a joint meeting of the American Institute of Electrical Engineers and the American Electrochemical Society at New York, on April 7, 1903.

ing the same thinly and evenly. A steel spatula or a strip of mica can be used with advantage.

In Fig. 2 is shown an illustration of a number of types of selenium cells, including the Bidwell, Ruhmer, Giltay, Webb, Clausen & Bronck, Mercadier and Fritts which I have brought with me for your consideration. The two cells to the extreme right and left are modifications of Mr. Shelford Bidwell's cells, the original form of which consisted of two fine copper wires, wound side by side, on oblong strips of mica with melted selenium spread over the surface, the one to the left being manufactured by Ernest Ruhmer of Berlin, and by Messrs. Clausen and Bronck, which consists of copper wire wound on slate. The one to the right is manufactured by Mr. J. W. Giltay of Delft, Holland, and consists of platinum wire wound on slate and covered with selenium. The four tiny cells shown against the white background are made by Mr. Hartwell W. Webb of New York city, and consist of german-silver wire wound on slate. The cell to the right is placed in a sealed flat glass tube. The two lower Webb cells are encased in ebonite. The small round cell is a tiny Mercadier cell made by Mr. Webb. The method of making the Mercadier cell is to use two narrow ribbons of sheet brass or foil, separated by a ribbon of parchment paper rolled up like a spiral spring. This is held between wooden clamps, one surface being ground and polished off smoothly, and a thin layer of selenium being spread over it.

In the center of the picture is shown a cell of the late Mr. C. E. Fritts of New York city, for which I am indebted to my friend, Professor Barker. In the Fritts cell a very thin layer of selenium, from one one-thousandth to one five-thousandth of an inch in thickness, is spread upon a plate of metal, generally zinc or brass. The selenium and metal plate form a chemical combination sufficient at least to cause the selenium to adhere and make good electrical connection. The upper surface of the selenium is then covered by a transparent conductor of electricity, preferably a thin film of gold leaf. Platinum or silver may also be employed. Thus the two surfaces of the selenium are covered by a metal and are connected to the two ends of the circuit. The upper or gold-leaf surface, however, permits the light to pass through and affect the resistance of the selenium beneath.

The tall cell in the lamp socket shown is the latest form of Mr. Ruhmer's cell, and this type represents, I believe, the most important development which has been made in the selenium cell, and it has now become most stable and responds most rapidly to variations in illumination. He employs two copper wires, wound spirally, side by side, around a cylinder of porcelain, which, after the wires have been covered with selenium, is placed inside of a globe, from which the air is exhausted, and it is mounted with a butt similar to an Edison incandescent lamp, and resembles a candelabra lamp. This makes a most convenient method of handling the cell, and by keeping it from the air the disadvantages inherent in all cells heretofore have been very largely done away with.

Another form of Ruhmer cell consists of two fine platinum wires wound on a glass cylinder 1¼ inches long and three-fourths of an inch in diameter; the wires, which are one thirty-second of an inch apart, are coated with selenium.

Selenium cells are very susceptible to moisture, and it is largely this taking up of moisture which produces the electrolytic effect in the cell, enabling one to connect it with a galvanometer and produce a current by merely focusing the light upon the cell. This phenomenon gave rise to the designation of the photo-electric cell.

Those who have worked with selenium cells know that heretofore they have been most unreliable, varying their resistances from time to time enormously; and in the case where copper wires are employed, there is a selenide of copper formed, which often renders the cells inoperative in a comparatively short time.

To some extent, the cells made originally have been protected by covering them with mica or lacquer or varnish; but placing them in an exhausted receptacle and mounting them in the manner devised by Mr. Ruhmer is, it seems to the writer, a most important step in the commercial development of the selenium cell.

Professor Bell has made a number of types of selenium cells, his standard form consisting of alternate disks of brass and mica, with the mica disks slightly smaller than the brass, forming a recess for holding the selenium, which is spread over the surface. All the evenly matched disks are connected to one end of the circuit, and all the odd disks to the other end. The cylindrical form of the cell enables it to be acted upon from all directions, when placed lengthwise in the focus of a parabolic reflector. This is also of great advantage in the Ruhmer type of cell.

Selenium cells possess the remarkable property of recovering the original resistances upon the removal of the source of light.

FIG. 3. PROPERTIES AND APPLICATIONS OF SELENIUM.—EXPERIMENTAL APPARATUS USED AT INSTITUTE MEETING.

It is well known that, in the case of the radiophone, if a beam of sunlight be thus intercepted by a blackened, perforated, revolving disk, a musical note, varying in pitch with the speed of the disk, will be produced in a rubber tube held at the opposite side of the disk.

A piece of apparatus has been devised consisting of a disk with slits near the edge, which is placed near an incandescent lamp, and a selenium cell. If the selenium cell is connected to a telephone and battery, and the disk is rapidly revolved, a musical note will be produced in the telephone, the pitch of which will correspond to the speed of the revolving disk.

Mr. Giltay has recently written me suggesting a very pretty experiment in this line, in which a double-vaned Crookes radiometer is placed between a selenium cell and an arc light, shielded by an alum cell. The light from the arc lamp causes the radiometer to revolve, intermittently screening the selenium cell and producing a musical note in the telephone attached thereto, the pitch of which is in accordance with the speed of revolution of the radiometer.

I have here to-night two forms of flame telephone transmitters, one of which was presented to me by Mr. Ruhmer, and the other I have purchased from Mr. Giltay, which I have mounted as you see it here (about 24 volts are required, depending upon the selenium cell). In each case you will note that I have an acetylene generator which conveys gas to the interior of an otherwise empty telephone transmitter. The diaphragm of these transmitters is made of pigskin, or a similar material. A tiny pipe runs from the back of the transmitter, and ends in one case in a single acetylene jet, and in the other case in three acetylene jets. By talking against the pigskin diaphragm, the gas inside is made to vibrate and produces a manometric flame. This flame throws its light upon a selenium cell, to which is connected a battery and a pair of very sensitive telephones between 100 and 200 ohms for each cell of battery, in which the sounds spoken into the transmitter are most perfectly reproduced. A thin sheet of paper inserted between the flame and the selenium cell serves to cut off all sound. It is self-evident that these telephone receivers might be at any distant point. I have worked them over considerable distances.

In Fig. 2 are shown a number of most interesting applications of the selenium cell in conjunction with a battery and relay, used for starting a motor, ringing a bell, firing a cannon, blowing a horn, and lighting incandescent lamps, all of which experiments I shall hope to show you in actual operation, as I have had them working most successfully in my laboratory; and you will see that by merely passing my hand before the selenium cell, I can start and stop the motor, turn the light on and off, and ring the bell and blow the horn, or I can fire this cannon, start my phonograph talking, etc. I am indebted to the courtesy of the Marconi company for the large relay used in certain of these experiments.

I have here also a three-horsepower motor, driving a 1½-kilowatt generator and supplying these lamps which have been courteously supplied by the General Electric Company, and by means of this selenium cell, relay, battery and a motor starter, for which I am indebted to the Cutler-Hammer Company, I hope to be enabled to start and stop the motor by merely passing my hand before the selenium cell.

[This experiment was successfully performed by Mr. Hammer, the motor being started and stopped by interposing the hand between a selenium cell and an acetylene flame. Fig. 3 shows the motor, generator and bank of lamps and also part of the other apparatus used by Mr. Hammer.]

An important commercial application of the selenium cell has recently been made by Mr. Ernest Ruhmer in connection with his electrically controlled buoy. Pintsch has constructed a large number of buoys containing compressed gas, which would last from one month to upward of a year; but it was heretofore necessary to burn these lights day and night, it being often impracticable by reason of distance at which they were placed, and frequency of storms, etc., to switch off the gas, so that it would not burn during the daytime. Mr. Ruhmer has placed one of his selenium cells in the top of such a buoy connected with a switching device which, as soon as the sun rises in the morning, causes the selenium cell to reduce its resistance, this causing the switching device to turn off the gas, which is again turned on upon the increase of resistance of the selenium cell by the approach of nightfall, or, if desired, in the case of a storm coming up. A buoy containing sufficient gas for one month could thus be made to answer without recharge for from three to five months.

The arrangements of the circuits, as originally devised by Mr. Ruhmer, is shown in Fig. 4. The voltmeter needle has been replaced by a relay, and the apparatus simplified. A single dry cell is interpolated in the selenium-cell circuit, as usually employed on the buoy; and this cell will last a year or more, and, with the relay, it is placed in the bottom of the buoy and arranged to be absolutely waterproof. When I was in Berlin last August one of these buoys had been in operation since the previous October, turning the light on and off every night and morning; and Mr. Ruhmer has recently written me that it is still operating successfully, as are others which he has placed near Hamburg and in the Baltic Sea.

Mr. Ruhmer has also constructed an apparatus employing the selenium cell to which he has given the name, "photographophone," which is one of the most remarkable pieces of scientific apparatus that it has ever been my pleasure to see. In Fig. 5 the apparatus is shown diagrammatically. It consists of a box containing a gelatine or celluloid film, such as employed in moving-picture machines, and is driven at high speed by means of an electric motor. In the front face of the box is set a cylindrical lens about the size of one's little finger. A short distance away from the box is placed an arc lamp and a telephone. Words spoken or sung into the telephone superimpose the waves in the telephone circuit upon the current flowing in the arc-light circuit, and cause a corresponding variation in the light of the arc. The rays from the arc lamp pass through the cylindrical prism already referred to, and are caused to fall in sharp, white lines on the moving sensitive film. This film is then taken out of the box and developed, and then shows a series of perpendicular striations parallel to one another, which are really a photographic record of the sound waves originally entering the telephone. Where the striations are fine and close together, the pitch is high, but where they are broader and farther apart, the pitch is low The developed film is next placed back into the box and the motor again started. The arc lamp remains in its original position, but burns steadily, as the telephone is not operated. The rays from the arc lamp passing through the lens are therefore quite uniform, and the moving gelatine strip acts as a screen to cut off these rays, allowing the light intermittently to fall upon the selenium cell at the back of the box, producing a variation in its resistance and a corresponding effect in the telephone receivers connected thereto. A battery is also interpolated in the circuit with the selenium cells and the telephones. By holding these telephones to the ear, the reproduc-

tion of the sound is perfect, as I can vouch for from personal experience with the apparatus.

Mr. Ruhmer contemplates utilizing this photographophone as a receiving instrument with its wireless-telephone system, in which he employs a beam of light.

Mr. Shelford Bidwell has also made a device for producing pictures or writing at a distance by combining the properties of selenium with the chemical telegraph.

Various inventors have endeavored to solve the problem of seeing what goes on at a distance by employing selenium. These various inventions have been termed the telescope, telephote, telectroscope and the telephotograph, but they have thus far reached

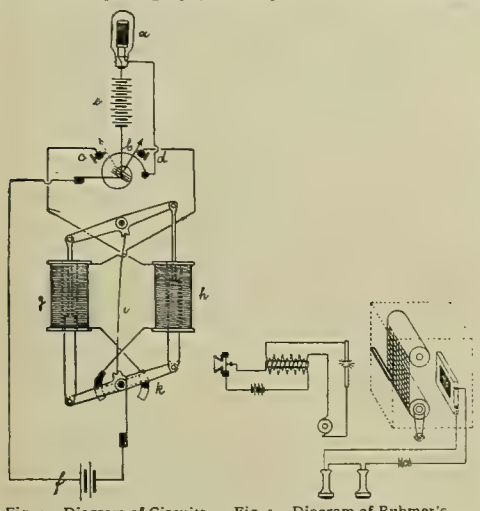

Fig. 4. Diagram of Circuits of Selenium Buoy. Fig. 5. Diagram of Ruhmer's Photographophone.

PROPERTIES OF SELENIUM.

little further than descriptive matter, drawings and crude experiments.

Various people have suggested the use of selenium cells for photometric purposes; and it is interesting to note that Mr. Latimer Clark suggested this application the evening in which Mr. Willoughby-Smith first brought to public notice the phenomena of variation in resistance of selenium when exposed to light, to which I have already referred.

Mr. Fritts has suggested making a form of photometer which would be sensitive to lights of different color, as well as of varying candlepower, by employing as a film on the surface of his cell a gold foil which transmits green rays, a silver foil the blue rays, and so on, and suggests that a solid transparent conducting film which would transmit all of the rays would be far better, and thus remove the color stumbling block in photometric work.

Sir William Crookes has constructed an exceedingly interesting type of radiometer, in which he has coated the revolving vanes on one side with selenium, and on the other with chromic acid. He found that the white light from a sperm candle repelled the selenium, while the yellower light of the wax candle repelled the chrome, thus indicating the relative absorptive powers of the different substances for rays of different refrangibility, resulting in mechanical motion; just as the same selective capacity operates in photography as chemical action.

In 1891 Professor Barnard of Lick Observatory

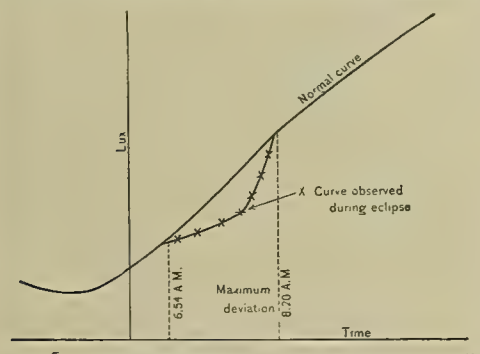

FIG. 6. PROPERTIES OF SELENIUM.—CURVE TAKEN WITH RUHMER CELL DURING ECLIPSE.

employed a selenium cell as a device for automatically detecting comets, and Minchin has employed the selenium cell quite extensively in his astronomical investigation.

In Fig. 6 is shown a curve which Mr. Ruhmer recently sent me which shows some observations made by means of his selenium cell during an eclipse, these being the only observations which anyone was enabled to make at that time, on account of stormy weather. Mr. Ruhmer has prepared an interesting paper bearing on this and other applications of the selenium cell to meteorology. He made his observations on October 31, 1902.

Selenium is found in Vesuvian lava, and in natural sulphur as a sulphur selenide in the Lipart Islands. It is also found in Norway and other iron pyrites. It occurs in meteoric iron and in such rare metals as eucarite as a selenide of silver and copper in Sweden and Chili; as crooksite, a selenide of copper and thallium, with a little silver, from Norway; as clausthalite, a selenide of lead in the Hartz Mountains, from Zinken and Clausthal, in Inverg, Rheinsberg, Saxony, Rio Tinto, Spain, Mendoza, South America; as riolite at Culebras, Mexico; as lehrbachite, a selenide of mercury and lead from the Hartz Mountains; as zorgite, a selenide of copper and lead from Glasbach in the Hartz Mountains. Selenium, although widely distributed over the globe, occurs only in small quantities and in some instances is found in native state. Selenium is placed among the rare metals. Chemically pure crystalline selenium costs about $1 per gramme, and the ordinary commercial article about 10 cents per gramme.

Phelps Printing Telegraph System.

The principal object of a recent invention of William Pitt Phelps of Merchantsville, N. J., is to provide a printing-telegraph instrument of the "stock-ticker" class with a self-winding apparatus whereby the heavy weights which are manually wound at the receiving instruments may be dispensed with. Self-winding devices have long been used; but in no instance has a serviceable and reliable apparatus of this class been devised which has not been detrimental to the speed of the machine, and particularly is this true where the winding is done by the press arm or where the winding magnets have been placed in circuit with those of the type wheels and press mechanism.

In double type-wheel printing systems it is advantageous to employ an auxiliary main line for no other purpose than to actuate the press-shifting apparatus, for by other plans the shifting from the printing of figures to letters, or vice versa, is accomplished only when the type-wheels are in certain positions of rotation, or, as often occurs, only after they have been rotated a considerable distance. By employing an auxiliary main line, however, the shifting

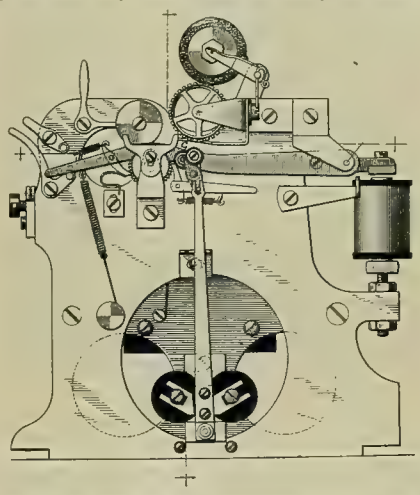

FIG. 1. PHELPS PRINTING TELEGRAPH SYSTEM.—SIDE ELEVATION OF RECEIVER.

may be done on the instant, without moving the type-wheels at all. In fact, while the wheels are held in one position letters and figures may be alternately printed with all that rapidity with which the press may be raised and lowered.

One of the essential features of Mr. Phelps' invention consists in utilizing such auxiliary main line both for actuating the press-shifting apparatus and to convey currents from the transmitter to drive a spring-winding apparatus by which the type-wheels of the printers are rotated. Preferably, such currents are sent over the auxiliary main line by automatically opening and closing the circuit at the transmitter, while at the same time the press-shifting apparatus may be actuated by current reversals; but to enable the transmission of current reversals at all times supplemental means must be employed for closing the auxiliary circuit at moments when it is broken by the commutator, which periodically transmits currents to the spring-winding magnets.

Of course, current reversals might be employed to drive the spring-winding apparatus, and the press-shifting apparatus might be actuated by a neutral magnet; but the preferable plan is the one above outlined, in which the spring-winding apparatus is driven by a neutral magnet under the action of pulsatory currents, positive or negative, while the press-shifting apparatus is actuated by the armature of a polarized magnet, which is set in one direction or the other, according to the polarity of current flowing. Fig. 1 is a side elevation of the improved printing receiver, and Fig. 2 is a diagrammatic view of the transmitting apparatus and circuits.

The speed at which a stock ticker may be operated is usually limited by the press mechanism, from the fact that the press arm is heavy and is ordinarily lifted against the tension of a strong retracting spring, and to further burden the press arm with the work of winding an apparatus for driving the type wheel would proportionately lower the speed of a part already too slow and correspondingly diminish the running capacity of the printer. Mr. Phelps says his object, above all else, has been to provide an automatic winding apparatus for driving the type wheels, which should in no manner encumber the press mechanism. Of course, a rotary motor might be used in an auxiliary line to wind a spring or to otherwise store power for driving the type wheels of a printer, while still employing reversals of current to operate the press-shifting mechanism, for the

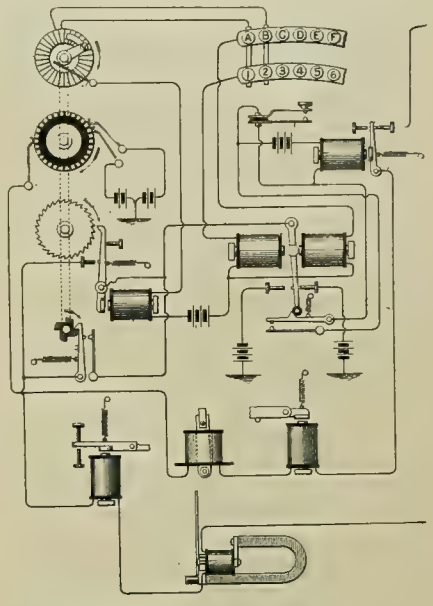

FIG. 2. PHELPS PRINTING TELEGRAPH SYSTEM.—CIRCUIT DIAGRAM.

armature of an ordinary motor would rotate in the same direction, whether current were sent to line in one direction or the other to determine whether letters or figures should be printed. Such an arrangement would be less serviceable than the preferred forms above described. Mr. Phelps' invention is patented, the patent being assigned to the Western Union Telegraph Company of New York.

Cost of London County Council Tramways.

[From the London correspondent of the Western Electrician.]

London, May 13.—With the impending opening of the London County Council tramways in the south of London, a good deal of criticism has been launched at the council for embarking upon such an expensive system on the one hand, and because the actual cost has exceeded considerably the original estimates. This being so, the council has felt itself compelled to issue a report upon the matter, from which it is made clear that a considerable modification of the original plan has been responsible for the increased cost. For instance, in the original estimates, a generating station was provided for at Camberwell, but since then a more expensive one has been purchased at Greenwich. Also a new car shed has been decided upon, and these two things, among others, increased the estimates by some $1,600,000. Of course, in reckoning out the cost per mile of the first section opened, it must not be lost sight of that sufficient generating plant is provided to meet the demands of a considerable system. To set all doubts at rest, the council's own estimate of the actual cost of the Tooting lines—those to be first opened—works out at about $1,300,000 per mile. But included in this is the whole cost of the temporary generating plant at Loughborough Junction, which, it is expected, will be sufficient to supply several other sections, and the council states that these approximate figures are subject to revision when the proper proportion of the complete system is charged to each section. The Tooting lines amount to 6.1 miles, and it is affirmed that after making the allowances which ought to be made, the difference between the actual and estimated costs per mile will not be more than $5,000, and this difference is put down to several reasons. Among them are that these are the first lines in London to be converted from horse traction to the conduit system, and to special expenditure having been incurred in expediting the work by the employment of night and Sunday labor. Incidentally, too, it may be mentioned that no allowance has as yet been made for credits of considerable amounts in respect of the sale of horses and old materials from the discontinued horse lines and of the disposal of properties no longer required.

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DATES AHEAD.

New York State Independent Telephone Association, Butterfield House, Utica, N. Y., June 10th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

Pacific Coast Electric Transmission Association, Hotel Rafael, San Rafael, Cal., June 16th and 17th.

Independent Telephone Association of the United States of America, Chicago, June 24th and 25th.

American Society of Mechanical Engineers, Saratoga, Springs, N. Y., June 22d to 26th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

International Association of Municipal Electricians, Hotel Rudolf, Atlantic City, N. J., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

ONE of the valuable pieces of information imparted at the electric-light convention this week was in Mr. Robert L. Elliott's paper, presented as chairman of the committee on theft of current. Mr. Elliott's paper was a very practical one, and in it, among other things of value, he showed what states have laws, more or less satisfactory, covering the offense of diverting electricity fraudulently, and what states have not. Electric-light companies in the states of the latter category should, as Mr. Elliott well says, appreciate the advisability of urging upon their state legislatures the passage of special laws as soon as possible. The points to be covered in a law designed to prevent and punish the stealing of electricity are given, and it will be seen that in several states the existing laws of this character could be amended to advantage. Mr. Elliott is to be thanked for a useful service rendered to the association, and, indeed, to all electric-light companies.

IT IS probably true that the convention of the National Electric Light Association held in Chicago this week drew out the largest attendance and was on the whole the most successful of any in the history of the organization. The meeting in Cincinnati last year, under the administration of Mr. H. L. Doherty, was a notable one for the injection of new ideas and the general impetus given to the work of the association. Mr. L. A. Ferguson, equally progressive and energetic, continued the good work during the year of his administration, with the result of such an increase of interest that the Chicago convention was a record breaker. Many new subjects were discussed, some of them very valuable, and the proceedings of the convention will constitute a highly useful addition to the literature of the art. Mr. Anthony's very excellent report on "Office Methods and Accounting" may be mentioned as a practical guide to success in teaching central-station companies to know "where they are at" in the matter of cost and selling price of current—knowledge of fundamental importance, but of which too many companies have only a vague idea. It is a difficult report to summarize in a technical journal and almost too long to print entire, but we recommend to every central-station manager that he endeavor to secure a copy of the report and the accompanying forms. Many other valuable papers and reports were presented on such important subjects as standard transformer voltages, the attitude of the employer toward the employe, steam turbines, steam heating from central stations and unaccounted-for current. The question box, a feature introduced last year, was a monumental repository of information, and as it was printed and provided with an index its usefulness was greatly enhanced. No one who attended the convention can have failed to have profited by his coming, and, judging from the very large attendance, this idea was firmly fixed in the minds of electric-lighting men. We congratulate Mr. Ferguson on his administration and the splendid convention that closed it, and we congratulate the association on securing for its new president such an able, progressive and sagacious man as Mr. Charles L. Edgar of Boston.

SUCH a strike as that of the telephone-cable splicers in Chicago brings vividly to mind the extent to which all the varied activities of modern life are dependent on the telephone. According to the newspaper account, someone, supposed to be a striker or a strike sympathizer, cut some of the underground telephone cables on the West Side, and as a result several hundred telephones were rendered useless. A large hospital in an outlying district was cut off from wire communication with the rest of the town; business houses were deprived of the "telephone door," and many residences were included among those who were forced to do without the service. Patrons immediately realized the extent to which they relied on the telephone in conducting their daily affairs. Finding, after repeated attempts, that they could not get "Central," they became "maddened with vexation," to use the expression of the newspaper reporter who made a tour among them, and many damage suits, directed at the telephone company, were threatened. The case of the hospital was particularly distressing. Doctors were unable to call the hospital; friends of patients could not ask about their welfare; the nurses and attendants of the hospital found it impossible to transact business over the telephone. Physicians living at a long distance from the hospital and wishing to take patients there were forced to make the trip to the hospital before they could make arrangements. In another case, the failure of a man to get telephone connection with his store to send a message to his wife that he could not come home from a suburban town until the next morning brought on sickness of his wife, who was worried and thought that something had befallen her husband. Many instances of this kind occurred during the few days when the trouble was at its height. Fortunately, the company was soon able to repair the cables; but it is safe to say that the cut-off subscribers gained an idea of what it meant to be deprived of telephone service such as they had never had before. Probably, too, if these telephone users were now asked their opinion of the "two-telephone nuisance" they could adduce some testimony not often brought out.

WE PRINT on another page a letter to David R. Francis, president of the St. Louis World's Fair, from Thomas A. Edison, accepting the appointment as honorary chief consulting electrician for the exposition. Mr. Edison is regarded as the foremost electrical inventor of the world, and the mere fact that he has pledged his assistance to the fulfillment of the plans now outlined adds greatly to the dignity of the electrical department of the exposition. The exposition authorities and Professor Goldsborough are certainly to be congratulated, for the tone of Mr. Edison's letter indicates a decided interest in the exposition. We have heard, from time to time, reports to the effect that electrical exhibits would receive but scant recognition, and that only a portion of the Electricity Building would be used for this purpose, the remainder being devoted to machinery exhibits. These reports have evidently been given out by persons intent on belittling the electrical display, and we learn, on the best of authority, that there is absolutely no foundation for such a statement, as the applications now on file in the electrical department aggregate, we understand, several thousand feet in excess of the area of the building.

NOTWITHSTANDING the protection thrown about the South American countries by the ægis of the Monroe doctrine, the United States supplies only about one-eighth of the imports into South America. This does not appear to be a fair proportion, and obviously it is desirable that the United States should secure a larger share of this trade. In order to accomplish this, more direct steamship lines to the leading ports are needed, and, also, banking houses in the leading cities of Latin America, controlled by United States capital. Salesmen from the United States should be familiar with the language of the country in which they desire to sell their goods. The increased study of Spanish in the schools of this country will greatly facilitate this attainment. A more intimate knowledge of the needs and idiosyncracies of the people of the South American countries is also needed. The Philadelphia Commercial Museum, which disseminates information of this character, states that the United States buys more of the products of Brazil than Great Britain, France and Germany combined; yet Brazil imports 2½ times as much from Great Britain as from the United States. The leading exports of Brazil are coffee, rubber and sugar, and of these the United States buys nearly one-half. The imports into Latin America are largely manufactured products. In 1902 three-fourths of the imports from the United States into South America consisted of this class of goods. Our trade with Mexico is very satisfactory, but in the South American countries there is opportunity for great extension. These nations are growing and developing and will need electrical apparatus, as well as other machinery, in constantly increasing amount. They are almost at our door, and, as we buy liberally of them, we should expect an equitable share of their business in return. The electrical trade of the United States with the countries south of the Isthmus is far from satisfactory, even as things are, and with the prospect of an increased demand, due to the development sure to come, electrical manufacturers in the United States should bestir themselves to secure what they are entitled to in equity in the southern half of the American hemisphere, but which they have allowed to slip away from them by indifference.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The twenty-sixth convention of the National Electric Light Association more than fulfilled all expectations. It was held on Tuesday, Wednesday and Thursday of this week (May 26th to 28th) in the Auditorium Hotel, Chicago, under the presidency of Louis A. Ferguson, and was attended by about 850 delegates and visitors. The programme presented was a very excellent one and was well carried out. The sessions were well attended, and the discussions were animated and helpful. A general report of the convention, with a portrait and sketch of the new president, some of the papers presented, notes and personal gossip, a group picture of the delegates and illustrations of some of the exhibits, and a list of the names of the members and visitors, is given in this issue of the Western Electrician. Such was the wealth of material presented, however, that some of the papers and discussions are reserved for future publication.

Charles L. Edgar, the New President.

In selecting Charles L. Edgar of Boston as its president the National Electric Light Association has certainly placed its interests in competent and well-tried hands, for Mr. Edgar is one of the leading central-station men of the country. A native of New Jersey and brought up, almost, under the Edison influence, Mr. Edgar has been connected with electric lighting since the pioneer days of the incandescent lamp. Since graduating from college he has given his whole time to the electrical industry, and such has been his capacity and application that he is now at the head of a central-station system which is perhaps only second to that of New York, although, without looking up the latest returns, one is hardly sure whether second place in output belongs to Boston or Chicago, so closely do they run.

Mr. Edgar is president of the Edison Electric Illuminating Company of Boston, of the Boston Electric Light Company, the Somerville Electric Light Company, the Woburn Light, Heat and Power Company, the Newton and Watertown Gas Light Company and eight other central-station companies. These companies are closely associated and supply electricity to Boston and its environs. The Boston Edison Company was organized in 1886, and the next year Mr. Edgar went with the young company as general superintendent. He has been with it ever since, rising, by successive steps, to be general manager, vice-president and president, holding the last-named office for four years.

Notwithstanding his notable record, Charles Leavitt Edgar is still a young man. Born near Princeton, N. J., in December, 1860, he was graduated from Rutgers College in 1882 with the degree of B. A. He took a post-graduate course in electricity at the same college, receiving the degree of A. M. in 1885 and E. E. in 1887. Mr. Edgar had relatives at Menlo Park, which is not far from his boyhood home, and he frequently visited there, being brought up, consequently, in the Edison atmosphere. It is not strange, therefore, that soon after leaving college he formed a connection with the parent Edison company, the Edison Electric Light Company of New York. He remained with this company, beginning in the original factory, until 1887, when, as before stated, he went to Boston. At the time of leaving the parent Edison company he was its chief engineer.

In Boston Mr. Edgar has built up a very extensive central-station business—a business with an income that will this year reach $3,250,000. The Boston Edison Company is now building a 60,000-kilowatt turbine station in South Boston. Mr. Edgar has been president of the Association of Edison Illuminating Companies for three terms and is president of the Massachusetts Electric Lighting Association. He is also chairman of the Boston branch of the American Institute of Electrical Engineers. He has been a member of the National Electric Light Association for years, being vice-president in 1890 and again first vice-president at the time of his election to the presidency on Thursday of this week. He is a member of the Lawyers' and University Clubs of New York and of the Art, Exchange and University Clubs of Boston.

In central-station work Mr. Edgar has always been noted as an advocate of the storage battery. He read the first storage-battery paper before the Institute many years ago. His company put in the first storage battery in this country, importing a Tudor outfit from Germany. Other evidences of progressiveness are shown by the fact that Mr. Edgar was one of the first to adopt the Wright demand meter, after a study of the system in England, and also that he installed the first vertical engines in an American power plant.

Mr. Edgar's home is in Brookline. He has a wife and one son—the latter a lad of 15 who declares that he will follow his father's footsteps in the electric-lighting industry.

Monday Evening's Reception.

Eastern delegates began to arrive on Sunday, and by Monday evening perhaps 200 visitors were in attendance, 60 coming in on the New York "special." The first feature of the programme was of a social nature—a reception tendered the members and visitors of the association by the electrical interests of Chicago. This reception was held on Monday evening in the parlors of the Auditorium and was a delightful affair. The ladies and gentlemen renewed old acquaintances and made new ones. There was dancing, and elaborate refreshments were served. Among the Chicago people serving on the receiving committee were Mr. and Mrs. Samuel Insull, Mr. and Mrs. B. E. Sunny, Mr. and Mrs. L. A. Ferguson, Mr. and Mrs. C. D. Crandall, Mr. and Mrs. W. A. Kreidler, Mr. and Mrs. B. J. Arnold, Mr. and Mrs. T. P. Gaylord, Mr. and Mrs. E. B. Ellicott and Mrs. and Mrs. C. H. Wilmerding.

It may be mentioned in this place that the entertainment committee was made up of Messrs. James Wolff (chairman), Homer E. Niesz, J. W. Buell, A. L. Tucker, B. E. Sunny, W. R. Pinckard and W. W. Low. The general reception committee consisted of Messrs. B. E. Sunny (chairman), Samuel Insull, E. B. Ellicott, F. L. Perry, C. D. Crandall, T. P. Gaylord, Bion J. Arnold, Thomas I. Stacey, H. R. Hixson, F. E. Donohoe, R. C. P. Holmes, F. B. Badt, G. H. Atkin, Francis Raymond, J. R. Wiley, A. D. Lundy, C. E. Gregory, W. H. Slingluff, W. M. Smith, George B. Foster, M. B. Austin, W. S. Goll and C. H. Wilmerding.

Opening of the Convention.

President Ferguson called the association to order at 10:30 a. m. on Tuesday, May 26th. He read the text of a formal resolution adopted the preceding evening by the Chicago City Council welcoming the association to Chicago. This was in lieu of the appearance of Mayor Harrison, who was unable to be present to extend in person the city's welcome. On motion of Samuel Insull a suitable acknowledgment of the association's appreciation of the City Council's resolution was prepared and transmitted to the city authorities. Secretary J. B. Cahoon was not present, owing to ill health, but E. H. Davis of Williamsport, Pa., the second vice-president of the association, filled his place very acceptably. President Ferguson then delivered his annual address, as follows:

CHARLES L. EDGAR.

President L. A. Ferguson's Address.

The year just closing with this convention has been an unusually active one for the officers of your association, as there have been many important matters presented requiring their attention.

Through persistent canvassing, the membership of the association has been increased in one year more than 225 per cent., until now we number in our active and associate membership list 532 members, 452 of whom are active and 80 associates, besides 26 honorary members. The association has become in one year even more national in its character, and its importance and value are becoming more generally recognized.

It has been customary in the past for the president in opening the convention, to review the development of the art during the year, but we shall this year depart from the usual custom, following the suggestion of our president of last year.

The president of this association should not be burdened by detail, and the office should be that of chief executive, whose duties consist in enlarging the scope and value of the association's work and conserving the interests of its members by directing the forces at his command, rather than that of historian, and the work of review should be done by one whose daily thought and activity are along the lines of watching the development of the art. Following this idea, your president appointed a progress editor, who has covered, in a very exhaustive and elaborate report, the development of electricity in its applications to light and power.

In addition to the standing committees already in existence at the last convention, there have been appointed during the year reporters on five special subjects, all of great importance to the members of the association. These reporters have been actively engaged gathering information and suggestions from all the members, which they have assorted, sifted and compiled, and from which they have drawn certain conclusions which will be submitted to you as recommendations in the form of carefully prepared reports. In most cases these reporters have met with ready and courteous assistance from the members, and I am sure, when their excellent reports are read, all those who have assisted in any way will feel amply repaid, for they will then appreciate the immense amount of time and effort that has been expended by these gentlemen, who have been so painstaking and unselfish in their work for the association's good. The reports of these special committees are not merely perfunctory reports, but represent months of special and continuous thought, and will prove, I trust, as valuable and interesting as the papers which have been prepared especially for this convention.

The question box introduced at the last convention will be treated in a somewhat different manner. It was considered expedient this year to make a special department of this subject, and an editor was appointed to handle it. It has grown to such proportions that your president has deemed it advisable to have the questions and answers printed completely for distribution at this convention, and instead of going through the laborious operation of reading the questions and answers aloud, we have decided to present the question box to you in its completed form, and, if found desirable, discuss it at one session of the meeting.

At the last convention there was considerable discussion on the subject of the relation between manufacturers and central-station companies, and I am pleased to report that through our personal efforts in taking up with the manufacturers individual cases as they arose, we have found all the manufacturers willing to co-operate with us to all reasonable extent. We have been very successful this year in handling several cases of unfair competition, when they have been brought to our attention, and in no instance where our assistance has been requested have we failed in protecting the interests of our member companies.

Early in the year there was one notable case brought to our attention, and our assistance asked, by one of our member companies. The parties proposing the opposition had obtained a franchise and city contract for lighting. We acted in the capacity of advisers to our member company, and, after considerable effort traced the real backers of the opposition, and succeeded, by using the influence of the association and its members, in inducing the manufacturers to discontinue negotiations for the sale of machinery and the financial houses to reconsider their proposed support, resulting in a complete abandonment of the proposition, leaving the field clear to the original company. The value of the association to this member company in this one case would more than pay its dues for a hundred years.

The committee on standard rules for electrical construction and operation has been called upon this year for unusually active work in connection with the National Electrical Code. Certain changes in the rules for overhead construction had been proposed by a committee of the National Underwriters' Electrical Association, and were under consideration by a committee representing the American Institute of Electrical Engineers. Feeling that some of the proposed changes in the rules were impracticable, objectionable and unfair to the member companies of this association, your president communicated with the president of the American Institute of Electrical Engineers, and urged postponement of favorable action on these changes until they might be considered by the National Electric Light Association. The request was granted, and your committee on standard rules for electrical construction and operation was invited to attend the future joint meetings of the committees of the National Underwriters' Electrical Association and of the American Institute of Electrical Engineers.

Two meetings were held in Boston, one in February and one in March, at both of which your committee and your president were in attendance and took an active part. Your committee took the position that no changes could be made in these rules without a meeting of the conference, consisting of representatives of all associations interested in the subject, as follows: American Institute of Architects, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Street Railway Association, Factory Mutual Fire Insurance Companies, National Association of Fire Engineers, National Board of Fire Underwriters, National Electric Light Association, Underwriters' National Electric Association.

This position, after considerable argument, was sustained, and as a result of the efforts of your committee, assisted by the committee from the Association of Edison Illuminating Companies and the

American Institute of Electrical Engineers, the underwriters removed many of the objectionable features in the proposed changes of the rules.

The organization of a conference—after an inactivity of five years or more—to finally settle all questions of rules of the National Electrical Code is of prime importance to the central-station companies of this country, and it will prevent the establishment of rules by the underwriters which might seriously injure the electrical interests of the country and retard the development of the industry.

The necessity for closer relations with other associations of kindred character was shown by the joint work of the committees of the National Electric Light Association and the Association of Edison Illuminating Companies, in the matter of the National Electrical Code. The American Institute of Electrical Engineers, whose membership is made up largely of purely technical men, may lay down some rules, or the National Bureau of Standards may adopt some standards of measurement, which, while they may appear good from a purely scientific standpoint, may be exceedingly bad from the business standpoint of the members of this association.

Some of the members of this association are also members of the Association of Edison Illuminating Companies, and the various state gas and electric-light associations throughout the country, and the officers and engineers of the member companies are members of the American Institute of Electrical Engineers, and of the American Society of Mechanical Engineers, and other similar societies, so that if the influence which it is possible for them to wield is brought to bear on any given subject affecting them, and under consideration by other bodies, there is no doubt that serious injury to the interests of the member companies of this association may thereby be prevented. I would recommend to you, therefore, the appointment of a small committee of forceful men to watch the movements of other kindred bodies and engineering societies to confer with them, from time to time, and to promote a closer relationship with them, so their actions may not be antagonistic to the members of this association.

There is probably no piece of apparatus in the construction of the central station at the present time, the results of which are awaited with such keen interest by central-station managers as the steam turbine. We have arranged for the presentation of a paper on this subject by a man who has had much experience in the operation of one type of turbine, and the discussion will be led by others who are especially versed in the subject, as far as they, as manufacturers, have been able to acquire knowledge. Yet I feel that we will not have exhausted the subject at the close of this convention, and when we stop to consider that two manufacturers of steam turbines in this country have taken orders in 12 months for approximately 540,000-horsepower capacity, you may realize what an important factor it may ultimately become in our business. It seems wise, therefore, that we should not rest with the information these distinguished gentlemen may give us at this convention, but we should appoint a committee of three good mechanical engineers to follow the development of the steam turbine during the coming year and report the results at the next convention.

There is a growing demand for electric power in factories, and it is important to central-station companies that this business should be obtained for their service. Statistics showing the useful and economical application of electricity in factories, together with costs at various rates per kilowatt-hour, are not readily obtainable, and I would recommend the appointment of a committee of three men from different sections of the country, to gather statistics on "purchased electric power in factories," and report at the next convention, or sooner, if found feasible.

In choosing the papers for this convention, I have tried to touch upon each branch of the central-station business treating of some phase of production, by-products, distribution, customers' apparatus, engineering and testing, and management. It has been my intention to avoid confining the papers and reports entirely to purely technical subjects, and to treat with considerable liberality questions which might properly be classed under the management of the central station. Many of the subjects to be presented are entirely new to this association, and have never been discussed before in our conventions.

To the gentlemen who have so kindly contributed papers, and to the editors and reporters of the various committees whose names appear on the programme, and to those gentlemen, members of other active committees, who by their valiant support have helped me conserve the interests of the members, to our industrious and ever-watchful assistant secretary, who so ably handles the routine work, and to the electrical press; to all of these, who have been of such assistance to me in administering the affairs of the association as its president, I am deeply grateful, and to them I extend my most sincere appreciation.

Letters of Regret.

On motion of H. L. Doherty the president's address was referred to a committee of three. Letters of regret were read from Elihu Thomson, Thomas A. Edison, Carl Hering, Professor E. L. Nichols of Cornell, Professor H. S. Carhart of Ann Arbor, Mich., Dr. W. R. Harper, A. E. Kennelly and others. As "editor of progress" Mr T. C. Martin of New York then presented his report.

T. C. Martin's Report on Progress.

Mr. T. Commerford Martin's report as the committee on progress in electric lighting was a long and valuable production. Beginning with statistics of the industry, and noting the increasing use of incandescent gas lighting, Mr. Martin gives some interesting figures relating to English and German central stations, for comparison, and then speaks, successively, of storage-battery equipment, high-tension overhead transmission and new types of arc lamps. The Bremer arc lamp is briefly described and illustrated. Taking up successively high-tension underground transmission, motors and electric drive, electric heating and improvements in fuses, the committeeman next devotes considerable attention to vacuum-tube lighting, speaking of the work of Tesla, McFarlan, Moore and Cooper Hewitt. Methods of charging for current are given considerable attention, and next in order Nernst lighting and the osmium lamp are discussed. The next subject taken up is the diffusion of light from arc lamps, and then electroliers, chemical work for central stations and the Hewitt static converter are taken up in the order named. Consideration of cheaper production of current brings the writer to the steam turbine, and the concluding topic is the question of state electrical laboratories.

Mr. Martin covers a wide field (his report, if printed in full, would fill seven pages of the Western Electrician), but he executes his task well, and his review shows in a striking manner the varied interests that enter into, or are allied with, the electric-lighting field.

Office Methods and Accounting.

The greater part of Tuesday morning's session was very profitably devoted to the reading of the report on "Office Methods and Accounting," prepared and presented by W. M. Anthony, comptroller of the Chicago Edison Company. It was accompanied by a book of forms arranged with a thumb index for ready reference. This report is one of the most valuable ever presented to the association. Mr. Anthony is an authority on accounting and office methods, and the association felt, in listening to him, that it was being instructed by an expert. In the discussion H. L. Doherty of Denver, Samuel Insull of Chicago, Samuel Scovil of Cleveland and others took part. Reference was made to the cost of producing a kilowatt of current, and Mr. Scovil and Professor Bemis of Cleveland had a good-natured but nevertheless somewhat spirited passage-at-arms on this point. Mr. Scovil said that non-electrical men (evidently having Professor Bemis in mind) often made ridiculous statements about producing current at the switchboard at one or two cents a kilowatt-hour. Mr. Insull said that true knowledge of the cost and selling price would check the tendency toward the municipalization of public-service industries. Few municipal-plant managers have such knowledge. W. W. Bean of St. Joseph, Mich., wanted Professor Bemis to explain why he had advocated municipal ownership of electric-light plants if he knew nothing about the subject. The professor could not give a very lucid explanation, and the talk drifted into a rather acrid discussion of municipal ownership, which was, however, cut short by the president's announcement that the hour for adjournment had come.

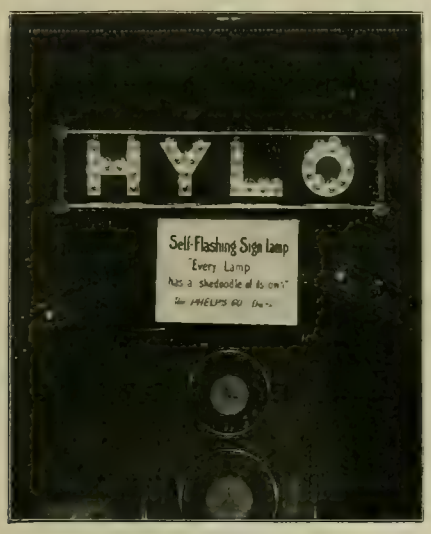
Tuesday Afternoon Session.

The first feature of the session of Tuesday afternoon was the reading of the paper of Sidney Hosmer of Boston on "Advantages to Be Derived from Consolidation of Electrical Interests." This paper is presented entire on page 434. The discussion was opened by Peter Junkersfeld of Chicago, who stated that the machinery in the old stations, operated during a few hours in a few months of the year, is worth just as much to a central-station management as the equivalent capacity in machinery in a new station. J. W. Lieb, Jr., of New York also discussed the subject briefly.

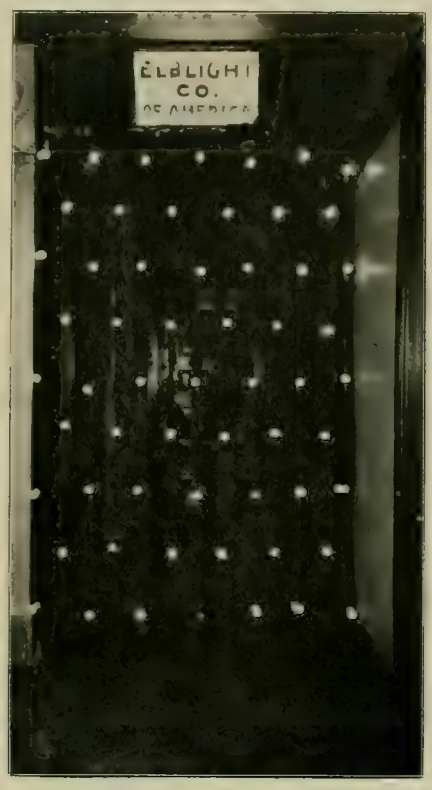
A. Bement of Chicago abstracted his paper on "Boiler and Furnace Efficiencies." This subject was discussed by W. L. Abbott of Chicago, who said, speaking of smoke prevention, that some methods work some times in some places, while, for some reason for which no one can account, they do not work in other places. The method described by Mr. Bement would be a panacea for this almost universal complaint, Mr. Abbott thought, if it could be applied as it is in the case which he describes. Mr. Lieb also discussed the paper, as did C. G. Y. King of Chicago, Alex Dow of Detroit and Mr. Bement.

"Standard Transformer Voltages" was the subject of a paper by John S. Peck of Pittsburg. This is an important subject and will be alluded to at greater length in a future issue of the Western Electrician. It was discussed at length by V. D. Moody of Schenectady, N. Y., P. D. Wagoner of Schenectady, C. C. Gartland of Sioux City, Iowa, Mr. Lieb, C. F. Hewitt of Elkhart, Ind., W. G. Carlton of Chicago, H. J. Gille of St. Paul, H. C. Wirt of Schenectady and the author of the paper also spoke.

J. Henry Hallberg of New York read his paper on "The Application of Four-ampere Series Arc Lamps for Street Lighting." A long discussion ensued, the participants being W. D'A. Ryan of Schenectady, P. E. Bertrand, H. C. Wirt, Arthur Williams of New York, Mr. Lieb, W. Worth Bean of St. Joseph, Mich., and Mr. Hallberg. In connection with this subject, Professor Elihu Thomson's paper entitled "Notes on Enclosed-arc Lamps" was read by Mr. Ryan. The question of relative lighting



Hylo Lamp Sign over Hotel Desk.



Elblight Display.

Federal Electric Company's Signs.

SOME EXHIBITS OF SIGN AND DECORATIVE LIGHTING AT ELECTRIC-LIGHT CONVENTION.

distances of large units as compared with small ones for street lighting was gone into at some length. Mr. Ryan said that the minimum is difficult to determine. He doubted whether it were possible to go below 4.4 amperes, that is, from a purely lighting point of view, leaving financial considerations out of the question. Mr. Hallberg closed the discussion by saying that the four-ampere lamp worked all right in Cincinnati.

President Ferguson appointed W. M. Anthony of Chicago, N. F. Brady of New York and Mr. Lathrop of St. Paul as an auditing committee to examine the accounts of the treasurer.

Wednesday Morning Session.

Before taking up the regular programme President Ferguson announced the appointment of the following gentlemen as the committee on nominations: Samuel Insull, Chicago; James I. Ayer, Boston; Charles R. Huntley, Buffalo. Secretary Davis announced the appointment of the committee on the president's address as follows: H. L. Doherty, Madison, Wis.; C. L. Edgar, Boston, and H. H. Fairbanks, Worcester, Mass.

Charles F. Scott of Pittsburg, president of the American Institute of Electrical Engineers, then read a paper entitled, "The Young Engineer in the Electric-lighting Plant." This paper was discussed by W. B. Jackson of Madison, Wis., John F. Gilchrist of Chicago, Charles E. Hay of Springfield, Ill., James I. Ayer of Boston, J. W. Lieb of New York, Professor H. E. Clifford of Boston, Professor W. L. Robb of Hartford, Conn., W. M. Anthony of Chicago and Professor W. E. Goldsborough of St. Louis.

John W. Ferguson of the Chicago Edison Company followed with his paper on "Tactful Relations with Customers." This subject was considered in remarks made by Leon H. Sherck of New Orleans, Mr. Gilchrist of Chicago, Arthur Williams of New York, C. S. Rogers of Youngstown, Ohio, Mr. Anthony of Chicago, C. L. Wakefield of Dallas, Texas, G. W. Brine of Atlanta, E. F. Phillips of Detroit and C. M. Lewis of Bellevue, Ohio.

The next subject presented was "The Attitude of the Employer Toward Benevolent Insurance and Educational Associations Among Employes," considered in a paper written and read by Arthur Williams of New York. This was briefly discussed, and then President Ferguson read, by title, W. D'A. Ryan's paper on "Light and Illuminating Engineering." Adjournment for luncheon was then taken.

Wednesday Afternoon.

Dr. J. D. McGowan's paper on "First Aids and Appliances for the Injured" was the first feature of this session. On motion of Mr. Gille of St. Paul the doctor's valuable paper was ordered printed for distribution to all the companies represented, for the use of employes. Before presenting his paper Dr. McGowan sent around, for the delegates' inspection, what he termed "two good things" in the way of first-aid appliances or "accident cases," to be used in case of injury to anyone employed in the power house or central station. One of these "good things" was a box containing a hypodermic syringe, bandages and other appliances, ready for instant use, and the other was a box of various medicines and instruments, such as is used by the Chicago Edison Company in its different central stations and on its wagons in Chicago. The doctor's paper was listened to with great interest. It will be printed in full in a later issue of the Western Electrician.

Steam Turbines.

Professor William Lispenard Robb of Rensselaer Institute, Troy, N. Y., was then introduced and presented a paper on "Steam Turbines." This paper was followed with the greatest attention by the delegates on account of the apparent imminence of the steam turbine as the prime mover in large electric power plants. Professor Robb used many explanatory diagrams during his discourse and brought out the advantages of the steam turbine as used in central lighting stations in a very clear and accurate manner. W. L. R. Emmet of Schenectady was then introduced by the president, who said that Mr. Emmet is entitled to great credit in bringing the Curtis steam turbine to its present great efficiency. Mr. Emmet told at some length of the various stages of the development of the Curtis turbine, telling of Mr. Curtis' and his own work in this connection and explaining in an interesting manner the operation of the Curtis turbine. Mr. Emmet's talk was particularly valuable, owing to his close connection with the development of this turbine. The discussion was then brought to a close to allow the delegates to accept the Commonwealth company's invitation to visit the new Fisk Street plant, in which, ultimately, 14 5,000-kilowatt steam turbines are to be installed, as described in the Western Electrician of last week.

About 300 of the gentlemen, in charge of President Insull and Vice-president Ferguson of the Commonwealth company, took advantage of the invitation. The affair was very well managed. The party proceeded by special trolley cars to the Van Buren Street bridge on the South Branch of the river, where four boats were in waiting, including the electric launch Rotary of the Commonwealth company and the Robert E. Burke, a much larger craft. At the plant the gentlemen were divided into squads of a dozen or 20, each in charge of a Commonwealth engineer, who piloted the party and explained the many interesting features of the plant. A group photograph was taken of the whole party, and refreshments were served in a tent. Returning, the Robert E. Burke took a large portion of the party down the river and out into the lake, making a landing at the Chicago Yacht Club, near the Auditorium. The excursion was successful in every particular.

Thursday Morning.

The first session of the last day opened in an auspicious manner, with a large number of delegates in attendance. President Ferguson called the meeting to order at 10:15 and started the business of the morning by calling upon John W. Glidden of DeKalb, Ill., for his report upon "District Steam Heating." Mr. Glidden, in his report, went into the subject in a most thorough manner. The subject of steam heating, as run in connection with electric power stations, proved of great interest to the delegates attending this convention, as many are considering the installation of a steam-heating system to utilize the exhaust steam of their power stations. In the course of his paper Mr. Glidden recommended that a committee be appointed to investigate district steam heating. Mr. Maunsell indorsed Mr. Glidden's paper very highly and he seconded Mr. Glidden's motion that a committee for the investigation of the steam-heating question be appointed. Mr. McGee of Red Oak, Iowa, suggested that a committee appointed by the National Electric Light Association without funds has but little chance to gain the wanted information, as the average heating man has no appliances to test accurately for benefit derived. President Ferguson then suggested that the financing of this committee be left to the executive committee. Mr. Walbank of Montreal gave some of his experiences regarding the gathering of information on this subject. J. E. Nyle of West Chester, Pa., Mr. Gille of St. Paul, Mr. McCabe of Lewistown, Pa., and Mr. Brine of Atlanta, also took part in the discussion. The motion for a committee of investigation was carried.

The discussion of steam turbines, which was postponed from Wednesday, was then continued by Mr. Emmet adding a few words to his talk of Wednesday. In the further discussion of this subject Mr. Glidden of DeKalb, Ill., J. S. Robinson, Columbia, Tenn., Mr. Maunsell of Topeka, Mr. Gillette, Harold Almert of Chicago, Mr. Gawger, Mr. Carson, Professor Clifford, Mr. Gille of St. Paul and Mr. Hanks took part.

A paper on "Salt as a By-product" was read by Alex Dow of Detroit. This paper dealt with an entirely new feature as connected with the electric-lighting situation, and was listened to with the closest attention by those present. On the closing of the reading of this paper the president called for discussion upon this paper. No one wishing to discuss the subject, Mr. Ferguson introduced Professor Clifford of the Massachusetts Institute of Technology, who gave an interesting talk on "Some Fundamentals in Photometry." In the course of his remarks Professor Clifford told of many of his experiments with various photometers. Before the discussion of Professor Clifford's paper, Professor Matthews of Purdue University was introduced, and he read the report of the committee on the "Investigation of Photometric Values of Arc Lamps." Instead of taking up the investigation of arc lamps alone, the committee also investigated the Nernst lamp, the Welsbach lamp and the naked gas flame. Tests of the watts per candle of the Nernst lamp were shown as made on one-glower, three-glower and six-glower lamps with various shades. Tests of direct-current arc and Nernst lamps were shown by curves plotted to show candlepower. Tests were made on different kinds of mantle gas burners, and curves plotted and shown gave a clear idea of their comparative values. The effect of putting different shades on the gas burner was also shown by a plotted curve. The tests showed that the naked gas flame varied from seven to 27 candlepower. Professor Matthews gave but the gist of the committee's report. He then gave an explanation of the Matthews' integrating photometer, which was on exhibition in the convention hall. In this explanation Professor Matthews gave a very full and complete discourse on the value of his instrument in obtaining the candlepower of incandescent lamps.

Mr. Williams of New York then read his paper on "Decorative and Sign Lighting." He stated that, as reporter on this subject, he had come to the conclusion that decorative and sign lighting could best be explained by a series of photographs and illustrations showing the value of this manner of advertising. During his talk Mr. Williams, instead of reading his report, called special attention to various illustrations in the printed report of the committee, which was distributed at the convention.

Immediately after the conclusion of Mr. Williams' report the remarks of Professor Clifford and the reports of Professor Matthews and Mr. Williams were opened to the delegates for discussion. Professor W. E. Goldsborough, now of the World's Fair, St. Louis, said that the value of the photometer and its advancement should be impressed on the delegates. There was quite a long discussion. Mr. Ryan exhibited some interesting charts, showing the effects of colors under the arc, Nernst, incandescent and Welsbach lights. Great difference is shown in the colors as tested under the different lights. Discussion was then closed by the president, and the association adjourned until 2:15 p. m.

Concluding Session.

With a large number of delegates in attendance, the closing session of the convention was called to order at 2:30 p. m. on Thursday. President Ferguson introduced William Cooper of Cincinnati, Ohio. Mr. Cooper read a paper on "Relative Advantages of Electrical and Mechanical Methods of Variable-speed Control for General Power Service." Mr. Cooper's paper dealt very thoroughly with the different methods employed in the obtaining of variable speed in the different classes of machines, tools, etc., in which such speed is required. The discussion of Mr. Cooper's paper was participated in by W. W. Bean of St. Joseph, Mich., Mr. Lloyd of Chicago, Mr. H. M. Lyman of Chicago, Mr. Gille of St. Paul, Mr. Williams of New York, Mr. Lieb of New York, Mr. F. W. Bowen of Kenosha, Wis., Mr. Brooks and H. T. Hartman, Philadelphia, Mr. F. E. Smith, Somerville, Mass., Harold Almert, Oak Park, Frederick J. Pearson, Chicago. Mr. Cooper closed the discussion with a few appropriate remarks. The general discussion dwelt almost entirely on the advantages of electric drive over that derived from gas engines, etc.

Robert L. Elliott of Chicago read a report on "The Theft of Current." Much interest was shown by the delegates in the reading of this report, as the theft of current is experienced in almost all of the country's lighting stations. Mr. Elliott's paper is given in full on pages 420 and 421 of this issue.

After Mr. Elliott had finished his report the president called upon Mr. Bartlett of Philadelphia for a few remarks in regard to the theft of current. Mr. Bartlett described various ways in which theft can be guarded against, and also told of some of his companies' experiences in the loss or theft of current. Mr. Gilchrist of Chicago and Mr. Williams of New York took an active part in the discussion of Mr. Elliott's report.

After the close of the discussion, the president called for Mr. L. G. Van Ness of Lincoln, Neb., who was on the program for a paper on "Unaccounted-for Current." As Mr. Van Ness was not present, the president introduced H. T. Hartman, who had prepared the Question Box for 1903. Mr. Hartman read a short portion of his report and left the remainder for the perusal of the delegates at their leisure.

N. F. Brady, representing the committee on president's address, made a report recommending that a committee of three engineers be appointed to report at the next annual meeting on the development of the steam turbine. It was also recommended that this

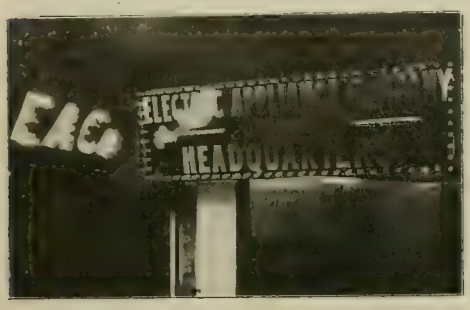
Benjamin Electric Manufacturing Company.

Holophane Glass Company.

EXHIBITS AT ELECTRIC-LIGHT CONVENTION.

[illegible] authorized to expend a sum not to ex- [illegible] investigation of this subject. It [illegible] recommended that a committee of three members be appointed by the president to collect in- [illegible] report at the next meeting on the subject of co-operation with kindred bodies and engineering societies. The committee also recommended that the Question Box be continued in its present form, and that a progress editor be appointed and also reporters on special subjects. The committee finally recommended that the president's address be printed and distributed to the members in pamphlet form. The committee's report was adopted.

The association then resolved itself into executive session for the reading of the reports of the various



ELECTRIC APPLIANCE COMPANY'S EXHIBIT.

officers and committees and the election of officers for the ensuing year.

In executive session these officers were elected:

President—Charles L. Edgar, Boston.

First vice-president—S. B. Livermore, Winona, Minn.

Second vice-president—John W. Lieb, Jr., New York.

Executive committee—Louis A. Ferguson of Chicago, H. H. Bottomley of Fall River, Mass., and Alex Dow of Detroit.

The secretary and treasurer will be appointed by the new president. It is not unlikely that Ernest H. Davis of Williamsport, Pa., will receive the appointment.

Boston was selected as the next place of meeting, and the association adjourned subject to the call of the officers.

Convention Notes and Personal Gossip.

Harry P. Moore represented the Chase-Shawmut Company of Boston.

The cultured Bostonian, S. B. Condit, Jr., was constantly in attendance.

Of course, G. G. Luthy of the Royal Electric Company strolled in from Peoria.

The Adams-Bagnall Electric Company appeared in the person of J. G. Pomeroy of Chicago.

J. Holt Gates of Chicago was at the convention extolling the merits of the engines he handles.

J. J. Lowthian of the New York office of Baker & Co., arrived Monday with the eastern contingent.

William Goltz, the well-known electrical engineer of Chicago, spent considerable time at the meeting.

Treasurer William Coale of the Sterling Electrical Manufacturing Company did the honors for Warren, Ohio.

Manager W. S. McCarthy of the American Conduit Company was on hand on Wednesday afternoon.

Pittsburg appeared this time in the person of Charles P. Hill of the Doubleday-Hill Electric Company.

Mr. Moloney of the Moloney Electric Company was constantly on hand, doing the honors for St. Louis.

George W. Conover, the well-known Chicagoan, mingled with his many friends in attendance at the convention.

The Miller Anchor Company, Norwalk, Ohio, exhibited the Miller anchor for electric-light and telephone poles.

C. E. Corrigan and H. G. Osburn of the Osburn Flexible Conduit Company made many new friends for "Flexduct."

Foree Bain, the well-known electrical expert of Chicago, mingled with the delegates and guests at the convention.

The India Rubber and Gutta Percha Insulating Company was represented by General Sales Manager James B. Olson.

Vice-president A. H. Patterson of the Phœnix Glass Company arrived on Monday with the New York delegation.

J. A. Hammett of the western office of the H. B. Camp Company, maker of vitrified-clay conduits, looked after the interests of his company at the convention. The Camp products are very extensively used all over the country, and seem to be in greater demand than ever.

John H. Fowler of the Fowler-Jacobs Company, producer of cedar poles, mingled with his many customers at the convention.

Ravenna, Ohio, appeared in the person of J. B. Estabrook, assistant secretary and treasurer of the Colonial Electric Company.

L. F. Mahler of Chicago, district manager of the Curtiss-Crippen Engineering Company, was in attendance at the convention.

T. H. Bailey Whipple, assistant to the second vice-president of the Sawyer Manufacturing Electric Company, was on hand.

Charles A. Hibbard, western agent for the Varley Duplex Magnet Company, was one of the constant attendants at the convention.

Assistant Western Manager Edgar H. Hammond of the American Electrical Works did his usual excellent work on behalf of his wire.

Secretary Thomas R. Mercein of the Northwestern Electrical Association put in an appearance, and, as usual, made a pleasing impression.

Manager George Brinton Davis of the Standard Chemical Company of Boston exploited the merits of soaposo as an unexcelleed station cleaner.

The American Push-button Telephone Company of New York city reports an order for 500 telephones to go to Japan, secured at the convention.

J. A. Johnson, secretary of the Kuhlman Electric Company, arrived Wednesday morning and interested central-station men in the Kuhlman transformer.

A. H. Charles Dalley, representing the Underfeed Stoker Company, Chicago, looked after the interests of the Jones stoker, manufactured by this company.

General Manager John S. Speer of the Speer Carbon Company was West on a business trip, and stopped over for a couple of days at the Auditorium.

The H. W. Johns-Manville Company of New York exhibited a line of its various specialties, which were examined with interest by many delegates and visitors.

President George L. Lindsley of the Lindsley Bros. Company, Chicago, and J. Alexander Navarre, assistant business manager, looked after the Lindsley interests.

The Sprague Electric Company this time made no exhibit. The company was represented by Messrs. Kittle and Alexander Henderson of the conduit department.

Baltimore was represented in true southern style by William J. Flanery. The Electrical Material Company is eastern and southeastern agent for Duncan meters.

Daniel C. Hemingray, the genial secretary of the Hemingray Glass Company of Covington, Ky., mingled with his many friends and customers at the convention.

Of course, ubiquitous Henry C. Eddy of the American District Steam Company managed to drop into the convention to appear as the exponent of the Holly steam system.

R. C. Lamphier of the Sangamo Electric Company, Springfield, accompanied by Secretary Jacob Bunn of the company, made an interesting exhibit of Gutmann wattmeters.

M. Jesse Brayton, manager of the electrical department of the Utica (N. Y.) Gas and Electric Company, fulfilled a promise made earlier in the year and visited the convention.

The Cutler-Hammer Manufacturing Company, Milwaukee, made no exhibit, but was fully represented by the following-named gentlemen: F. R. Bacon, H. H. Cutler, A. P. Munning.

Past-president Henry L. Doherty of the National Electric Light Association arrived from Denver, Colo., to do his part at the Ferguson convention of 1903. Mr. Doherty is still unmarried.

Stanley recording wattmeters, manufactured by the Stanley Instrument Company of Great Barrington, Mass., were forcibly called to the attention of the delegates through attractive literature.

Mr. B. E. Sunny handled the financial end of the entertainment of the visitors for the local interests, and, as might be expected, he did it so well that there was no lack of the sinews of war.

J. B. Wallace of Chicago, the well-known representative for the Hazard and Waclark companies, improved the opportunity to renew his acquaintance with many old-time customers and friends.

The Westinghouse interests were represented by some 40 men at the convention. From the home office in Pittsburg there came Frank H. Taylor, Arthur Hartwell, W. H. Whiteside, C. S. Cook, John S. Peck, F. N. Kollock, Jr., S. H. Anderson, G. B. Dusinberre, W. M. Probasco, H. P. Davis and Charles F. Scott. The Chicago office was represented by T. P. Gaylord, Ervin Dryer, C. W. Regester, Frederick Nelson, W. R. Pinckard and several others.

The Nernst Lamp Company was represented by Vice-president C. W. Rice, M. W. Hanks and R. H. Lee, Jr., of Pittsburg and A. E. Fleming, G. E. Bennett and F. H. Carpenter of Chicago.

General Manager W. V. Sweeten of the American Push Button Telephone Company was on hand and staid late. Mr. Sweeten has a very novel exhibit consisting of a complete telephone system.

The following-named gentlemen represented the interests of the National Conduit and Cable Company of New York: H. F. Tate, W. S. Eckert, J. B. Honan, W. H. Pearl and F. B. Switzer.

"King Coale" of the Minneapolis office of the Columbia Incandescent Lamp Company arrived on Wednesday. Mr. Garrison was detained at his home in St. Louis by a slight attack of illness.

Misses Billings and Douglas, as usual, earned the kindliest remarks from all convention delegates by their indefatigable energy and courtesy in handling the trying details relative to convention business.

The Gould Storage Battery Company was, as usual, represented by Western Manager E. L. Draffen, assisted by Harry B. Oakman, A. S. Hubbard and Ed. Lyndon. Mr. Draffen made no attempt at an exhibit.

The Benjamin Electric Manufacturing Company exhibited at the Auditorium the "wireless clusters." This company is making quite a specialty of these clusters, as well as doing an extensive supply business.

A. O. Kuehmsted, R. H. Watson and G. M. Ellis did the honors for the Gregory Electric Company, Chicago. At the reception on Monday night Messrs. Kuehmsted and Watson were accompanied by their wives.

Among those who were constantly in attendance was Purchasing Agent Holmes of the Chicago Edison Company. Mr. Holmes mingled in the gay throng on Monday evening accompanied by Mrs. Holmes.

The John A. Roebling's Sons Company was represented by H. C. Gieffell, Chicago; F. W. Harrington, New York; D. F. Ivins, Trenton, N. J.; George C. Bailey, A. B. Conover, Jr., William H. Singluff and H. C. Griffen, Chicago.

C. F. Zeigler of the Reynolds Electric Flasher Manufacturing Company was energetic enough to see that the Reynolds flasher did most excellent work as an advertising aid to the Westinghouse company and to the Electric Appliance Company.

Assistant Manager E. R. Grier of the Bryant Electric Company and the Perkins Electric Switch Man-

WESTERN ELECTRIC COMPANY'S EXHIBIT.

ufacturing Company arrived from Bridgeport in Chicago on Tuesday. Mr. Grier was warmly welcomed by his many western friends.

The Electric City, the house organ of the Chicago Edison Company and Commonwealth Electric Company, issued an attractive "convention supplement" with its May number. Portraits of the officers, with interesting information, were given.

George F. Porter, formerly secretary of the National Electric Light Association, and now sales manager of the Atlantic Insulated Wire and Cable Company of New York, looked after the interests of his company in his usually skillful manner.

The oscillating electric fan displayed by the Shedd Electric and Manufacturing Company of New York, with its deflector, was inspected with interest by many of the delegates. President R. J. Peterson looked after the interests of his company.

W. R. Mason, western manager of the Mechanical Boiler Cleaner Company, was, of course, in attend-

ance. The Garrigus boiler cleaner made by this company has been adopted by a number of the central stations through the efforts of Mr. Mason.

Homer E. Niesz of the entertainment committee, who managed the entertainment features for the ladies, covered himself with glory through his courtesy at the reception and in all matters appertaining to the pleasure and comforts of the ladies.

The exhibit of the Economical Electric Lamp Company, maker of the "turn-down" incandescent lamp, attracted wide attention. The company was represented by Mr. Loebenthal, who had no difficulty in interesting central-station managers in his lamp.

Western Sales Manager William M. Porter of the Alphaduct Manufacturing Company was constantly on hand and made a very interesting exhibit of alphaduct. Mr. Porter and Mrs. Porter, with Miss Porter, attended the reception on Monday night.

Ernest L. Clark of the Valentine-Clark Company made his mark this time at the convention by bringing Mrs. Clark. It is said hereafter Mrs. Clark will not be absent from any convention. Mr. and Mrs. Clark attended the reception and they met a bevy of friends.

Of course, Western Manager Pierce of the Manhattan Electrical Supply Company was on hand daily. Mr. Pierce has built up a great business for the Manhattan company, and his store on Fifth Avenue is now recognized as one of the standard houses in the West.

Of course the Okonite Company rose in the firmament, and this time the star of them all was personated by Geo. T. Manson. Just previous to the reception, however, Manager Chas. E. Brown of the Central Electric Company gave a little dinner at the Auditorium Annex.

Francis Beidler & Co. of Chicago, producers of cedar poles, entertained its customers and friends at the Auditorium. The Beidler poles are used by many of the electric-light companies throughout the country. The company distributed a tasty leaflet among the delegates.

Western Manager George B. Foster of the Bullock-Wagner Company was one of the most welcome guests at the reception on Monday evening. Mr. Foster is one of those bachelors whose presence is felt to be a necessity at every function where ladies are in attendance.

General Manager Edmund Dickey of the Dickey-Sutton Carbon Company arrived on Wednesday morning. The Dickey-Sutton Carbon Company is running full blast in Lancaster, and is very much gratified with the reception its product has met in the electric-lighting trade.

Western Manager Shainwald of the Standard Paint Company, as usual, made a most excellent impression by the presentation of a very valuable

ALPHADUCT MANUFACTURING COMPANY'S EXHIBIT.

souvenir. This time the gift, presented with the compliments of the Standard Paint Company, was a memorandum book "fit for a king."

Francis Raymond was accompanied by Mrs. Raymond at the reception on Monday night. Mr. Raymond did the honors for the General Incandescent Arc Light Company. Among the other G. I. men were J. Henry Hallberg, H. P. Ball, Fred Johnson and H. B. Coles of the Cleveland office.

"Ask Kirk" was the unique advertising sign displayed by the McRoy Conduit Company of Chicago, Brazil, Ind., and New York. Western Manager Kirkpatrick made a hit with his "Ask Kirk" sign, and it is safe to say nothing could have better advertised his institution than this little placard.

The Keuffel & Esser Company made an interesting exhibit of their various specialties. The Keuffel & Esser Company does a large business among electrical designers and draftsmen with its various types of slide rules, and a full line of these were exhibited, as were also tape lines and mathematical instruments.

The Electric Appliance Company was represented by President W. W. Low and a host of lieutenants. Messrs. Bennett and Roll as usual distinguished themselves with their novel advertising schemes. Mr. Low was accompanied by Mrs. Low and his attractive daughter at the reception Monday evening.

Assistant Manager of Sales R. J. Russell of the Wagner Electric Manufacturing Company arrived bright and early Tuesday morning. Mr. Russell reports the company's business as being phenomenally good. In fact, it requires the straining of every nerve to keep up with orders for the Wagner product.

Western Manager E. A. Jenkins of the Paiste Company made no exhibit at the Auditorium convention, but nevertheless Paiste switches were decidedly in evidence. Mr. Jenkins has built up in the

PITTSBURG SEWER PIPE AND CONDUIT COMPANY'S EXHIBIT

West a great demand for his company's goods, and, as someone put it, Paiste switches are diamonds, not paste.

The Jandus Electric Company was represented by Western Manager J. H. Cooke. Mr. Cooke made no attempt at an exhibit of the Jandus enclosed arc lamps, electric fans or small power motors, but it is needless to say that the Jandus goods were in evidence just the same, as Mr. Cooke was everywhere during the meetings.

The Standard Underground Cable Company, as is its custom, occupied one of the handsomest parlors at the convention. Western Manager J. R. Wiley, Chicago, was in attendance in company with E. J. Pietzcker, W. M. Rogers, C. J. Marsh of New York city, T. E. Hughes of Philadelphia and A. A. Anderson of Pittsburg.

A. P. Munning, general sales agent of the Cutler-Hammer Manufacturing Company, came from the New York headquarters of the company to look after the interests of his concern. Mr. Munning is widely and favorably known in electrical circles, and is most indefatigable in bringing the Cutler-Hammer products to the front.

Charles E. Coleman of Eugene Munsell & Co. made quite a hit with his mica light reflector. This is a new incandescent-lamp shade made out of mica and metal, as a sort of substitute for the glass shade. Mr. Coleman fitted up a number of chandeliers in the Auditorium with these shades, and they attracted considerable attention.

General Manager Geo. C. Keech of the western branch of the Bryan-Marsh Company headed a handsome contingent of Bryan-Marsh lamp men. Assisting Mr. Keech were L. P. Sawyer, general manager of the northwestern district office, E. H. Haughton of the Cincinnati district office, J. S. Corby, J. L. Barnard and A. G. Bowers.

Vice-president F. S. Terry of the Sunbeam Incandescent Lamp Company put in an appearance on Tuesday. Mr. Terry is one of those indefatigable workers in the lamp field that has made his presence felt from New York to San Francisco, and he has won for himself a reputation of being one of the ablest organizers in the electrical field.

President Frank S. Beardslee of the Beardslee Chandelier Manufacturing Company came from his factory Tuesday afternoon in time to become one of the group of central-station and electrical people photographed on the Art Institute steps. Mr. Beardslee has met with great success in his fixture manufacturing business in Chicago.

Millard Hopkins, vice-president of A. P. Hopkins & Co. of Escanaba, Mich., producers of cedar poles and ties, was everywhere in evidence at the convention and did most excellent work for his company. The Hopkins company is one of the largest producers in cedar poles, and has supplied some of the leading electric-light companies in the West.

Manager of Sales F. L. Hutchison of the National Electric Company of Milwaukee, in company with Charles G. Burton, manager of the Chicago office, and C. L. Waters, chief engineer, and F. L. Richards and Charles D. Knight, did the honors for their company at the convention. In this connection it is not inopportune to repeat the announcement to the effect that the National Electric Company is the newly organized institution that has been started by the Christensen Engineering people to handle its recently established electrical branch.

G. M. Gest, the conduit contractor of New York and Cincinnati, assisted by F. C. Mott and W. T. Jackson of Cincinnati, were at the convention. Mr. Gest is one of the best-known conduit men in the country, and has made some of the largest installations in that line. Some interesting Gest "wrinkles," entirely new, were shown in the Annex.

The Dearborn Drug and Chemical Company of Chicago, as usual, came to the front with a novel advertising scheme. This time the boiler doctors were advertised in the shape of a ball and socket puzzle that created lots of sport among the delegates. President W. H. Edgar and R. F. Carr were on hand in the interests of the company.

F. N. Boyer, manager of the supply department of the General Electric Company's Chicago office, accompanied by Mrs. Boyer, constituted one of the most popular couples at the reception on Monday night. Mr. Boyer is a man whose friends are legion, and it is said that no manager in the West has a more thoroughly devoted line of employed than "Boyer."

J. S. Maurer and E. Kearns did excellent work advertising Hart & Co.'s specialty. Hart & Co.'s balloons floated above the interesting exhibit of the Red Cross lubricant for commutators, as well as a number of other specialties. This compound has won for itself an extensive sale not only in this country but in the United Kingdom, Holland and Germany.

Of course, the Chicago Insulated Wire Company was there. This time, however, Mr. Wm. M. Smith of the company succeeded in bringing Mr. Turlay. This latter gentleman is so well known to the electrical trade that he needs no introduction, but heretofore he has delegated all conventions to Mr. Smith. It is rumored that this will not be Mr. Turlay's last convention.

In electing as chairman of the entertainment committee James Wolff of the New York Insulated Wire Company the local electrical interests made no mistake. The tally-ho ride on Tuesday under the man-

AMERICAN CIRCULAR LOOM COMPANY'S EXHIBIT.

agement of Mr. Wolff was voted a great success by the ladies. Assisting the chairman were his cousins, the Misses Florence, Belle and Jane Bissicks and Miss Millikin.

Secretary and Manager J. H. McGill of the Crescent Company, Chicago, was daily on hand in the rotunda. Mr. McGill has been busy for several months reorganizing the Crescent Company and advertising the various Crescent specialties. The Crescent commutator compound and cord spool are novelties that have made a wide sale for themselves all over the United States.

F. S. Churchill, Jr., representing W. N. Matthews & Bro. of St. Louis, did considerable knocking. This time Mr. Churchill was exploiting a novelty in the shape of a steam scale knocker. Through the aid of this interesting device the scale is literally knocked from the sides and tubes of the steam boiler. It is needless to say that Stombaugh guy anchors also were not forgotten by Mr. Churchill.

General Sales Manager Henry Geary came to the convention from Fostoria and arrived early Wednesday morning. At Chicago Mr. Geary met General Manager J. R. Crouse of the company's Cleveland office and J. B. Crouse. B. G. Tremaine of the Fostoria Company also arrived on Wednesday accompanied by his brother, Secretary and Treasurer H. A. Tremaine of the Crouse-Tremaine Carbon Company. Incidently it may be said that under Mr. Geary's management of the sales department the

[illegible] Company has expanded in a most gratifying [illegible] recent visit to the factory revealed [illegible] most gratifying; overtime work [illegible] of the day and there were few nights in the week that the Fostoria factory was [illegible] blast.

[illegible] Batley, one of the oldest and best-known [illegible] conduits, and now general manager of the Pittsburg Sewer Pipe and Conduit Company of Pittsburg, Kan., ably represented the interests of his company at the meeting. The Pittsburg vitrified-clay conduit is already widely used in the West, and it is said that Mr. Batley has secured a number of new customers through the convention.

Arthur Jones, the well-known courteous electric gentleman so long identified with the Sprague Company, has severed his connection with that institution and appeared at the convention as the Cook County representative for the National Electric Company of Milwaukee. Mr. Jones will have his headquarters with Manager C. G. Burton of the National Electric Company's Chicago office.

B. C. Kenyon of Diehl fame handled fans with his usual exquisite grace. This time Mr. Kenyon was exploiting his novelty in the shape of the Coleman combined guard and deflector fan now being pushed so strenuously by the Diehl Manufacturing Company. The fact that the Diehl company has its reputation at stake behind this deflector fan is a sufficient guaranty that it is a decidedly meritorious article.

The ladies were well cared for by the entertainment committee, of which Mr. James Wolff was chairman. They were taken for a tally-ho ride on Tuesday, visiting the South Side parks and boulevards and stopping at the Washington Park Club for luncheon. On Wednesday the visiting ladies were entertained at a matinee party at Powers' Theater, where "The Little Princess" was the attraction.

Manager W. H. Jacob of the Triumph Electric Company could not resist the temptation to steal away from one of the busiest offices in Cincinnati to mingle with his many old friends in Chicago. Mr. Jacob, although still a young man, is an old-timer so far as the electrical business is concerned, and his success as manager of the sales department of the Triumph Electric Company has been phenomenal.

Pass & Seymour came nobly to the front this time in the person of Secretary and General Manager B. E. Salisbury and Western Manager John W. Brooks. Mr. Salisbury reports a most flourishing business at the company's factory, and the busy appearance of the company's western office indicates also that Western Manager Brooks is contributing a goodly proportion of the orders that keep it in such full blast.

Secretary and Treasurer James Porter Gilbert arrived from Niles, Ohio, on Tuesday morning to look after the interests of the Standard Electrical Manufacturing Company. Mr. Gilbert was assisted by T. H. Babcock, Chicago agent of his company. Mr. Gilbert only started the manufacture of the Star lamp during the last year, and already the product of his factory has met with rapid sale throughout the United States.

The Duncan Electric Manufacturing Company of Lafayette, Ind., made an interesting and attractive exhibit in one of the parlors on the second floor. This exhibit was devoted exclusively to the Duncan meters. The Duncan meter has been received with pronounced favor throughout the West, and the exhibit at the Auditorium enabled delegates to see for themselves by actual inspection the many fine points of the instruments.

It was conceded that the National Carbon Company put on one of the best fronts at the convention. A glance at the following list of names indicates that there is method in the sales policy pursued by the general sales manager, N. C. Cotabish: F. W. Wilkins, A. D. Spear, F. H. Murray, F. C. Park, F. H. McDowell, F. J. Kysela, A. V. Ward, A. G. Henry, A. C. Carrier, Wallace O'Conner, D. D. Dickey. The National company has on its books 440 plants using Columbia carbons.

The interests of the Standard Vitrified Conduit Company of New York were ably looked after by Vice-president and Secretary B. S. Barnard of New York. This company's literature was seen everywhere throughout the hotel, and Mr. Barnard was kept busy at all times explaining the merits of his product. Not only did the company make new friends through the efforts of Mr. Barnard, but it was also rewarded with a number of orders, which were secured by him.

Western Manager Thos. G. Grier of the American Circular Loom Company did himself proud in the production of one of the most unique exhibits at the Auditorium. Mr. Grier, however, generously gives credit to his young lady assistant for aid in the production of the artistic points in the exhibit. Mr. Grier was joined at the Auditorium by General Manager Clark of the company's eastern office and the popular and ubiquitous Kirkland. Mr. Corey was also in attendance.

F. S. Palmer, the popular representative of the Consolidated Engine Stop Company, seized the opportunity of the electric-light convention to make a western trip, and at the same time spent three days mingling with the delegates at Chicago. The stop now being exploited by Mr. Palmer places an electric motor or motor-driven machine under control from any number of places in the factory. From Mr. Palmer it is learned that Pittsburg has proved a tremendous market for these stops.

Julian Roe was constantly on hand and did the honors for the Crocker-Wheeler Company. Mr. Roe, with his usual farsightedness in the matter of catchy advertising, distributed a valuable souvenir in the shape of a matchbox that will undoubtedly be kept in the pockets of many friends of the Crocker-Wheeler Company. He also distributed a little booklet on electric lighting. Putnam A. Bates of Ampere, Charles W. Startsman of Ampere and Mr. Whipple of the Chicago office were also in attendance.

President M. K. Eyre of the Buckeye Electric Company arrived at the Auditorium on Tuesday morning. Mr. Eyre came direct from Cleveland and was joined by Chicago Manager J. H. Cooke of the Buckeye company and Mr. Bonham. From general reports the Buckeye Electric Company has through Mr. Eyre's conservative management, increased not only the company's sales, but also the excellent reputation of its lamps. The Buckeye company this time made no attempt at an exhibit.

General Manager Frank MacGovern came out from New York in the interests of the Rossiter-McGovern Company. Mr. McGovern was joined in Chicago by his St. Louis manager, J. A. Peirce. The Rossiter-MacGovern company has been wonderfully successful as buyer and seller of second-hand electrical machinery and its extensive dealings in the West have been noticeable. Manager Peirce of the St. Louis office has done excellent work in extending the company's influence throughout the middle West and Southwest.

President N. Ewing and Secretary Milton Mills came up from St. Louis, arriving Tuesday morning, to represent the Ewing-Merkle Electric Company of St. Louis. The strides made by this new concern since its organization last winter have been phenomenal. It now occupies a very large and handsome building on Pine Street in St. Louis, and is carrying six floors of most valuable stock. This success is not to be wondered at, as every executive of the company is an old and experienced man in the electrical supply business.

Manager of Sales Charles Blizard of the Electric Storage Battery Company arrived in Chicago to attend the reception on Monday evening. Mr. Blizard was assisted at the Auditorium by H. B. Gay, the company's Cleveland representative, G. H. Atkin, Chicago manager, O. E. Osthoff, the company's Chicago engineer, G. H. Hill of Chicago and R. H. Klander of St. Louis. Mr. Blizard was elated over the fact that his company has just closed in St. Louis a contract for a storage battery that is said to be the largest accumulator plant in the world.

The Banner Electric Company of Youngstown, Ohio, appeared in the persons of General Manager W. L. Norris and other gentlemen. Mr. Norris is developing, in addition to a most extensive lamp business, a line of electrical specialties which he had hoped to be able to present at the convention. In this matter there was some delay, and, as a consequence, the Banner exhibit consisted solely of Banner lamps. An interesting folder most modern in its conception and entitled "A Banner Soliloquy," told the story of the merits of Banner lamps in a most unique manner.

The Western Electric Company had one of the most attractive exhibits at the convention. In Room 102, Auditorium Hotel, it exhibited a line of sample circuit-breakers, switches and various types of arc lamps, as well as American transformers, Sunbeam lamps and a full line of fans. In the Auditorium Annex the company installed a motor-generator set and a complete 25-light alternating equipment, with lamps distributed throughout various parts of the hotel. The exhibits were in charge of William S. Hine and L. G. Bassett. Messrs. Stockton, Squires, Howlett and Cobb looked after the interests of the apparatus department. E. M. Scribner, E. W. Rockefeller and P. T. Ackerson, assisted by Messrs. Ferris, Field, Milnor, Aaron, Brown and Devine, looked after the interests of the supplies department. Mr. Otis of the switchboard and construction department, and Mr. Kretchmar of the advertising department, were also in attendance.

Of course, that old timer, Western Agent A. M. Searles of the Warren Electric Manufacturing Company, was in attendance at the Auditorium. Mr. Searles was indefatigable in his energetic exploiture of the Warren alternators. The Warren company during the last year has almost doubled the capacity of its works. A visitor at Sandusky would be surprised to note the phenomenal growth of this most successful institution during the last two years. The Warren alternator, too, has won for itself as a thoroughly reliable machine a reputation second to none in the world.

The Messrs. Gilchrist of the Federal Electric Company were decidedly in evidence at the reception and in the matter of exhibits. Federal electric signs were all over the Auditorium and attracted much favorable comment. The campaign now being carried on by the Federal company instilling into the central-station mind the good business policy of encouraging users of current to consume more and more, is one that not only reverts to the advantage of the Federal company but to the central-station man as well. Federal signs are conceded to be money makers for the central-station man.

Edward W. Jewell of the Jewell Electrical Instrument Company, through a slight delay in the arrival of his exhibit, was not able to open his display until Wednesday morning. It was just in time, however, to catch the convention at full tide. Mr. Jewell presented a handsome line of switchboard and portable instruments, including the Jewell illuminated-dial ammeter and voltmeter. There was also shown a complete battery outfit, also Jewell circuit-breaking switches, ammeters, voltmeters, etc. Mr. Jewell has won for his instruments a reputation for accuracy and reliability second to none in the United States.

The Crouse-Hinds Electric Company made a most interesting exhibit. Messrs. Crouse and Western Manager Frederick F. Skeel were constantly in attendance. The Norbitt specialties, which have recently been introduced in the West through the energetic exploiture of Manager Skeel, have met with a most favorable reception. The Crouse-Hinds switch business has also grown to an extent that necessitated extensive additions to the factory. It is not too much of a compliment to state that a large portion of the company's present prosperity is due to the successful sales made throughout his territory by Mr. Skeel.

F. G. Bolles of the advance department of the Bullock Electric Manufacturing Company was constantly in attendance. Mr. Bolles made no attempt this time at an exhibit, from the fact that the company is doing such a large business, especially in heavy electrical machinery. However, as chairman of the Ohio state committee on standardization of literature, Mr. Bolles was most indefatigable in his work urging manufacturers to "standardize your literature." Mr. Bolles also again perpetuated his identification scheme that proved so valuable at last year's electric-light convention. By the aid of the Bullock book and the numbered buttons, delegates were easily identified.

The Fort Wayne Electric Works had a large contingent of representatives. Following are the names of the Fort Wayne men in attendance: General Manager F. S. Hunting, P. J. Ryan of the Cincinnati office, W. C. Knight of the St. Louis office, A. A. Serva of Fort Wayne, E. A. Wagner of the transformer department and Manager Walter S. Goll of the Chicago office, assisted by J. A. Raymond and Frank McMaster. The Fort Wayne exhibit consisted chiefly of a tiny revolving fan motor that won

Banner Electric Company.

Crouse-Hinds Electric Company.

EXHIBITS AT ELECTRIC-LIGHT CONVENTION.

many friends, and also a Fort Wayne desk fan motor. In addition to these there were presented a line of type-K motors, type-A transformers and a full line of bulletins.

The General Electric Company occupied the large south parlor on the first floor of the Auditorium Hotel. Among those representing the company who attended the convention were: J. R. Lovejoy, general manager lighting, railway and supply departments; B. E. Sunny, western manager, Chicago; C. B. Davis, manager Boston office; A. F. Giles, manager Atlanta office; J. S. Anthony, acting manager New York office; A. D. Page, manager incandescent-lamp sales, Harrison, N. J.; C. D. Haskins, W. S. Moody, H. W. Hillman and P. D. Wagoner of Schenectady, N. Y.; J. C. Calisch, Buffalo; Geo. D. Rosenthal, St. Louis; W. M. Deming, Cincinnati; F. G. Vaughen, Schenectady; J. H. Livsey, Detroit; H. L. Monroe, Dallas, Tex.; W. F. Smith, Minneapolis; G. L. Thompson, Philadelphia; A. D. Babson, New York; J. Scribner, manager lighting department, Chicago; F. N. Boyer, manager supply department, Chicago; F. W. Willcox, lamp works, Harrison, N. J., and F. H. Gale, Schenectady.

The Elblight system of decorative lighting was explained at the convention by Russell Spaulding, president, and E. H. Abadie, general manager, of the Elblight Company of America, both from New York, and J. Allen Haines of the Chicago office. The south parlor was handsomely decorated with Elblight cable and Elblight miniature lamps of many colors festooned and all covered with a profusion of greens. Portieres of Elblight cable, and lamps covered with greens were in the doorways and lent to the reception to the delegates, ladies and members, a festive appearance in sharp contrast with the rest of the hotel. This same parlor was used throughout the convention as the headquarters of the General Electric Company, and the decorations were so attractive they were left in place during the entire convention. The company had headquarters in suite 601-2, where it exhibited, showing among other things an aquarium with Elblight cable and a lamp burning under water. Emphasis is laid on the assertion that the Elblight system is the only system of decorative lighting approved and listed by the National Board of Fire Underwriters.

Westinghouse and Sawyer-Man representatives called attention to the fact that the Auditorium Hotel Company has in use over 38,000 Sawyer-Man incandescent lamps. This company's generating plant is located adjacent to the Annex of the hotel, and furnishes light and power for the two hotels and the theater. It is the largest isolated plant in the West and includes a 500-kilowatt Westinghouse engine-type, direct-current generator. A special panel board, designed to show the operation of various types of Westinghouse precision instruments, was to be seen in the dynamo room and attracted considerable attention. One instrument shown is the synchroscope. The angle between the instruments being synchronized, is always equal to the angle between the pointer and the vertical position. When the movable pointer coincides with the dummy pointer at the top of the scale, the machines are in phase and the switch may be closed, thus synchronizing the machines in the shortest possible time, and with the least possible current flowing between them at the moment of closing the switch. There was also a power-factor meter, a type-F wattmeter, a type-F ammeter, a type-F voltmeter, a two-wire, single-phase, integrating wattmeter, and a frequency meter.

One of the most interesting displays at the convention was that by the Holophane Glass Company, which showed not only samples of the 150 different styles of globes manufactured, but also had a dark room showing tests between holophane and other styles of globes. One of the most interesting tests was the difference between three 16-candlepower lamps in a holophane globe and three lamps of the same candlepower in an ordinary opaline or clear-glass globe. The difference in the illumination between the two was striking. In addition to these dark-room tests, there was a fine display of fixtures equipped with holophane globes, especially of the larger sizes, while out in the hall the largest piece of pressed glass in the world, 20 inches in diameter, was lighted by colored lights, and attracted a great deal of attention. The advertising method of this company was thoroughly up to date. Each delegate and guest at the convention received an engraved invitation, calling attention to the dark-room display and the company's exhibit at the Auditorium and also to complete test rooms at the company's office, 18 East Adams Street. One thing that attracted a great deal of attention was signs posted in different parts of the hall, reading "$2.50 for nothing, Room 634." The company made a present to all delegates of a neat package, containing one upright holophane, one pendent holophane and one of the new Pagoda reflectors, representing a value of $2.50.

So many things have been done in the domain of electric signs that a really new idea in that line might have been thought to be impossible. However, the Hylo self-flashing sign lamp is fairly entitled to the mark of novelty. When sign letters are flashed on and out in the ordinary way, they lose much of their advertising value because the sign is dark a large part of the time. The object of the Hylo device is first of all to show the entire outline of the letters in baby filaments of one candlepower. The Hylo sign is never out. Each lamp has in addition to the baby filament a big filament of eight or 16 candlepower which flashes up at irregular intervals. Each Hylo sign lamp is a complete flashing unit and will operate singly in any Edison socket. The flashing mechanism is all contained within an Edison base of usual size. The advantage of a flashing sign can thus be secured without any change in wiring and without the trouble and expense of a commutating mechanism. The Phelps Company of Detroit, Mich., which makes this sign lamp, asserts a total life of 4,000 hours—1,000 hours for the big filament and 3,000 for the baby filament. It says that a 16-candlepower Hylo sign lamp will operate on an average of 30 watts per lamp. It is also declared that the long life of the two Hylo filaments will compensate for the extra first cost. The Phelps Company was represented at the convention by Alex Dow, president of the company; W. E. Phelps, vice-president; W. J. Phelps, the inventor, and J. Wiley Phelps, sales manager.

SOME OF THE DELEGATES AND VISITORS AT THE CHICAGO ELECTRIC-LIGHT CONVENTION.

Members and Visitors.

Following is a list of the names of the delegates and visitors in attendance at this week's convention of the National Electric Light Association in Chicago. Lack of space compels the omission of the ladies' names:

Abadie, Eugene H., Elbright Company of America, ... New York
Abbott, W. L., Chicago Edison Company ..... Chicago
Albert, H. H., Standard Electrical Manufacturing Company ..... Niles, Ohio
Alderson, F. J., Stanley Instrument Company ..... Gt. Barrington, Mass.
Alexander, E. D., Commonwealth Electric Company ..... Chicago
Allen, J. S., Beloit Electric Company ..... Beloit, Wis.
Allen, L. D., Chicago Edison Company ..... Chicago
Almert, Harold, Cicero Light, Heat and Power Company ..... Oak Park, Ill.
Anderson, A. A., Standard Underground Cable Company ..... Pittsburg, Pa.
Anderson, A. E., Roanoke Railway and Electric Company ..... Lynchburg, Va.
Anderson, A. J., Manhattan Electrical Supply Company ..... Chicago
Anderson, S. H., Westinghouse Electric and Manufacturing Company ..... Pittsburg
Andress, G. W., Stanley Electric Manufacturing Company ..... Chicago
Angus, Geo. P., Lancaster Electric Light Plant ..... Lancaster, Wis.
Anthony, W. M., Chicago Edison Company ..... Chicago
Apperson, R. D., Lynchburg Traction and Light Company ..... Lynchburg, Va.
Apple, V. G., Dayton Electric Manufacturing Company ..... Dayton, Ohio
Armstrong, W. C., Westinghouse Electric and Manufacturing Company ..... Pittsburg
Arnold, Bion J. ..... Chicago
Arnold, M. S., Arnold & Brownell Electric Company ..... Plainwell, Mich.
Atkin, G. H., Electric Storage Battery Company. ..... Chicago
Atkins, Wm. H., Edison Electric Illuminating Company ..... Boston, Mass.
Austin, M. B., M. B. Austin & Company ..... Chicago
Ayer, Jas. I., Simplex Electric Heating Company. ..... Boston, Mass.
Babson, A. D., General Electric Company ..... New York
Badt, F. B. ..... Chicago
Bailey, George C., John A. Roebling's Sons Company ..... Chicago
Bailey, George C., Roeblings' Company ..... Chicago
Bain, Force ..... Chicago
Baker, C. O., Jr., Baker & Company ..... New York
Baker, Frank J., Evanston Electric Illuminating Company ..... Evanston, Ill.
Ball, Wm. D. ..... Chicago
Barbour, G. H., De Forest Wireless Telegraph Company ..... New York
Barlow, G. W., Chicago Edison Company ..... Chicago
Barnard, B. S., Standard Vitrified Conduit Company ..... New York
Barnard, J. L., Bryan-Marsh Company ..... Chicago
Barr, Edw. L., Stanley Electric Manufacturing Company ..... Chicago
Barrett, J. G., Commonwealth Electric Company. Chicago
Barrett, John P., Jr., Chicago Edison Company ..... Chicago
Barron, A. M. ..... South Bend, Ind.
Bartlett, P. H., Brush Electric Light Company ..... Philadelphia, Pa.
Bartlett, E. P., John A. Roebling's Sons Company. ..... Chicago
Bassett, L. G., Western Electric Company ..... Chicago
Bate, Paul H., Chicago Edison Company ..... Chicago
Bates, Putnam A., Crocker-Wheeler Company ..... Ampere, N. J.
Batley, A. R., Pittsburg Sewer Pipe and Conduit Company ..... Pittsburg, Kan.
Beach, E. N., Banner Electric Company ..... Youngstown, Ohio
Beal, M. A., Rockford Edison Company ..... Rockford, Ill.
Bean, W. Worth, Benton Harbor and St. Joe Electric Railway and Light Company ..... St. Joe, Mich.
Beattys, W. H., Jr., The Cutler-Hammer Manufacturing Company ..... Chicago
Bemis, Edward W., Supterintendent Waterworks. ..... Cleveland, Ohio
Bengler, H. M., Elmira Water, Light and Railroad Company ..... Elmira, N. Y.
Bennett, G. E., Nernst Lamp Company ..... Chicago
Bennett, I. A., Electric Appliance Company ..... Chicago
Benton, C. A., Marine Engine and Machine Company ..... New York
Bergenthal, V. W., Stanley Electric Manufacturing Company ..... Chicago
Berry, Wm. C., Chicago Edison Company ..... Chicago
Bertrand, P. A., Gas and Electric Company ..... Springfield, Mo.
Best, W. J., Green Fuel Economizer Company ..... Chicago
Biegler, Philip S., Chicago Edison Company ..... Chicago
Bijur, Joseph ..... New York
Billings, H. E., National Electric Light Association ..... New York
Bird, T. J., Lake Charles Ice, Light and Water Works Company ..... Lake Charles, La.
Bish, C. H., Port Clinton Electric Light and Power Company ..... Port Clinton, Ohio
Bish, M. O., Knox Lake Light and Power Company ..... Knox, Ind.
Blinn, A. C., Sandusky Gas and Electric Company. ..... Sandusky, Ohio
Blizard, Chas., Electric Storage Battery Company. ..... Philadelphia

Bay, Leon, Electric Appliance Company.....Chicago
Bullock, Thos. H., Bullock Electric Manufacturing Company.....Cincinnati, Ohio
Burdett, W. H., Buckeye Electric Company....Chicago
Burgess, A. L., Ide & Sons.....Chicago
Burgess, Thos., Electric Appliance Company.....Chicago
Burns, Lee, General Incandescent Arc Light Company.....New York
Burnham, H.....Fall Rivers, Mass.
Burton, F. W., Kenosha Gas and Electric Company.....Kenosha, Wis.
Busch, H. M., Illinois Power and Light Company.....Alton, Ill.
Bussey, A. G., Bryan-Marsh Company.....Chicago
Byrd, Alexander A., Lake Cities Electric Railway Company.....Michigan City, Ind.
Byron, F. N., General Electric Company.....Chicago
Bryden, N. S., Westinghouse Electric and Manufacturing Company.....Pittsburg.
Brady, N. E., United Electric Light and Power Company.....New York City
Brayton, M. J., Utica Gas and Electric Company.....Utica, N. Y.
Briggs, L. A.....Fond du Lac, Wis.
Brine, G. W., Georgia Railway and Electric Company.....Atlanta
Brobeck, J. G., The Simplex Electrical Company.Chicago
Bronson, D. B., Chicago Edison Company.....Chicago
Brooke, Irving E., Chicago Edison Company...Chicago
Brooks, John W., Pass & Seymour.....Chicago
Brooks, Morgan, University of Illinois...Urbana, Ill.
Brooks, F. H., Vicksburg Railway and Light Company.....Vicksburg, Miss.
Brown, E. C., Electric Appliance Company.....Chicago
Brown, Frank E., Dept. Water Supply, Gas and Electricity.....New York City
Bryan, F. A.....South Bend, Ind.
Bryant, W. C., The Bryant Electric Company.....Bridgeport, Conn.
Buddy, H. J., General Electric Company....Philadelphia
Buell, B. D., Chicago Edison Company.....Chicago
Buell, J. W., General Electric Company.....Chicago
Bullen, D. R., General Electric Company.....Boston
Bullock, F. W., Jamestown Light and Power Company.....Jamestown, N. Y.
Bullock, Thos. H., Standard Electric Manufacturing Company.....Niles, Ohio
Bunn, Jacob, Sangamo Electric Company.Springfield, Ill.
Burke, E. J., Westinghouse Electric and Manufacturing Company.....Chicago
Burt, Austin, Waterloo and Cedar Falls Gas and Electric Company.....Waterloo, Iowa
Burton, Charles G., National Electric Company.....Chicago
Bushnell, O. J., Chicago Edison Company.....Chicago
Bushnell, S. Morgan, Chicago Edison Company...Chicago
Calisch, J. C., General Electric Company..Buffalo, N. Y.
Campbell, M. G., Kansas City Electric Light Company.....Kansas City, Mo.
Canfield, M. C., Stanley Electric Manufacturing Company.....Chicago
Carlton, W. E., Chicago Edison Company.....Chicago
Carpenter, F. H., Nernst Lamp Company.....Chicago
Carr, R. F., Dearborn Drug and Chemical Works.Chicago
Carrier, A. E., National Carbon Company....Cleveland
Carson, Geo. S., Iowa City Electric Light Company.....Iowa City, Iowa
Case, A. B., Chicago Edison Company.....Chicago
Cassidy, J. W., Independent Light and Power Company.....Quincy, Ill.
Cassin, Edw. A., Gregory Electric Company....Chicago
Chadsibadhy, W. E., Chicago Edison Company..Chicago
Chambers, J. W., Stanley Electric Manufacturing Company.....Chicago
Chapman, Frank H., Yost Electric Manufacturing Company.....Toledo, O.
Clarke, Chas. Sanford, The Engineer.....Cleveland, O.
Clarke, P. L., Edison Electric Company.....Chicago
Clark, E. L., The Valentine-Clark Company.....Chicago
Clifford, A. E., American Electrician....New York City
Coale, Wm., Sterling Electric Manufacturing Company.....Warren, Ohio
Cobb, C. W., Western Electric Company.....Chicago
Coe, A. V. R., Brush Electric Light Company.....Philadelphia, Pa.
Coles, H. B., General Incandescent Arc Light Company.....Cleveland, Ohio
Colley, C. B., American Can Company....Maywood, Ill.
Collins, F. L., Illinois Steel Company.....Chicago
Collins, W. Forman, Western Electrician.....Chicago
Collins, W. F., Wausau Electric Company..Wausau, Wis.
Collins, W. H., Chicago Edison Company.....Chicago
Combiths, J. E., Commonwealth Electric Company.....Chicago
Condit, S. B., Jr.....Boston, Mass.
Cone, Owen P., Hawks Electric Company....Goshen, Ind.
Conuely, C. B., General Electric Company.....Chicago
Conover, Geo. W.....Chicago
Conover, A. B., Jr., John A. Roebling's Sons Co.....Chicago
Conolly, B. A., Lima Electric Railway and Light Company.....Lima, Ohio
Cook, C. S., Westinghouse Electric and Manufacturing Company.....Pittsburg
Cooke, J. H., Buckeye Electric Company.....Chicago
Cooke, W. J., McGuire Manufacturing Company.Chicago
Cooper, W.....Cincinnati, O.
Corby, J. S., Bryan-Marsh Company.....New York
Corey, R. B., Columbia Incandescent Lamp Company.....New York
Cotabish, N. C., National Carbon Company.....Cleveland, Ohio
Cowles, J. W., Woburn Light, Heat and Power Company.....Boston, Mass.
Crandall, C. D., Western Electric Company....Chicago
Cravath, J. R., American Electrician.....Chicago
Crider, J. S., Washington Carbon Company.....Washington, Pa.
Crine, Thos. S., Chicago Telephone Company...Chicago
Croninger, Cliff R., General Electric Company..St. Louis
Crosby, Geo. E., Brookline Gas Light Company..Boston
Crossman, T. E., official stenographer.....New York
Crouse, J. Robert, Fostoria Incandescent Lamp Company.....Fostoria, Ohio
Crouse, Mr., Crouse-Hinds Electric Company.....Syracuse, N. Y.
Cushing, H. C., Jr., "The Central Station".....New York
Cushman, G. H., San Antonio Gas and Electric Company.....San Antonio, Texas
Cutter, George, Geo. Cutter Company.....Chicago
Dale, John H., The Dale Company.....New York
Dales, Jas. S., Lincoln Gas and Electric Company.....Lincoln, Neb.
Dales, John P., American Insulated Wire and Cable Company.....Chicago
Dalley, A. H. Chas., Underfeed Stoker Company of America.....Chicago
David, Chas. B., General Electric Company, Boston, Mass.
Davidson, C. L., Chicago Edison Company.....Chicago
Davidson, J. A., Port Huron Light and Power Company.....Port Huron, Mich.
Davis, Geo. B., Standard Chemical Company.....Boston, Mass.
Davis, H. L., Home Rubber Company.....Chicago
Davis, H. P., Westinghouse Electric and Manufacturing Company.....Pittsburg
Davis, Ernest H., Edison Electric Illuminating Company.....Williamsport, Pa.
DeCamp, A. J., Philadelphia Electric Company.....Philadelphia
Deming, W. M., General Electrical Company.....Schenectady, N. Y.
Dennis, Fred L., South Bend Electric Company.....South Bend, Ind.
Dibble, S. F., General Electric Company.....Chicago
Dickey, Edmund, Dickey-Sutton Carbon Company.....Lancaster, Ohio.
Dinsmore, S. A., Electric Appliance Company...Chicago
Dirsman, J. F., Edison Electric Light Company.....York, Pa.
Dodd, Philip L., Electrical Review.....New York
Doherty, Henry L., Denver Gas and Electric Company.....Denver, Colo.
Donley, W. E., W. E. Donley Electric Light and Power Company.....Big Rapids, Mich.
Donohoe, F. E., American Electrical Works....Chicago
Doody, John T., Chicago Edison Company.....Chicago
Douglas, S. A., American Vitrified Conduit Company.....New York
Dow, Alex., Peninsular Electric Light Company.....Detroit, Mich.
Downer, J. D., Western Electrician.....Chicago
Draffen, E. L., Gould Storage Battery Company..Chicago
Dryer, Ervin, Westinghouse Electric and Manufacturing Company.....Chicago
Duncan, Thos., Duncan Electric Manufacturing Company.....Lafayette, Ind.
Dunn, D. W., Stanley Electric Manufacturing Company.....Chicago
Dunkee, Albert, Chicago Edison Company.....Chicago
Dusinberre, Geo., Westinghouse Electric and Manufacturing Company.....Pittsburg
Dye, H. C., City Electric Light Plant.....Golion, Ohio
Eaker, F. E., Commonwealth Electric Company..Chicago
Eastman, G. N., Chicago Edison Company.....Chicago
Eaton, C. J., Commonwealth Electric Company.....Chicago
Eckert, W. S., The National Conduit and Cable Company.....New York
Edgar, Charles L., Edison Electric Illuminating Company.....Boston, Mass.
Edgar, William H., Dearborn Drug and Chemical Works.....Chicago
Edkins, E. A., Chicago Edison Company.....Chicago
Elden, Leonard L., Edison Electric Illuminating Company.....Boston, Mass.
Eley, J. N., Georgia Railway and Electric Company.....Atlanta, Ga.
Ellicott, Edward B., City Electrician.....Chicago
Elliott, G. W., Electrical World and Engineer.....New York
Elliott, Robert L., Chicago Edison Company...Chicago
Elliott, W. L., Antigo Electric Light Plant..Antigo, Wis.
Ellis, G. M., Gregory Electric Company.....Chicago
Emphill, R., Jr., Washtenaw Light and Power Company.....Ann Arbor, Mich.
Enderlin, J. F., Aberdeen Electric Light Plant.....Aberdeen, Miss.
Engel, W. P.....Defiance, Ohio
Estabrook, J. B., Colonial Electric Company.....Ravenna, Ohio
Etheridge, Locke, Stanley Electric Manufacturing Company.....Chicago
Evans, David, Field-Evans Iron Company.....Chicago
Ewing, N. W., Ewing-Merkle Electric Company.St. Louis
Eyre, W. K., Buckeye Electric Company..Cleveland, Ohio
Fairbanks, H. H., Worcester Electric Light Company.....Worcester, Mass.
Fairclough, W. H., Chicago Edison Company....Chicago
Fairclough, W. H., Jr., Chicago Edison Company.....Chicago
Ferguson, John W., Chicago Edison Company..Chicago
Ferguson, Louis A., Chicago Edison Company...Chicago
Ferguson, Rob., Chicago Edison Company.....Chicago
Ferris, Robert, Edison Illuminating Company.....Monmouth, Ill.
Ferris, Thos., General Electric Company.Milwaukee, Wis.
Ferris, W. J., General Electric Company.....Chicago
Field, A. W., Columbus Edison Company.Columbus, Ohio
Field, E. R., Western Electric Company.....Chicago
Fife, H. O., Chicago Edison Company.....Chicago
Fitzall, W. W., United Electric Company of New Jersey.....Jersey City, N. J.
Flannery, W. J., Electrical Material Company.....Baltimore, Md.
Flather, Frederick A.....Chicago
Fleming, A. E., Nernst Lamp Company.....Chicago
Forbrich, C. W., Western Electrician.....Chicago
Foreman, W. E., Westinghouse Electric and Manufacturing Company.....Chicago
Foster, Geo. B., Bullock Electric Manufacturing Company.....Chicago
Foster, O. C., Bullock Electric Manufacturing Company.....Chicago
Fowler, John H., Fowler-Jacobs Company.....Chicago
Frame, A. B., O. R. G. Company.....Portland, Ore.
Frank, E. H., Guarantee Electric Company.....Chicago
Freeman, G. A., Chicago Edison Company.....Chicago
French, A. K., Dennison Manufacturing Company.....Chicago
French, Charles, Electrical Review.....Chicago
Frey, J. J., Hillsboro Electric Light and Power Company.....Hillsboro, Ill.
Friend, A. H., M. B. Austin & Co.....Chicago
Frosch, Henry F., Chicago Edison Company....Chicago
Fuller, H. W., Potomac Electric Power Company.....Washington, D. C.
Fuller, R., Fuller Company.....Detroit, Mich.
Fuller, Willard, Acme Switch Company....Cleveland, O.
Gaffrey, John J., United Electric Light Company.....Newark, N. J.
Gale, F. H., General Electric Company.....Chicago
Gammans, J. H., Oregon Electric Power Company.....Chicago
Gannett, H. L., Chicago Edison Company.....Chicago
Gardner, Stephen, Chicago Edison Company....Chicago
Gardner, William R., Pittsfield Electric Company.....Pittsfield, Mass.
Gattland, C. C., Sioux City Gas and Electric Company.....Sioux City, Iowa
Gay, H. B., Electric Storage Battery Company.....Philadelphia
Gaylord, Truman P., Westinghouse Electric and Manufacturing Company.....Chicago
Gear, Harry B., Chicago Edison Company.....Chicago
Geary, H. H., Fostoria Incandescent Lamp Com-
Gerlach, A. G., Chicago Edison Company.....Chicago
pany.....Fostoria, Ohio
Gerlach, J. D., Chester Light, Water and Ice Company.....Chester, Ill.
German, C. D.....Shawano, Wis.
Gibson, John J., Westinghouse Electric and Manufacturing Company.....Chicago
Gibson, P. S., Westinghouse Electric and Manufacturing Company.....Chicago
Gieffell, H. C., John A. Roebling's Sons Company.....Chicago
Gilbert, L. H.....Montpelier, Ohio
Gilchrist, John F., Chicago Edison Company....Chicago
Giles, A. F., General Electric Company.....Schenectady, N. Y.
Gilmore, A. D., Chicago Edison Company.....Chicago
Gilmore, Frank M., A. Sorg, Jr., & Co.....Chicago
Gille, H. J., St. Paul Gas Light Company.St. Paul, Minn.
Gillespie, A. D., Monarch E. and Wire Company..Chicago
Gillette, J. C., Evansville Gas and Electric Light Company.....Evansville, Ind.
Glidden, John W., De Kalb-Sycamore Electric Company.....De Kalb, Ill.
Goddard, Stephen H., Electrical Review.....New York
Godkin, M. L., Western Electrician.....New York
Goebst, J. H., Chicago Edison Company.....Chicago
Goldsborough, W. E., Department of Electricity, World's Fair.....St. Louis
Goll, W. S., Fort Wayne Electric Works.....Chicago
Goltz, Wm., Goltz Engineering Company.....Chicago
Gray, E. W. T., Westinghouse Electric and Manufacturing Company.....New York
Greene, Edgar B., Edison Company.....Altoona, Pa.
Greene, L. A., American Electrician.....Chicago
Greene, L. W., Brooklyn Electric Light Company.....New York
Greene, W. J., Cedar Rapids Electric Light and Power Company.....Cedar Rapids, Iowa
Gregory, Chas. E., Guarantee Electric Company..Chicago
Grier, Thomas G., American Circular Loom Company.....Chicago
Griffen, H. C., John A. Roebling's Sons Company.....Chicago
Griswold, J. P., Edison Electric Illuminating Company.....Topeka, Kan.
Guild, C. G., Jenney Electric Light and Power Company.....Ft. Wayne, Ind.
Gum, Guy C., Delavan Light and Fuel Company.....Delavan, Wis.
Hallberg, J. Henry, General Incorporated Arc Light Company.....New York
Hamilton, R. T., Banner Electric Company.....Youngstown, Ohio
Hammond, E. H., American Electrical Works..Chicago
Hanks, M. W., Nernst Lamp Company.....Pittsburg, Pa.
Hanna, A. C., Commonwealth Electric Company.....Chicago
Hardin, F. E., Crouse-Hinds Electric Company..Chicago
Harding, J. H., La Porte Electric Company.....La Porte, Ind.
Harrington, F. W., John A. Roebling's Sons Company.....New York
Hart, John E., Banner Electric Company.....Youngstown, Ohio
Hartwell, Arthur, Westinghouse Electric and Manufacturing Company.....Pittsburg
Haskins, Caryl D., General Electric Company.....Schenectady
Hatch, A. S., Public Lighting Commission.....Detroit, Mich.
Haughton, E. H., Bryan-Marsh Company.....Cincinnati
Hawkins, F. M., Crouse-Hinds Electric Company.....New York City
Hawley, Theo. L., Citizens' Electric Company.....Eureka Springs, Ark.
Hay, Chas. E., Springfield Electric Light and Power Company.....Springfield, Ill.
Hayward, R. H., General Electric Company.....Chicago
Hazeltine, W. P., Lynn Gas and Electric Company.....Lynn, Mass.
Hebard, F. C., Commonwealth Electric Company.....Chicago
Hemingray, D. C., Hemingray Glass Company.....Covington, Ky.
Heliger, Max, Rockford Edison Company...Rockford, Ill.
Henderson, Alex., Sprague Electric Company..New York
Henry, A. C., National Carbon Company....Cleveland
Henry, D. Carl, The Henry Electric Light Company.....Chicago and Denver
Hickok, F. S.....Berwyn, Ill.
Hill, Chas. Phillips, Doubleday-Hill Electric Company.....Pittsburg, Pa.
Hill, George W., Electric Storage Battery Company.....Evanston, Ill.
Hillis, C. C., Electric Appliance Company.....Chicago
Hillman, E. B., Warsaw Electric Plant....Warsaw, Ill.
Hixson, H. R., Simplex Electrical Company....Chicago
Hoagland, H. C., Kalamazoo Valley Electric Company.....Kalamazoo, Mich.
Hogue, Oliver R., Chicago Edison Company....Chicago
Holloway, Wm., Chicago Edison Company.....Chicago
Holmes, R. C. P., Chicago Edison Company.....Chicago
Holmes, Welles E., Newton & Watertown Gas Light Company.....Newton, Mass.
Honan, J. B., National Conduit and Cable Company.....New York
Hope, Harry M., Chicago Edison Company....Chicago
Hopkins, Millard.....Escanaba, Mich.
Hosmer, Sidney, Edison Company of Boston...Boston
Howard, Benj. K., Chicago Edison Company....Chicago
Howard, D. H., Chicago Edison Company.....Chicago
Hubbard, A. S., Gould Storage Battery Company.....New York City
Hughes, T. E., Standard Underground Cable Company.....Philadelphia
Hunt, Chas. B., London Electric Company..London, Ont.
Hunting, F. S., Ft. Wayne Electric Works.....Ft. Wayne, Ind.
Huntington, Arthur, Westinghouse Electric and Manufacturing Company.....Chicago
Hutchings, Jas. T., Brush Electric Light Company.....Philadelphia
Hutchinson, F. L., National Electric Company.....Milwaukee, Wis.
Hutchison, H. C., Cincinnati Gas and Electric Company.....Cincinnati, Ohio
Ibsen, C. H., Chicago Edison Company.....Chicago
Insull, Fred W., Calumet Lighting Company.....Evanston, Ill.
Insull, Samuel, Chicago Edison Company.....Chicago
Ivins, D. F., John A. Roebling's Sons Company.....Trenton, N. J.
Jackson, W. B., D. C. & W. B. Jackson...Madison, Wis.
Jackson, W. T.....Cincinnati
Jamieson, B. G., Chicago Edison Company.....Chicago
Jampolis, Henry, Chicago Edison Company.....Chicago
Jenkins, Edw. A., H. T. Paiste Company.....Chicago
Jenkins, Fred R., Quincy Engine Works.....Chicago
Jewett, F. N.....Chicago
Johnson, F. E., City Electric Light Plant.....Kendallville, Ind.
Johnson, F., G. I. Arc Light Company.....St. Louis
Johnson, Geo. B., Sprague Electric Company...Chicago
Johnson, J. A., Kuhlman Electric Company.Elkhart, Ind.
Johns, Samuel C. D., Cleveland Electric Illuminating Company.....Cleveland, O.
Johnston, R., Commonwealth Electric Company.....Chicago
Jones, Arthur, National Electric Company.....Chicago
Jones, Geo. Harvey, Chicago Edison Company...Chicago
Joyce, M. B., Chicago Edison Company.....Chicago
Judge, John P., General Electric Company.....Schenectady, N. Y.
Junkersfeld, P., Chicago Edison Company.....Chicago
Karapetoff, W., Westinghouse Electric and Manufacturing Company.....Pittsburg, Pa.
Kearns, E. W., Hart & Co.....Chicago
Keech, George C., Bryan-Marsh Company.....Chicago
Keene, Allen A., Western Electric Company....Chicago
Kelly, W. E., Western Electrician.....Chicago
Keller, C. A., Chicago Edison Company.....Chicago
Kelley, W. G., Chicago Edison Company.....Chicago
Kenny, E. J., Consumers' Carbon Company.....Lancaster, Ohio
Kent, R. B., Jr., Crouse-Hinds Electric Company.....Chicago
Kenyon, B. C., Diehl Manufacturing Company.....New York City
Kern, H. R., Brush Electric Light Company.....Philadelphia, Pa.
Kerns, L. E., Consolidated Gas Company of New Jersey.....Long Branch, N. J.
Kester, John T., Hillsboro Electric Light and Power Company.....Hillsboro, Ill.
Ketcham, Philip H., Jr., American Circular Loom Company.....New York
Kettle, E. B., Sprague Electric Company.....Chicago
Keyes, F. A., American Steel and Wire Company.....New York

Kimball, J. R., Evanston Heating Company. Evanston, Ill.
King, C. G. Y., Chicago Edison Company.....Chicago
Kinney, E. P., Capital Electric Engineering Company.....Lansing, Mich.
Kirchner, F. C., Banner Electric Company.....Youngstown, Ohio
Kirkland, H. B., American Circular Loom Company.....New York
Kirkpatrick, E. F., McRoy Clay Works.....Chicago
Kittredge, E. R., Wisconsin Chair Company.....Port Washington, Wis.
Klauder, R. H., Electric Storage Battery Company.....St. Louis
Klusman, C., Chicago Edison Company.....Chicago
Knight, C. D., National Electric Company.....Milwaukee, Wis.
Knight, C. S., Jr., American Steel and Wire Company.....Chicago
Knight, W. C., Fort Wayne Electric Works....St. Louis
Kohler, F. W., Kohler Bros.....Chicago
Koiner, C. W., Madison County Gas and Electric Company.....Oneida, N. Y.
Kollock, T. M., Westinghouse Electric and Manufacturing Company.....Pittsburg, Pa.
Korst, P. H., Janesville Electric Company.....Janesville, Wis.
Kratzer, F. G., Fostoria Incandescent Lamp Company.....Fostoria, Ohio
Kreider, C. R., Kohler Brothers.....Chicago
Kreidler, W. A., Western Electrician.....Chicago
Kretschmar, F. K., Western Electric Company..Chicago
Kuehmsted, A. O., Gregory Electric Company....Chicago
Kuhlman, C. A., Monarch Electric and Wire Company.....Chicago
Kusler, A. H.....Jacksonville, Ill.
Kutas, E. J., Bryan-Marsh Company....Cleveland, Ohio
Kysela, F. C., National Carbon Company.....Cleveland, Ohio
La Ferer, Chas. A., Citizens' Electric Company.....Battle Creek, Mich.
Lake, Edward N., Chicago Edison Company.....Chicago
Lake, W. F. S., Buffalo Forge Company..Buffalo, N. Y.
Lamphier, R. C., Sangamo Electric Company.....Springfield, Ill.
Landis, H. G., Electrical Supply and Construction Company.....Wichita, Kan.
Lane, J. W., Jr., National Engineer.....Chicago
Lange, J. H., Portsmouth Street Railroad and Light Company.....Portsmouth, Ohio
Lansingh, V. R., Holophane Glass Company....Chicago
Lathrop, A. P., Edison Electric Light and Power Company.....St. Paul, Minn.
Lauritzen, H. M., Holophane Glass Company...Chicago
Le Bourveau, L. G., T. H. Bullock & Co. .....Chicago
Leek, C. D., Wisconsin Chair Company.....Port Washington, Wis.
Leekes, Geo. H., North Shore Electric Company.....Evanston, Ill.
Lee, R. H., Jr., Nernst Lamp Company..Pittsburg, Pa.
Leiderer, William, Chicago Edison Company...Chicago
Levee, Geo. B., Electric Appliance Company.....Chicago
Levermore, S. B., Winona Railway and Light Company.....Winona, Minn.
Lewis, C. M., Bellevue Light and Power Company.....Bellevue, Ohio
Lieb, J. N., Jr., Edison Electric Illuminating Company.....Brooklyn, N. Y.
Lillibridge, Ray D., Stanley Electric Manufacturing Company, Otis Elevator Company, Dodge & Day.....New York
Lindsay, E. C., W. W. Lindsay & Co.....Philadelphia
Lindsley, E. A., Lindsley Brothers Company....Chicago
Link, R., Keuffel & Esser Company.....Chicago
Litscher, C. J., Illinois Electric Company.....Chicago
Livsey, J. H., General Electric Company..Detroit, Mich.
Lobenthal, M., Economical Electric Lamp Company.....New York
Lord, Irving P., Waupaca Electric Light and Railway Company.....Waupaca, Wis.
Low, D. W., Alliance Gas and Electric Company.....Alliance, O.
Lowthian, J. J., Baker & Co.....Newark, N. J.
Low, W. W., Electric Appliance Company.....Chicago
Lundy, A. D.....Chicago
Lunn, Ernest, Chicago Edison Company.....Chicago
Luthy, G. G., Royal Electric Company.....Peoria, Ill.
Lynch, A. H., United Electric Company....Newark, N. J.
Lyndon, Edward, Gould Storage Battery Company.....New York City
Lyons, P. F., N. I. R. Company.....Bristol, R. I.
McCabe, E. F., Lewistown Electric Light Company.....Lewistown, Pa.
McCall, W. A., Western Electrician.....Chicago
McClurg, W. A., Plainfield Gas and Electric Light Company.....Plainfield, N. J.
McComber, A., McComber-Whyte Rope Company..Chicago
McCoy, F. S., Adams-McCoy Electric Company.....Muscatine, Iowa
McDonald, W. D., Westinghouse Electric and Manufacturing Company.....Chicago
McDowell, F. H., National Carbon Company.....Cleveland, Ohio
McDowell, J. W., Manhattan Electric Supply Company.....New York
McGee, D. F., Red Oak Electric Company...Red Oak, Ia.
McGillan, F. L., Valentine-Clark Company.....Chicago
McGlensey, John F., Chicago Edison Company..Chicago
McGowan, Dr. J. D., Chicago Edison Company...Chicago
McGrath, W. H., Houghton County Electric St. Co.....Houghton, Mich.
McKana, Geo. E., Chicago Edison Company.....Chicago
McKinlock, Geo. A., Central Electric Company..Chicago
McLaughlin, K. A., New Omaha Thomson-Houston Company.....Omaha, Neb.
McManigal, W. J.....Omaha, Neb.
McMaster, Frank, Fort Wayne Electric Works...Chicago
McMullin, J. B., Electric Appliance Company....Chicago
McNamee, T. W., Wabash Electric Light Company.....Wabash, Ind.
McReynolds, T. C., Kokomo Railway and Light Company.....Kokomo, Ind.
Macdonald, C. H., J. A. & W. Bird & Co.....New York
MacKenzie, John D., Federal Electric Company..Chicago
Mahler, L. F., De Laval Steam Turbine Company.....Chicago
Manson, Geo. T., The Okonite Company.....New York
Manwaring, A. H., Brush Electric Light Company.....Philadelphia, Pa.
Markle, Herbert, Northern Electric Manufacturing
Marks, L. B.....New York City
Marlow, E. S., Potomac Electric Power Company.....Washington, D. C.
Marshall, H. E., Evanston Electric Illuminating Company.....Evanston, Ill.
Marsh, Chas. J., Standard Underground Cable Company.....New York
Marsh, H. H., Engineering News.....Chicago
Marsh, J. H., Electrical Review.....New York
Martieu, H. L., Central Electric Company.....Chicago
Mason, E. R., Porter & Berg.....Chicago
Mason, H. E., M. B. Austin & Co.....Chicago
Mason, W. R., Mechanical Boiler Cleaner Company.....Chicago
Matlack, E. V., Laclede Power Company..St. Louis, Mo.
Maunsell, C. R., Edison Electric Illuminating Company.....Topeka, Kan.
Maurer, J. S., Hart & Company.....Chicago
Mead, C. E., The Independent Light and Power Company.....Quincy, Ill.
Mench, F., Jackson Light and Power Company.....Jackson, Mich.
Mercein, Thos. R., N. W. Electrical Association.....Milwaukee, Wis.
Menirma, A., M. B. Austin & Co. .....Chicago
Merrill, F. L., Standard Railway Materials Company.....Chicago
Merrill, W. W., Chicago Fuse Wire and Manufacturing Company .....Chicago
Messer, Chas., Dearborn Electric Company.....Chicago
Miles, G. R., Chicago Edison Company.....Chicago
Millerard, A. L., Westinghouse Electric and Manufacturing Company.....Chicago
Miller, A. M., Westinghouse Electric and Manufacturing Company.....Chicago
Mills, Milton, Ewing-Merkle Electric Company..St. Louis
Milner, Geo. S., Western Electric Company....Chicago
Milnor, L. T., Western Electric Company.....Chicago
Mohr, Howard K., Brush Electric Light Co..Philadelphia
Moloney, T. O., Moloney Electric Company....St. Louis
Monroe, H. L., General Electric Company..Dallas, Texas
Montague, J. E., Buffalo and Niagara Falls Electric Light and Power Company..Niagara Falls, N. Y.
Montgomery, Geo. A., Quebec Jacques Cartier Electric Company.....Quebec, Canada
Montgomery, John T. W., Roebling Construction Company.....New York
Moore, Harry P., Chase-Shawmut Company.....Boston
Moore, Wm. A., Fairbanks, Morse & Co.....Chicago
Moser, A. G., Bartlett Illuminating Company.....Saginaw, Mich.
Mueller, Richard, Chicago Edison Company.....Chicago
Mullin, E. H., General Electric Company..New York City
Munning, A. P., Cutler Hammer Manufacturing Company .....Milwaukee, Wis.
Murray, F. H., National Carbon Company.Cleveland, Ohio
Myers, Geo. M., Southwest Missouri Light Company .....Joplin, Mo.
Navarre, J. Alex., Lindsley Brothers Company..Chicago
Ness, Wm. N., Chicago Edison Company.....Chicago
Neuman, W. S., Hunterdon Electric Company.....Lambertville, N. J.
Newman, D., Illinois Electric Company.....Chicago
Nicholson, J. A., General Electric Company.....Chicago
Niesz, Homer E., Chicago Edison Company.....Chicago
Norden, Mortimer, Norden-Bittner Electric Company .....New York
Norris, B. H., General Electric Company...Lynn, Mass.
Norris, N. L., Banner Electric Company.....Youngstown, Ohio
Noyes, Ernest H., Pittsburg Reduction Company.Chicago
Nyle, J. E., Edison Electric Illuminating Company .....West Chester, Pa.
Oakman, H. B., Gould Storage Battery Company.....New York
O'Brien, John, Chicago Edison Company.....Chicago
Ochs, S. O., Stanley Instrument Company.....Great Barrington, Mass.
O'Connor, Wallace, National Carbon Company..Chicago
Ogden, O. O., Western Electric Company.....Chicago
Olson, Jas. B., India Rubber and Gutta Percha Insulating Company .....New York City
Osborn, L. J., Fairbanks, Morse & Company....Chicago
Osburn, H. G., Osburn Flexible Conduit Company.....New York City
Osthoff, Otto E., Electric Storage Battery Company .....Chicago
Ott, William H., Chicago Edison Company.....Chicago
Packard, W. D., New York and Ohio Company.....Warren, Ohio
Page, A. D., General Electric Company..Harrison, N. J.
Palmer, F. S., Consolidated Engine Shop Company .....New York
Palmer, Phil H., Municipal Plant.....Bloomfield, Iowa
Parer, C. C., Chicago Edison Company.....Chicago
Park, F. C., National Carbon Company..Cleveland, O.
Parkinson, R. V., Illinois Maintenance Company.....Chicago
Parsons, Wean, Southwest Missouri Light Company .....Joplin, Mo.
Partridge, C. E., Chicago Edison Company.....Chicago
Patterson, H. C., Chicago Edison Company....Chicago
Pearl, W. H., National Conduit and Cable Company .....Chicago
Peck, Ed., Schenectady Railway Company.....Schenectady, N. Y.
Peck, John S., Westinghouse Electric and Manufacturing Company .....Pittsburg, Pa.
Peirce, J. A., Rossiter, MacGovern & Co.....New York
Perry, F. L., Western Electrician.....Chicago
Perry, James W., H. W. Johns-Manville Company.....New York City
Peterson, J. W., Electrical Equipment Company..Chicago
Phelps, J. Wiley, The Phelps Company....Detroit, Mich.
Phelps, W. E., The Phelps Company.....Detroit, Mich.
Phelps, W. J., The Phelps Company.....Detroit, Mich.
Phillips, C. E.....Chicago
Phillips, E. F., Peninsular Electric Light Company .....Detroit, Mich.
Phillips, F. D., Electric Appliance Company....Chicago
Philo, L. F., Western Electrical Supply Company.....St. Louis
Pierce, C. R.....Chicago
Pierce, F. M., Manhattan Electrical Supply Company .....Chicago
Pierce, Geo. M., Brodhead Electric Light Company .....Brodhead, Wis.
Pierce, W. H., Commonwealth Electric Company.....Chicago
Pietzcker, E. J., Standard Underground Cable..Chicago
Pilloce, Geo. W., Fulton Light, Heat and Power Company .....Syracuse, N. Y.
Pinckard, W. R., Westinghouse Electric and Manufacturing Company .....Chicago
Platt, S. C., Commonwealth Electric Company.....Chicago
Pomeroy, J. G., Adams-Bagnall Electric Company.....Chicago
Pond, Frank H., Chuse Engine and Manufacturing Company .....Chicago
Porter, Geo. F., Atlantic Ins. Wire and Cable Company .....New York
Porter, J. W., Porter & Berg.....Chicago
Porter, Louis I., Chicago Edison Company .....Chicago
Porter, Wm. M., Alphaduct Manufacturing Company .....Chicago
Porter, W. S., Eldora Electric Light Company.....Eldora, Ia.
Price, Chas. W., Electrical Review.....New York
Probasco, W. M., Westinghouse Companies.....Pittsburg, Pa.
Proutt, F. G., Memphis Consolidated Gas and Electric Company .....Memphis, Tenn.
Purdy, A. H., Edison Electric Illuminating Company .....Topeka, Kan.
Putnam, W. F., Red Wing Gas and Electric Company .....Red Wing, Minn.
Radford, J. A., Commonwealth Electric Company.....Chicago
Radtke, A. A., Chicago Edison Company.....Chicago
Rall, S. A., Electric Appliance Company.....Chicago
Ramey, H. B., Peerless Electric Company..Warren, Ohio
Ramsey, Chas. E., Carlisle Gas and Water Company .....Carlisle, Pa.
Randolph, M. B., Westinghouse Electric and Manufacturing Company.....Seattle, Wash.
Randolph, R. J., Bunny Company .....Milwaukee, Wis.
Rathbone, R. L., Westinghouse Electric and Manufacturing Company .....Detroit
Raven, F. W. .....Chicago
Rawson, Allen E., Westinghouse Electric and Manufacturing Company .....Seattle, Wash.
Raymond, Francis, General Incandescent Arc Light Company .....Chicago
Raymond, J. H., Fort Wayne Electric Works....Chicago
Redman, Geo. A., Rochester Gas and Electric Company .....Rochester, N. Y.
Remers, Fred W., People's Power Company..Moline, Ill.
Retallec, Charles, Light and Power Company.....Marquette, Mich.
Reynolds, Harry F., Marion Light and Heating Company .....Marion, Ind.
Rice, Arthur L., Engineer Publishing Company.....Cleveland, Ohio
Rice, Calvin W., Nernst Lamp Company..Pittsburg, Pa.
Rich, A. B. .....Chicago
Richardson, F. L., Chicago Edison Company....Chicago
Rider, Q. J., Jr., Western Electric Company....Chicago
Robbins, Walter, Western Electric Company....Chicago
Rockwell, Edwin R., Guarantee Electric Company .....Chicago
Rodman, Thomas H., Milwaukee Electric Company.....Chicago
Roe, Julian, Crocker-Wheeler Co.....Chicago
Roe, Richard, Citizens' Light and Power Company.....Joliet, Ill.
Rogers, S. C., Youngstown Consolidated Gas and Electric Company .....Youngstown, Ohio
Rogers, W. M., Standard Underground Cable Company .....Chicago
Rollins, J. H., Albion Power Company....Albion, N. Y.
Rollins, R. W., Hartford Electric Light Company.....Hartford, Conn.
Roper, D. W., Chicago Edison Company.....Chicago
Rosenthal, Geo. D., General Electric Company.....St. Louis
Ross, C. A. .....Chicago
Rummler, Eugene A. .....Chicago
Rushing, H. P., Chicago Edison Company.....Chicago
Russell, J. R., Wagner Electric Manufacturing Company .....St. Louis, Mo.
Ryan, Thos. J., Ft. Wayne Electric Works.....Ft. Wayne, Ind.
Ryan, W. D'A., General Electric Company.....Syracuse, Ind.
Ryder, B. H., American Steel and Wire Company.Chicago
Ryder, H. E., Marlboro Electric Company.....Marlboro, Mass.
Sack, R. E., Electrical World and Engineer.....Chicago
Sadler, J. M., Chicago Edison Company.....Chicago
Salisbury, B. E., Pass & Seymour.....Chicago
Sanderson, E., C. & C. Electric Company.....Chicago
Sawyer, L. P., Bryan-Marsh Company.....Chicago
Sayles, Geo. L., Sterling Electric Manufacturing Company .....Warren, Ohio
Schalck, F. R., Western Electrician.....Chicago
Schanlin, R. E., Westinghouse Electric and Manufacturing Company .....Chicago
Schayer, John J., Commonwealth Electric Company .....Chicago
Scheible, Albert, George Cutter Company .....Chicago
Scherck, Leon H., New Orleans Railway Company .....New Orleans, La.
Schildhauer, Edw., Chicago Edison Company....Chicago
Schinig, Edw. F., Beatrice Electric Company.....Beatrice, Neb.
Schmettge, Ralph, Chicago Edison Company..Chicago
Schroder, A. V., Springfield Electric Light and Power Company .....Springfield, Ill.
Schrum, A. J., Buckeye Electric Company.....Chicago
Schuchardt, R. F., Chicago Edison Company....Chicago
Schumuhan, E. E., Commonwealth Electric Company .....Chicago
Schupp, John X., General Electric Company....Chicago
Schwab, H., Monarch E. and Wire Company....Chicago
Schwartz, Carl, Chicago Edison Company.....Chicago
Schwertzer, E. O. .....Chicago
Scobey, M. L., Western Electric Company.....Chicago
Scott, Chas. F., Westinghouse Electric and Manufacturing Company .....Pittsburg
Scott, H. H., San Antonio Gas and Electric Company .....San Antonio, Texas
Scovil, Sam'l, Cleveland Electric Illuminating Company .....Cleveland
Scribner, J., General Electric Company.....Chicago
Searles, A. M., Warren Electric Manufacturing Company .....Chicago
Seminees, G. S., American Electric Works.....Chicago
Serva, A. A., Fort Wayne Electric Works.Ft. Wayne, Ind.
Seymour, E. K., Sprague Electric Company.....Chicago
Seymour, Herbert A., Chicago Edison Company..Chicago
Seymour, J. Alward, Meredith, Seymour & Co...Auburn, N. Y.
Shainwald, J. C., Standard Paint Company....Chicago
Sharpe, Wm., Ridgway Dynamo and Engineering Company .....Chicago
Shay, J. H., Chicago Belting Company.....Chicago
Sheldon, John D., Otis Elevator Company.Yonkers, N. Y.
Shockley, B. J., Albert Lea Light and Power Company .....Albert Lea, Minn.
Simons, V. D., Citizens' Electric Company.....Battle Creek, Mich.
Sims, W. F., Chicago Edison Company.....Chicago
Skeel, Frederick F., Crouse-Hinds Company....Chicago
Slingluff, Wm. H., John A. Roebling's Sons Company .....Chicago
Smith, Al., Keelyn & Smith .....Milwaukee, Wis.
Smith, F. Ellwood, Somerville Electric Light Company .....Somerville, Mass.
Smith, Frank S., Sawyer-Man Electric Company.....Allegheny, Pa.
Smith, Orin, Jr., Pawtucket Electric Company.....Pawtucket, R. I.
Smith, Q. J., New Lexington Electric and Power Company .....New Lexington, Ohio
Smith, W. F., General Electric Company.....Minneapolis, Minn.
Smith, Wm. M., Chicago Insulated Wire Company.....Chicago
Smythe, W. W., Jr., Western Electrician.....Chicago
Snyder, C. F., Bloomington and Normal Railway Electric and Heating Company.....Bloomington, Ill.
Soden, John K.....Chicago
Spaulding, Russell, Elblight Company of America.....New York
Spear, A. D., National Carbon Company..Cleveland, Ohio
Springer, Geo. B., Chicago Edison Company....Chicago
Squires, H. B., Western Electric Company.....Chicago
Stacey, Thomas I., Electric Appliance Company.Chicago
Stagg, F. L., Northern Electric Manufacturing Company .....Chicago
Startsman, Chas. W., Crocker-Wheeler Company.....Ampere, N. J.
Stephenson, D. J. .....Port Huron, Mich.
Stevens, E. H., United Electric Company.....Elizabeth, N. J.
Stewart, Norman, Westinghouse Electric and Manufacturing Company .....Chicago
Stiles, Aaron K., Streator Gas and Light Company .....Streator, Ill.
Stockton, W. L., Western Electric Company....Chicago
Storer, S. B., Westinghouse Electric and Manufacturing Company .....Syracuse, N. Y.
Stratton, G. M., General Electric Company.....Boston, Mass.
Strickland, J. F., Waxahachie Electric Light Company .....Waxahachie, Texas
Strohm, R. E., Chicago Edison Company.....Chicago
Sullivan, E. J., Beatrice Electric Company.....Beatrice, Neb.
Sunny, B. E., General Electric Company.....Chicago
Sweeter, W. G., American Push Button Telephone Company .....New York
Swenson, S. O., Chicago Edison Company.....Chicago
Switzer, Edgar J., Chicago Edison Company....Chicago
Switzer, F. B., National Conduit and Cable Company .....Muscatine, Iowa

Tanguay, J. E., Quebec Jacques Cartier Electric Company ..... Quebec, Canada
Taylor, Frank H., Westinghouse Electric & Manufacturing Company ..... Pittsburg, Pa.
Tenney, W. W., Simplex Electric Company.... Chicago
Terbeck, M. E., Chicago Edison Company..... Chicago
Thayer, A. Lester, The Browning Manufacturing Company ..... Chicago
Thomas, Maurice W., Michigan Electric Company. ..... Detroit, Mich.
Thomas, Milton, N. Y. Safety Steam Power Company ..... Chicago
Thompson, G. L., General Electric Company.. ..... Philadelphia
Thompson, J. Hurd, Manhattan Rubber Company. ..... Chicago
Thulin, J., Chicago Edison Company..... Chicago
Thurlby, A., Morriston File and Lock Company.. Chicago
Thurston, Ralph E., Commonwealth Electric Company ..... Chicago
Tibbe, A. A., Tibbe Electric Company.. Washington, Mo.
Tills, J. E., Chicago Edison Company ..... Chicago
Tobin, Arthur W., Electrical Equipment Company. ..... Chicago
Tracy, G. W., Martin Grate Company..... Chicago
Tratman, E. E. R., Engineering News..... Chicago
Tratt, W. J., W. E. Donley Electric Light and Power Company ..... Big Rapids, Mich.
Tregoning, Edgar, Attleboro Steam and Electric Company ..... Attleboro, Mass.
Tremaine, H. A., Crouse-Tremaine Carbon Company ..... Fostoria, Ohio
Tripp, Geo. B., Colorado Springs Electric Company ..... Colorado Springs
Tucker, A. L., Western Electric Company..... Chicago
Tulordock, Chas., Terre Haute Electric Company. Chicago
Turlay, T. C., Chicago Insulated Wire Company. ..... Chicago
Turner, J. W., Des Moines Edison Light Company ..... Des Moines, Iowa
Turner, M. E., Cleveland Electric Illuminating Co. ..... Cleveland, Ohio
Tyler, F. E. ..... Junction City, Kan.
Upham, W. P., Electric Appliance Company.... Chicago
Utley, P. L., Watertown Electric Company.... ..... Watertown, Wis.
Vallette, Chas. A., Edwardsville Electric Light and Power Company ..... Edwardsville, Ill.
Van Meter, A. L., Tolono Light and Power Plant. ..... Tolono, Ill.
Vaughen, F. G., General Electric Company..... ..... Schenectady, N. Y.
Vaughan, J. A., Carleton Chase Electric Company. ..... New York
Wagner, Edward A., Ft. Wayne Electrical Works. ..... Ft. Wayne, Ind.
Wagoner, P. D., General Electric Company..... ..... Schenectady, N. Y.
Waite, R. W., United Gas and Electric Company. ..... New Albany, Ind.
Wakefield, C. L., Dallas Ice Factory, Light and Power Company ..... Dallas, Texas
Wakefield, R. S., Western Electric Supply Company ..... St. Louis, Mo.
Wakeman, C. J., Hoopeston Electric Light and Heating Company ..... Hoopeston, Ill.
Wakeman, J. M., Electrical World and Engineer.. ..... New York
Walden, A. E., Freeport Railroad, Light and Power Company ..... Freeport, Ill.
Walbank, W. Whea, Lachine Rapids Hydraulic and Land Co., Limited ..... Montreal, Canada
Walker, M. S., The F. Bissell Company.... Toledo, O.
Wallace, R. S., Peoria Gas and Electric Company.. Peoria
Wallachs, H. L. ..... Fond du Lac, Wis.
Walsh, I. J., Chicago Edison Company ..... Chicago
Ward, A. V., National Carbon Company..... Chicago
Warder, W. J., Jr. ..... Chicago
Warner, Charles C., Wagner Electric Company.. Chicago
Waters, W. L., National Electric Company.... Milwaukee
Watson, R. H., Gregory Electric Company..... Chicago
Weberling, Thos., Municipal Plant..... Peru, Ill.
Weidgmant, J. B., Chicago Edison Company.... Chicago
Weis, Aug., Johnstown Light, Heat and Power Company ..... Johnstown, Pa.
Welch, James A., Pawtucket Electric Co..... ..... Pawtucket, R. I.
Welkins, C. W., National Carbon Company..... ..... Cleveland, Ohio
Wells, Chas. J., Fostoria Incandescent Lamp Company ..... Fostoria, Ohio
Wells, Wm. A., Commonwealth Electric Company. ..... Chicago
Whipple, F. G., Crocker-Wheeler Company..... Chicago
Whipple, T. H. Bailey, Sawyer-Man Electric Company ..... New York
White, J. G., J. G. White & Co..... New York
White, W. F. ..... New York
Whitfield, S. L., General Electric Company..... Chicago
Whiteside, W. H., Westinghouse Electric and Manufacturing Company ..... Pittsburg
Whitney, C. W., Electrical World and Engineer. ..... San Francisco
Whyte, Geo., McComber-Whyte Rope Company... Chicago
Wiley, J. R., Standard Underground Cable Company. ..... Chicago
Willard, E. R., Standard Paint Company..... Chicago
Willcox, F. W. ..... Harrison, N. J.
Williams, C. H., Madison Gas and Electric Company ..... Madison, Wis.
Williams, Paul F., Chicago Edison Company... Chicago
Wilmerding, C. H., Chicago Sectional Electric Underground Company ..... Chicago
Wilson, J. H., Mobile Light and Railroad Company ..... Mobile, Ala.
Wilson, T., Chicago Edison Company ..... Chicago
Winn, J. E., Cincinnati Gas and Electric Company ..... Cincinnati, Ohio
Wirt, H. C., General Electric Company..... ..... Schenectady, N. Y.
Wixson, C. S., Rhinelander Lighting Company.. ..... Rhinelander, Wis.
Wolff, James, New York Insulated Wire Company ..... Chicago
Wood, Elmer E., American Electrician..... New York
Woodward, E. E., Woodward Governor Company. ..... Rockford, Ill.
Woodworth, Philip B., Lewis Institute..... Chicago
Worthington, A. M., Louisville Lighting Company ..... Louisville, Ky.
Wright, W. E., Lake Cities Electric Railway Company ..... Michigan City, Ind.
Wyant, Robert E., Derby Gas Company.... Derby, Conn.
Wyckoff, A. D., Ball & Wood Company..... New York
Yawger, Edwin, Westinghouse, Church, Kerr & Co. ..... Pittsburg
Yost, J. Harry, Yost Electric Manufacturing Company ..... Toledo, O.
Young, J. Charles, American District Steam Company ..... Chicago
Ziegler, C. F., Reynolds Electric Flasher Manufacturing Company ..... Chicago

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The directors of the Cincinnati Gas and Electric Company have chosen the following-named officers: President, Andrew Hickenlooper; vice-president, Norman G. Kenan; treasurer and assistant secretary, Henry A. Barnhorn; secretary and assistant treasurer, H. W. Sage; auditor, H. R. Hooper.

Advantages to Be Derived from Consolidation of Electrical Interests.[1]

By Sidney Hosmer.

The advantages to be derived from any form of consolidation of manufacturing interests are properly divisible into three classes: (1) The advantage of the lower capital investment, (2) lower cost of production, and (3) better service. To these should be added, in the case of the transmission of electrical energy, the advantage to be derived from an improved load factor, which is almost certain to result from a combination of different classes of business. This improvement of load factor, of course, affects the matter of capital invested and also cost of production, but it is an advantage which applies to electrical consolidations, in addition to those which may apply to any other forms of consolidation.

In all cases where such consolidations have been effected, still another point has been gained, though it is not one due to the mere combination. That is, the small plants have, in most every case, been old and equipped with inefficient apparatus, while the consolidated plant has been of the most modern type and built under such conditions that the best engineering talent was available.

In the matter of invested capital, actual figures are hard to obtain. Taking the generating plant itself, we know that plants of 15,000 to 20,000-kilowatt capacity can be built for $90 a kilowatt, while plants of approximately 500 kilowatt run as high as $200, or over, due, of course, to the smaller units employed. Going above 20,000-kilowatt capacity, the comparison would not continue to show such marked gain. In this station we have reached units of a size where cost per kilowatt ceases to fall very rapidly, and where great structural complications and expense may begin, due to the fact that boiler units are not increasing in size.

Taking the distributing system in the case now being considered, there would probably be a slight loss, as we have obtained the load for the larger plant only by including greater territory, and this must inevitably increase the cost per kilowatt capacity.

A number of companies operating in a number of centers would have their lines installed in proportion to their business, and only small capacities running out to the edges of their territories. The lines between these various centers would have to be strengthened without a proportionate increase of business and a certain amount of waste territory covered. Here we find the question on which turns the decision whether the larger company shall have one or more plants.

It is the almost universal practice to-day to run everything from one station, using sub-stations for the transformation necessary for the supply of local districts; this may be proper as far as it has gone, but a point will be reached where the cost of lines and sub-stations, with the liability to interruption in each, will not only justify, but demand, a number of generating stations located with reference to the demand for current. The question of when this will be justified will depend entirely on coal and water facilities.

This matter of distribution of plants only comes in, of course, where area supplied is very large, and where transforming apparatus becomes very expensive. We know of only one case where this policy has been carried out consistently. That company, operating an electric railway, has located stations all over its territory, a majority of them under 5,000-kilowatt capacity, and a number of them without railroad facilities for coal. In the matter of size of plants, this is without doubt an extreme, but we should like very much to see their exact figures on investment, and also their cost of production.

We come here, also, to the question of safety and reliability. There is a limit to the amount of power it is desirable to put in one building. It has been demonstrated a number of times in our large stations that accidents can happen which will interrupt the entire plant. What this amount should be depends largely on the character of service supplied. On the one hand, it should be as small as possible, so that any accident may affect as small a percentage of supply as possible; on the other hand, it must be large enough so that any possible demand for current can be met without difficulty. A plant supplying feeders of normal capacity of 700 or 800 kilowatts could be divided into units of 10,000 or 15,000 kilowatts, without sacrificing any of the advantages of ample generating capacity, while a plant supplying feeders of 2,000 kilowatts, would have to be made in larger sections to give equal service.

In most cases it will be impossible to find a number of locations having good coaling and water facilities, so that a subdivided plant at one point may be preferable, but, of course, aside from coal and ash-handling machinery, there is no argument from the investment standpoint to justify putting all the plant at one place, while, on the other hand, distribution investment might be very much reduced by a number of generating stations at different points, provided always, of course, coal and water can be obtained. The Boston Edison Company is now erecting a plant for an ultimate capacity of 50,000 or 60,000 kilowatts. The situation there with reference to coaling and the shape of territory supplied is such that there is no choice but to locate the entire plant at one place. It is, however, the intention absolutely to divide that plant into at least three divisions, even to cutting the bus-bars for the separate divisions. Of course, arrangements will be made for connecting the bus-bars that they may be all supplied from one section at period of light load.

Turning now to the question of lower cost of production, we find in station cost alone a very marked gain, amounting to a difference of 500 or 600 per cent. between a plant of 500 kilowatts and one of 20,000. It is, of course, unnecessary to go into any discussion of how this is made up.

In this respect, improvement should be found in consolidation, continuing almost in the same ratio, no matter how large the plant may become. A subdivided plant may cost a little more to operate than one not subdivided, but the difference will scarcely be appreciable. This would be almost as true for a number of generating stations, if they were properly interconnected.

In the distribution of the consolidated company there might be some small gain in expense, but it could not be a very marked one. This expense is a function of the number of subscribers and miles of wire. In the consolidation the miles of wire would certainly be increased for the same customers, with consequent increase of expense of maintenance. If anything were gained here, it would probably be at the cost of increased investment; that is, the larger company would install distribution plant perhaps better and in a more lasting way, but at greater cost. In general expense and management, we could hardly expect much improvement, owing largely to the fact that responsibilities are largely increased and more complicated legal questions are brought in. Taxes would, of course, be decreased in such measure as we have saved investment.

In the purchase of supplies and apparatus, there should, of course, be a great improvement possible; but this would be somewhat counteracted by the fact that the larger company would require a much greater number of articles to be carried on hand and a considerable investment must necessarily lie idle.

Turning now to the quality of service, we find the small company almost invariably running without spare apparatus, and the service is liable to suffer if anything goes wrong. This is probably partly due to the fact that it is a greater burden for the small company to buy extra apparatus, but it is probably in a greater measure due to the character of management under which it is run. The management of the larger company has a greater appreciation of its responsibilities and realizes more thoroughly that development depends on reliability of service. This defect goes with the smaller company, because it is smaller and the margin of profit is less, and less can be put into management, etc., and not, as may be argued, because the company is old-fashioned and poorly handled.

Another defect which we find in most of the small companies, and which is not due to the mere fact that they are small, in the absence of modern methods and devices, owing to the fact that the plant usually is old, and capital is not always available to take advantage of the newest developments.

The question of 24-hour service also comes in. In a 500-kilowatt plant it costs as much to run one unit as it does the whole station in all except coal, as there are at most only two or three men to a watch, consequently, the long hours at very light load are an impossible burden. On the other hand, the cost in a large station, varies in all things approximately with the number of units in use, and kilowatts produced at light-load times bear same relation in cost to those produced on the peak. The difference in load factor between a small and large company comes in here also. A company supplying a great territory includes a number of different classes of business—residences, amusements, factories, and possibly street railways—so that the cost per kilowatt may be just as good at one part of the day as another.

Also, one company taking the place of several does not necessarily get the sums of the peaks of the different stations, as these may not coincide.

1. Paper read before the National Electric Light Association at Chicago on May 26, 1903. The author is connected with the Edison Electric Illuminating Company of Boston.

Cleveland Street Railways Consolidate.

It appears that the long-talked-of consolidation of the street-railway interests of Cleveland is about to be accomplished. At a meeting last week of the directors of the Cleveland Electric Railway Company and the Cleveland City Railway Company a plan was agreed upon. After ratification by the stockholders, some time after July 1st, this plan will be put into operation. The capital stock of the Cleveland Electric Railway Company is $13,000,000, with outstanding bonds amounting to $4,350,000, and some floating indebtedness. The capital stock of the Cleveland City company is $8,000,000, with a trifle over $2,000,000 in outstanding bonds and some floating indebtedness. A new company is to be formed in which the stockholders of the City company shall receive share for share for their stock, while those of the Cleveland Electric shall receive 1 3-10 shares for each share of their old stock.

The Cleveland Electric company has 136 miles of track while the City company has 84 miles. Horace

E. Andrews, president of the Cleveland Electric company will probably be president of the new company. John J. Stanley will be general manager, it is said. The board of directors will be made up of the directors of the two existing companies. Senator M. A. Hanna will undoubtedly be chairman of the board.

Western Union Poles Cut Down in Pennsylvania.

As a result of a decision handed down by the United States Circuit Court of Appeals sitting at Philadelphia, Pa., last week, holding that the Pennsylvania Railroad had a legal right to remove the Western Union Telegraph Company's poles and wires from the railroad's right-of-way, the Pennsylvania company sent out large forces of workmen, who cut down the poles of the telegraph company over the entire right-of-way from Pittsburg to the Atlantic coast. The territory covers about 1,000 miles, and it is said that 40,000 poles and 14,000 miles of wire were destroyed, entailing, at a conservative estimate, a loss to the Western Union company of about $1,000,000. In addition, the telegraph company will be asked to reimburse the railroad company for the expense of chopping down the poles and tearing away the wires.

The fight between the Pennsylvania Railroad and the Western Union Telegraph Company began last summer and is said to be the outcome of an announcement made by George J. Gould of his plan to secure an eastern port terminal for his Wabash Railway system. President Cassatt of the Pennsylvania road, it was said, opened the fight against the Western Union in order to bring Mr. Gould to terms and force him into giving up the project of making the Wabash a competitor of the Pennsylvania Railroad in the East. Periodically thereafter there were rumors that Mr. Cassatt and Mr. Gould had settled their differences and that the fight against the Western Union would cease, but these were promptly denied, and the matter went to the courts.

Ex-Judge John F. Dillon, counsel for the Western Union, states that the case will be taken to the United States Supreme Court. He declared that the action of the railroad company in tearing down the lines when it knew that an appeal to the United States Supreme Court was pending, was arbitrary, without precedent and contrary to the principles of law. Damage suits against the railroad will be instituted, should the Supreme Court decide in favor of the Western Union.

Eastern officials of the telegraph company are quoted as saying that reports of their crippled condition are greatly exaggerated and that business is going along without interruption, a large share of it being handled in a roundabout way along the Baltimore and Ohio and New York Central roads. The telephone, it is said, is also being brought into use in many places.

American Institute of Electrical Engineers.

In addition to the brief telegraphic account of the annual meeting of the American Institute of Electrical Engineers published in the Western Electrician of last week, the following facts, brought out at the meeting, are of interest:

The report of the board of directors for the year ended April 30th shows that during the year local branches have been organized at the following places: Allegheny, Pa. (Western University of Pennsylvania); Ames, Iowa (Iowa State College); Bethlehem, Pa. (Lehigh University); Boston, Mass. (Massachusetts Institute of Technology and local members); Cincinnati, Ohio; Columbia, Mo. (University of Missouri); Columbus, Ohio (Ohio State University); Denver, Colo.; Ithaca, N. Y. (Cornell University); Lafayette, Ind. (Purdue University); Madison, Wis. (University of Wisconsin); Philadelphia, Pa.; Pittsburg, Pa.; Schenectady, N. Y. (Union University and local members); St. Louis, Mo.; State College, Pa. (Pennsylvania State College); Urbana, Ill. (University of Illinois); Washington, D. C. (Columbian University and local members). The local organizations in Chicago and in Minneapolis, the latter in connection with the University of Minnesota, which have been in existence for some time, have taken on renewed activity during the present year.

The membership on April 30, 1903, was classified as follows: Honorary, two; members, 417; associates, 1,810; total, 2,229. The gain in membership during the year was 680, or 44 per cent. The total assets of the Institute are $40,599.69, of which $16,285 is represented by United States bonds. The surplus is $19,311.48. The receipts of the year were $30,181.25, of which all but $621.58 was expended.

In relation to the "union engineering building" project, President Scott reported that the resolutions recommended at the joint conference, and printed on page 409 of the last issue of the Western Electrician, had been adopted by the board of directors of the American Institute of Electrical Engineers. As the permanent committee to represent the Institute, President Charles F. Scott of Pittsburg, President-elect Bion J. Arnold of Chicago and Dr. S. S. Wheeler of Ampere, N. J., were appointed. This action was formally indorsed by the Institute as a society.

Chicago Street-railway Situation.

Now that the Mueller municipal-ownership bill has become a law, the local-transportation committee of the Chicago City Council has again resumed its labors. The most important matter to be considered by the committee is the possible waiver by the street-railway companies of their claims under the 99-year act. President D. G. Hamilton of the Chicago City Railway Company, in a letter addressed to Chairman Bennett of the local-transportation committee, intimates that the company is willing to waive the 99-year claims if reasonable rights are granted the company in the proposed ordinance. A sub-committee of the local-transportation committee plans to meet with Corporation Counsel Walker and other counsel for the city and frame a statement as to what the city will demand of the street-railway companies in return for a renewal of the expiring ordinances. The committee will then report to the main committee, and its decision will form the basis for the ordinance to be recommended to the council.

The officers and receivers of the Chicago Union Traction Company have been in New York, where plans for future action were formulated. It is asserted that this company is trying to delay matters, apparently for the purpose of awaiting a ruling from Judge Grosscup as to the value of its claims under the 99-year act. Efforts are said to have been made by the Union Traction Company to dissuade the Chicago City company from sending the Hamilton letter in which it urged the city to immediate action for the settlement of the traction question.

Mayor Harrison presented his annual message to the council on May 25th. It contained a very exhaustive statement of his views and recommendations on the traction question. The principal provisions upon which the mayor insists are as follows:

1. The traction companies must give an express and unequivocal waiver of the rights claimed under the 99-year act, as an absolute prerequisite to an extension of franchise grants. No compromise, in any form whatsoever, he asserts, shall be entertained on this point. For the council, as the companies request, to allow a value on these claims in any way would, the mayor contends, make the members of that body "copartners in this vicious and iniquitous heritage" of the state Legislature of 1865, which passed the act over the veto of the late Governor Oglesby. The act is held to be illegal and without effect.

2. Provision in any extension ordinance for an early public ownership and an actual municipal operation of these traction utilities.

3. Submission of any ordinance, before final enactment, to approval or rejection by the people under the "public opinion act," which allows a referendum on petition of 25 per cent of the voters.

Other provisions which the mayor considers essential to franchise extension are: An improvement of accommodations which will do away with the present uncomfortable and unwholesome overcrowding of cars; the simultaneous expiration of all franchises on or before 20 years after the date of grant and the express prohibition of the transfer of a franchise to a foreign corporation; the use of the underground trolley within a certain district, bounded by North Avenue, Twenty-second Street, and Western Avenue; the realignment of terminals, that transportation may be rapid and street congestion as far as possible avoided; a universal system of transfers and full publicity of accounts.

The representatives of the Union Traction Company have held a number of conferences at which the mayor's message was discussed, but no action has been taken except that it was agreed not to go before the council sub-committee when it meets to take up the Chicago City company's affairs.

Association of Railway Telegraph Superintendents.

The twenty-second annual meeting of the Association of Railway Telegraph Superintendents was held in New Orleans on May 13th to 16th. The sessions were held at the St. Charles Hotel and were presided over by President J. H. Jacoby. Many new names were added to the list of members. Reports of committees showed the affairs of the association to be in a prosperous condition. Indianapolis was selected as the place for the next meeting and the date was set at the third Wednesday in June, 1904. Following is a list of the officers elected for the ensuing year: President C. S. Rhoads, Indianapolis, Ind.; vice-president, C. P. Adams, Chicago; secretary and treasurer, P. W. Drew, Milwaukee, Wis.

The following papers were presented at the second day's session: "New Ideas in Block Signaling," William Maver, Jr.; "A New Type of Telegraph Switchboard," W. W. Ryder; "The Application of Combined Telephone and Telegraph Apparatus to Railway Service," A. T. Ferguson. C. F. Annett presented reports from officials of the Illinois Central Railroad referring to the advantages gained in the various departments of railroading by the use of the telephone. He stated that information is gained in two or three minutes which could not be obtained without the expenditure of two or three days without the telephone. The discussion aroused by the several papers was spirited and brought out many interesting points.

The members of the association were entertained at theater parties, excursions, etc., during the period of the convention. Among those present were E. W. Vogel, Railway Supply Company, Chicago; C. E. Brown, Central Electric Company, Chicago; W. S. Logue, Edison Manufacturing Company, New York; Avery P. Eckert, Safety Insulated Wire and Cable Company, New York; P. W. Miller, A. T. Ferguson and others, American Telephone and Telegraph Company; W. H. Adkins, Southern Bell Telephone and Telegraph Company, Atlanta, Ga.; Albert G. Francis, Chicago Telephone Company, Chicago.

Mr. Edison the Honorary Electrician of the World's Fair.

President Francis of the St. Louis Exposition has received the following autograph letter from Thomas A. Edison accepting the appointment of honorary chief consulting electrician of the exposition:

ORANGE, N. J., May 18, 1903.

David R. Francis, President St. Louis Exposition.

DEAR SIR: I beg to acknowledge receipt of your favor of April 22d, informing me of the great honor done me in appointing me honorary chief consulting electrician of the Universal Exposition, commemorating the acquisition of the Louisiana Territory.

In thanking you for this honor, and accepting it, I cannot but note with pleasure your reference to the fact that the exposition year falls on the twenty-fifth anniversary of my perfection and introduction of the incandescent lamp. This recognition of work in the field of electrical invention is very gratifying to me, especially as it comes in association with your magnificent demonstration to the world of what has been done in all branches of industry in the states comprised within the original territory—a region where, as a young telegrapher, I spent many arduous years before moving East.

Permit me to commend your judgment in allotting at the exposition a fine large building exclusively for electricity, and to express the fervent hope that it will be filled to overflowing with the latest examples of apparatus for light, heat and power and the communication of intelligence.

It will not only be my duty to take part in exhibiting such of my newer inventions as your colleagues may deem worthy of acceptance, but I hope to see from abroad, in rivalry with American advances, the results due to European leaders in the art to which I have given my life, because of my belief in it as one of the noblest agencies ever rendered available for human welfare and benefit.

With the best wishes for the brilliant success of the exposition and pledging my own assistance as it may be required, I have the honor to remain, Mr. President,

Very truly yours,

THOMAS A. EDISON.

WORLD'S FAIR NOTES.

Among the visitors to the Department of Electricity last week were Mr. A. L. Tucker of the Western Electric Company, and Mr. A. G. Fuller of the American Telephone and Telegraph Company.

Professor W. E. Goldsborough, chief of the Department of Electricity, attended the National Electric Light convention in Chicago. While in the city he secured several applications for exhibit space.

Thomas Moore, chief of the Department of Machinery, has returned from a brief trip to New York. Lieutenant Carden will remain in the East for some time, in the interests of the Machinery Department.

The three 80-kilowatt Westinghouse exciters for the big generating station of the exposition are being installed. The foundations for the 2,000-kilowatt generators are nearly complete, and the west end of Machinery Hall will soon be assuming the aspect of a central station.

A cablegram received last week from one of the largest electrical manufacturing concerns of Europe stated that they would exhibit in the Electricity Building on a large scale. Several of the most prominent European instrument makers have signified their intention to send a full line of their apparatus.

So many varied reports regarding the accommodations for visitors during the dedication period have been circulated that the following extract of a letter from Mr. Frank H. Taylor of the Westinghouse company is of interest: "I spent three days in St. Louis in connection with the dedication of the exposition, and I cannot forego the pleasure of congratulating you personally upon the conduct of the whole matter. You seem to have the entire country back of you."

Electric Railway to Connect Battle Creek and Lansing, Mich.

The Michigan Central Traction Company will build an electric line between Battle Creek and Lansing. This is an entirely new deal, and has no connection with other projected lines running into Lansing from the western part of the state. The road will take in Lansing, Grand Ledge, Charlotte, Bellevue, Olivet and Battle Creek, and will be 57 miles in length. The grades are all easy, except the bridging of the Thornapple River, where a 1,000-foot trestle will be required. The roadbed will be well ballasted and 75-pound rails will be used. It is expected that the construction will be well under way by August 1st. The capital stock of the company is $1,300,000 and is all held by S. W. McCall of Boston, who was in Detroit last week making the necessary arrangements for the organization of the company. The road will be double-tracked all the way and it is expected to make the 57 miles in one hour and 40 minutes. The contract for the construction was let to M. W. Burwell of New Haven, Conn. The officers and directors of the company who attended the directors' meeting were S. Bugart, Cleveland, president; J. W. Ewing, Grand Ledge, treasurer; F. H. Goadley, New York; J. Steeudge, Grand Ledge, and E. T. Pangborn, Battle Creek, directors.

The Keokuk and Western Illinois Electric Company has been incorporated with principal office in Chicago. The company proposes to build electric lines from Hamilton, Ill., to Keokuk, Iowa, and from Hamilton to Warsaw, Ill. Fred P. Vose of Evanston, Ill., and George E. Johnson of Chicago are among the incorporators.

DEVELOPMENT OF THE TELEPHONE FIELD.

Indiana Telephone Items.

The City Council of Crawfordsville has granted the Crawfordsville Co-operative Telephone Company a franchise to run two lines of poles and wires in the city. The franchise contains some rigid provisions and is most favorable to the city. The charges for residence telephones shall not be more than $6, and business telephones not more than $13 a year.

The Central Union Long-distance and the New Long-distance Telephone Companies suffered considerable damage from severe storms near Lebanon. The principal trouble was in trees being blown down upon their wires. Local companies in Madison County also suffered considerable damage.

The Indiana Appellate Court has rendered a decision of importance to telephone companies concerning taxation. The court held that where the State Board of Tax Commissioners assessed the property of a telephone company on returns of its property made by its secretary for a series of years, and it was assessed locally for property of a local nature, such as office furniture, and paid all such taxes, the county assessor and county auditor had authority, after notice to the company, to add to its assessment the value of tangible property owned by it in such years, but not returned to the state board, nor taken into account by it in making its assessment, although such property, consisting of telephone instruments, switchboards, etc., may not have been primarily assessable by the local authorities. But said local officers had no power to assess the "local franchise" of the company nor any of its capital stock for back taxes, merely because they were not properly listed or fully assessed in the schedules returned from year to year to the state board. That the state board has no jurisdiction to add "omitted property" of former years to its current assessment and charge the same with back taxes, but that power belongs to the local authorities.

The following telephone companies were incorporated during the week. The name and address of the company, capital stock, territory served and one official given: The Jefferson Telephone Company, $10,000; Jefferson, Scott, Clark, Jennings, Ripley and Switzerland Counties and the towns therein; William A. Kirk, Madison. The Ward Telephone Company, $1,400; exchange and home office in the residence of J. M. Newhouse; Hancock County; J. M. Newhouse, Greenfield. The Posey County Telephone Company, $50,000; Posey and Vanderburg Counties; Allen Gray, Mount Vernon. F.

Telephone News from the Northwest.

The West Duluth exchange of the Zenith Telephone Company is being fitted with a modern switchboard of 140 connections. The wires are being buried for a block from the central office to avoid fires and lessen the roaring caused by the wind.

The Northwestern Telephone Exchange Company will rebuild its St. Cloud, Minn., exchange, on a central-energy basis, with a modern system throughout.

The Mabel (Minn.) Telephone Company has been organized.

Pease Brothers of Richland Center, Wis., have sold a controlling interest in the Union Telephone Company to the Independent Consolidated Telephone Company of Milwaukee.

The Stevens Point (Wis.) Mutual Telephone Company has been formed to install a local exchange for Stevens Point.

E. F. Atwood has leased the local telephone system at Hallock, Minn., for five years and will improve it.

Notice is given that the Bagley (Minn.) Telephone Company has gone out of business.

The Spalding Hotel at Duluth will install a complete interior telephone exchange connecting every room in the building.

The Chicago, Milwaukee and St. Paul Railway Company is experimenting with telephones connected with telegraph wires between Marion and Perry, Iowa, 137 miles apart. Experiments have been made successfully and demonstrate that the idea is practicable.

The Cambridge (Iowa) Independent Telephone Company is constructing a toll line south to Elkhart.

The People's Telephone Company of Sigourney, Iowa, has been sold by Mrs. Dobie to C. F. Singmaster of Keota and Mr. Du Poise of Washington, Iowa, for $13,000.

The Mutual Telephone Company of Des Moines has asked the City Council to repeal its franchise, as the company finds that the rigid provisions of that document hinder it from borrowing funds. The company is behind on taxes, owing about $5,000 for the past three years, but points out that the Bell company's taxes for the same length of time has been about $500. R.

Ohio Telephone Notes.

The Stark County Telephone Company of Canton will spend a large amount of money this summer on the improvement, both of its city system and the country lines. It is stated that at least $80,000 will be used toward the improvements and extensions of the city lines alone, and the country lines will be extended to Middlebranch, Congress Lake, Hartville, New Baltimore, Uniontown, Greentown, Waynesburg and Magnolia and other places. The company will have complete connections with the United States company for long-distance service at several different points.

The Mount Ephraim Telephone Company of Mount Ephraim, Noble County, has been incorporated with a capital stock of $300.

Ed. L. Barber of Wauseon and James A. Bariley, his associate, have been in Huntington, W. Va., within the last few days, and it is reported that they were negotiating for a combination of the Independent interests of West Virginia, southern Ohio and northern Kentucky, but the opinion is advanced that the companies in the Ohio River towns are not favorable to such an arrangement.

The courts at Cleveland, in a case in which the Cuyahoga Telephone Company secured an injunction against a man to prevent him from raising the company's wires so that he could move a house under them, dissolved the injunction and rendered a decision that the company had no right to obstruct the streets so that such moving could not be done. The decision goes so far as to enable the man to cut the wires, if he cannot raise them high enough.

The Dunkirk telephone exchange of Dunkirk was badly damaged by a big fire, which consumed a good portion of the business section of that town, a few days ago. O. M. C.

Southern Telephone Developments.

The Sumter (S. C.) Telephone Company, operating a local exchange and country lines, has been reorganized with $10,000 capital. The system is valued at $24,000 and is being reconstructed. S. C. Baker was recently elected president.

The Southern Bell Telephone Company has just moved into its new exchange at Wilmington, N. C. The wires in the business section have recently been placed underground.

The Ellenboro Telephone Company of Ellenboro, N. C., has been chartered by the secretary of state.

The St. Georges (S. C.) Telephone Company, M. S. Cannon, president, has been chartered with a capital of $5,000.

The Hamilton Telephone and Power Company has applied for a charter to operate at Chattanooga, Tenn., in opposition to the Cumberland Telephone Company, and will also probably place an electric-light plant in operation. The company has strong financial backing.

The Home Telephone Company of Clarksville, Tenn., is building a number of out-of-town connections, to Guthrie and other points.

Warner Tubular-drop Patent Defeated.

Recently the Western Electric Company brought suit against the North Electric Company of Cleveland, alleging infringement of United States patent No. 477,616, issued June 21, 1892, covering the Warner tubular drop used in telephone work. The case was heard in the United States Circuit Court for the Northern District of Ohio, before Judge Wing, and on May 26th was decided in favor of the North Company (represented by A. L. Lawrence as attorney) and against the patent. None of the complainant's contentions was sustained. In view of the prior art the court declared lack of novelty in the patent.

NEW COMPANIES.

The Tri-county Mutual Telephone Company has been incorporated with headquarters at Creston, Ill. The capital stock is $2,500. Martin Kennedy is one of the directors.

Frank K. Ludlow has been granted a franchise to construct a telephone line in the country outside of Newport, Ky. His application for a franchise in that city is still pending.

The Crittenden County Telephone and Telegraph Company has been incorporated with a capital of $2,000. The headquarters will be at Crawfordsville, Neb. W. Z. Bunn, C. L. Campbell and Hugh Chambers are the incorporators.

The Home Telephone Company, with headquarters at Camargo, Ill., has been incorporated with a capital of $4,600. The company will operate in Douglas County. The incorporators are Eugene Rice, G. C. Jeffers and G. C. Wiseman.

A charter has been granted the American Telephone and Telegraph Company of Atlanta, Ga., with a capital stock of $25,000. E. J. Hall of Morristown, N. J., W. E. Holcomb of New York, A. Ward Cobb of Atlanta, and others are interested. Work will begin at once constructing lines through the state.

The Tri-State Telephone and Telegraph Company, organized at Augusta, Maine, has field its certificate of organization with the Maine secretary of state. Its capital is $6,000,000; nothing paid in. F. L. Dutton is president, E. F. Whittum is treasurer and E. H. Moulton of Minneapolis and L. L. C. Brooks and F. C. Nelson of St. Paul are directors.

Plans of the Federal Telephone Company of Cleveland.

A meeting of the stockholders of the Federal Telephone Company of Cleveland will be held at East Orange, N. J., on June 1st, to vote upon plans for refinancing the company. The proposition contemplates the reduction of the capital stock from $10,000,000 to $1,000,000 simply by reducing the value of the shares from $100 to $10, and the issue of $500,000 of first-mortgage trust bonds. The holders of stock will be asked to accept these bonds pro rata at a certain price, in order to secure money for a working capital. The Everett-Moore syndicate is the largest holder of stock, and has signified its willingness to this arrangement. Large creditors have agreed to an extension of time to five years, and will take collateral bonds of a second series as security for their claims. The reduction of capital stock will reduce the tax expenses in New Jersey something over $4,000 per year, and since there has been no stock sold as high as $10, there will be no loss to anyone. The plan will also save the small holders of stock from any loss, a plan which has been followed all through the reorganization of the Everett-Moore companies. They will be asked to take whatever of the bonds they can with the larger holders, in order to make the plan a success.

Cuyahoga Company Reduces Capital Stock.

The stockholders of the Cuyahoga Telephone Company, one of the Everett-Moore syndicate properties, at a meeting in Cleveland, Ohio, last week, voted to reduce the capital stock from $3,000,000 to $1,500,000. It was also decided to issue $1,500,000 six per cent. cumulative preferred stock, and with the proceeds make many extensions and improvements in the service. Under the management of President Dickson all but $1,971.66 of the deficit of $29,684.70 carried over at the beginning of the year has been made up. It is believed the report for June 1st will show a surplus instead. The ratio of expenses has been reduced from 51.06 to 46.07, and during the first four months of this year $12,472.55 of the earnings was expended for new work in the way of extensions.

The stockholders seemed to be very well pleased with the progress, condition and future plans of the company. Everything looks favorable for putting the Cuyahoga company on a successful operating and financial basis. Over 90 per cent. of the stock was represented at the meeting and more than 80 per cent. of the stockholders were present.

Independent Telephone Company for Canada.

A Canadian correspondent of the Western Electrician, writing from Ottawa, says that a powerful rival to the Bell Telephone Company in Canada is now in process of formation. An application is before the Canadian Parliament, on behalf of a number of American capitalists, principally residents of Philadelphia, for a charter for a telephone company with rights throughout the Dominion of Canada. The capital of this company is to be $30,000,000. The capitalists interested in this new company seeking to obtain a charter are also negotiating to purchase, or have already bought out, the Merchants' Telephone Company of Montreal, which company is only authorized to operate in the province of Quebec, and most of the capital stock of which is now controlled by American capitalists. As soon as the Dominion government grants the charter to the company first referred to, it is understood that it will absorb the Merchants' company.

New Independent Telephone Connections in Pennsylvania.

Officers and stockholders of the Pittsburg and Allegheny Telephone Company and the Johnstown (Pa.) Telephone Company have formed the Pittsburg and Johnstown Telephone Company for the purpose of completing the trunk line from Philadelphia between the two cities named. Independent companies in Maryland, Pennsylvania and West Virginia have agreed to an interchange of business with the new company, and it will connect Pittsburg in this way with 112 exchanges and more than 20,000 subscribers. S. H. Browne of the Pittsburg and Allegheny, and E. D. Schade of the Johnstown company, are at the head of the movement. The capacity of the company will be doubled in Allegheny County and more than a million dollars will be spent in improvements.

Twelve Hundred Telephone Companies in Iowa.

The assessment report to the Iowa state auditor shows the number of telephone companies in the state this year to be 1,200, as against about 700 last year. In addition, there are several hundred local and farm systems which are not reported. These figures are the more significant when it is remembered that there has been a considerable trend toward consolidation in the Independent lines of the state, a number of such consolidations having been effected.

Prof. Bell on Telephone Development.

As is well known, Alexander Graham Bell, the telephone inventor, has not been actively interested in telephone enterprises for some years. While in Indianapolis recently he was asked how many telephones there are in the country. In answer he is reported to have said: "That is way beyond me. The Bell patents have expired and there are so many companies manufacturing equipment now, and the development has been by such leaps and bounds, that no one could keep track of the number of telephones. Some years ago, before the Independent movement became so general, it was estimated that the telephone wires would reach many times around the world. But I have been out of the telephone business for 25 years and own just one share of stock to-day in the Bell Telephone Company. I invented the telephone in 1875 and filed my application on St. Valentine's Day, 1876, the same day that Dr. Gray made application for a patent for a similar discovery. However, I was the successful contestant."

Telephone-cable Splicers' Strike Settled.

The strike inaugurated about two weeks ago by the telephone cable splicers of the Chicago Telephone Company has been declared off and all the men have returned to work under an agreement satisfactory to all concerned. The cable pullers who had also intended to strike but who were forced out of work when the splicers quit, have also reached an agreement with the company and are again at work. The men demanded more pay and the scale has been adjusted to the satisfaction of both the employes and the company. No further trouble is expected.

Bell Output for April.

The American Telephone and Telegraph Company has issued the following report:

April—	1903.	1902.	1901.	1900.
Gross output.	104,429	108,242	72,396	53,190
Returned. ...	43,491	37,587	33,177	20,077
Net output.	60,938	70,655	39,219	33,113
Dec. 21 to April 30—				
Gross output.	410,390	387,795	288,505	236,193
Returned	160,137	152,085	122,604	83,121
Net output.	250,253	235,710	165,901	153,072
Outstanding April 30 ..	3,400,573	2,761,720	2,118,717	1,733,577

MANUFACTURERS AND DEALERS.

A bulletin of the "Latest Developments in Telephony" has just been published by the International Telephone Manufacturing Company, Chicago, and is being sent to all inquiring for a catalogue of this equipment. The pamphlet illustrates the full line of International central-energy and generator-call telephones and switchboards for large and small public and private plants, with a clear description of the many new ideas and improvements, of importance to the durability and efficiency of a plant, embodied in the construction of the various parts. It is an artistically and carefully arranged catalogue and will interest all who are engaged in the telephone constructing and operating field.

Bulletin No. 1 of the Stromberg-Carlson Telephone Manufacturing Company, Chicago, is devoted to a comprehensive treatment of telephone and switchboard apparatus for railway and interurban lines. The various types of pocket and portable telephone instruments and appliances used for such work are described, as well as different types of dispatchers' switchboards. Descriptions are given of the telephone dispatching systems installed on the lines of the Milwaukee Electric Railway and Light Company, the Detroit United Railway, and the Aurora, Elgin and Chicago Electric Railway Company. The catalogue, which has been carefully and skillfully prepared, closes with a set of rules and regulations specially governing interurban lines.

The Consolidated Telephone Company of Wheeling, W. Va., has purchased the property of the Farmington Telephone Company. A line is also being built from Grafton to Colfax. This company is purchasing many of the smaller properties of the state and uniting them under the one management.

A New Telephone Receiver.

The Holtzer-Cabot Electric Company of Boston, Mass., is placing upon the market its new telephone receiver, shown in Figs. 1 and 2. A glance will serve to show the lines of grace and symmetry of the shell, which is made in two parts—the body of the shell and the cap. Following the latest practice, binding-posts have been discarded. The terminals are entirely enclosed inside the shell, making a perfect electrical connection, and doing away with the danger of the

FIG. 1. A NEW TELEPHONE RECEIVER.

user receiving a shock, while the cord, which is in all cases supplied with the receiver, is given a substantial hitch about the yoke of the magnet in such a way that no strain can come on the connections. Thus the life of the cord is greatly extended, while the work of renewing the cord is very slight.

Fig. 2 shows the internal arrangement of the parts. The permanent magnets are of a special grade of magnet steel, while the pole-pieces are of the softest Norway iron. It will be observed that the construction is bipolar. The pole-pieces being semi-circular in section, give a much more efficient distribution of the magnetic lines than is possible in a receiver in which the section of the pole-pieces is rectangular. This point is well brought out in Figs. 3 and 4. These diagrams were made by covering thin diaphragms with iron filings and holding them over the poles of the magnets. By gently tapping the diaphragms the iron filings were caused to arrange themselves in positions showing the direction and intensity of the magnetic lines in the region of the pole-pieces. Fig. 3 shows the arrangement of the distribution in a field in which the pole-pieces are rectangular and Fig. 4 in which they are semi-circular.

The adjustment feature has been omitted entirely, and the receivers are permanently adjusted before leaving the factory. This is a distinct advance in receiver construction; only one adjustment is necessary, and this should be made by the manufacturers. The magnets are wound with silk-covered magnet wire, and corrosion is prevented by nickel-plating all exposed parts. In connection with the unusually strong magnet, a heavy diaphragm is used, making an extremely sensitive instrument and one that will respond perfectly through a wide range of conditions of transmission. These instruments are carefully standardized and are made with tools, jigs, etc., so that all parts are interchangeable. The receiver may be supplied with either pure hard-rubber or composition shell and the cord may be furnished with either silk or worsted covering.

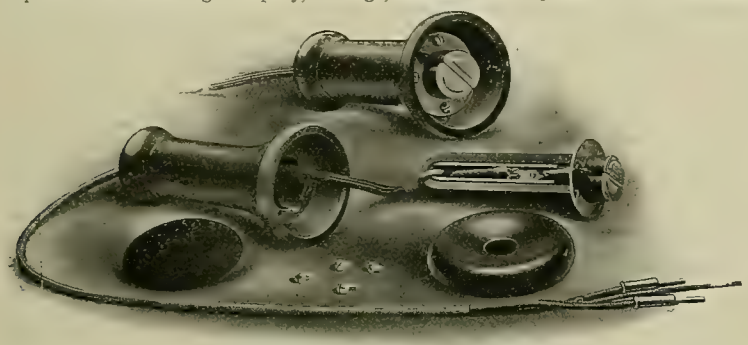


Fig. 2. Showing Various Parts.

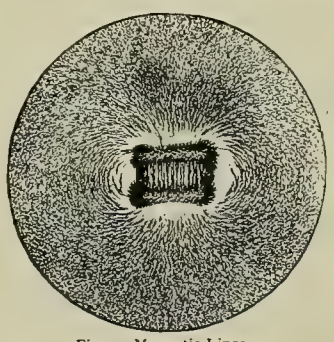


Fig. 3. Magnetic Lines.

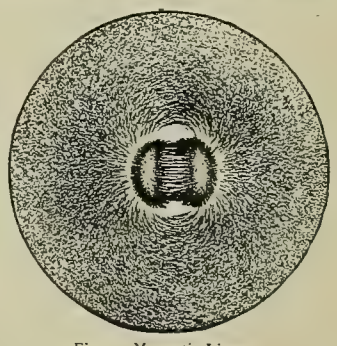


Fig. 4. Magnetic Lines.

A NEW TELEPHONE RECEIVER.

BOOK TABLE.

CONDUCTORS FOR ELECTRICAL DISTRIBUTION: Their Materials and Manufacture, The Calculation of Circuits, Pole-line Construction, Underground Working and Other Uses. By F. A. C. Perrine, A. M., D. Sc. New York: D. Van Nostrand Company. 1903. Pp. (6⅛ by 9¼ inches) vii., 287, with a number of diagrams and illustrations and five folded charts in cover pocket. Price, $3.50.

As a manufacturer, consulting engineer and professor of electrical engineering, Dr. Perrine has obtained a very wide and valuable experience in electrical transmission subjects in general, and particularly in relation to insulated wires and cables. In this book, upon which he has been engaged for some years, he has given the reader the benefit of this wide experience, and has produced a treatise that forms a distinct and valuable addition to technical literature.

In the opening chapters he takes up the properties of materials entering into the manufacture of conductors, both plain and alloyed, and then describes with exactness and valuable detail the manufacture of wire and wire finishing, such as galvanizing iron wire, stranding and gauging. Wire insulation is discussed in one chapter and another treats of cables, closing with a tabulated classification of employment for all conductors. A chapter devoted to calculation of circuits is an important part of the work. It considers wiring charts, graphic multiplication and division, slide rules, systems of distribution, heating limit, concealed and exposed wires, etc. Kelvin's law of economy in conductors takes up a chapter, and then follow treatments of multiple arc distribution and alternating-current calculation. The author then describes overhead lines with special consideration of the stresses, tension, temperature expansion, spans and levels of spans of pole lines.

Of considerable value to the power-transmission engineer is a chapter on line insulators with mention of the process of manufacture. The book closes with a chapter on underground conductors which brings this feature of electrical construction well up to the present state of the art. The five wiring charts which supplement the work have been prepared with care. The text is illustrated with a number of diagrams, half-tone illustrations and curves, and many tables are used in connection with the text.

ELECTRICAL PROBLEMS FOR ENGINEERING STUDENTS. By William L. Hooper, Ph. D., and Roy T. Wells, M. S. Boston: Ginn & Co. 1902. Pp. (5½ by 8¼ inches), v., 170, with about 90 illustrations and curves. Price, $1.25.

Following the recent publication of one or two similar books, this collection of electrical problems does not suffer from comparison, and contains much that is of merit and practical value for the student. The work contains sets of problem typical of those met with in electrical laboratory and engineering practice, with a brief treatment of the methods of solution. The first 12 sets of problems and calculations treat of electromotive force, resistance, inductance, capacity, thermo-electricity, electrochemistry, batteries, generators, etc. Then follow four sets of problems on alternating electromotive forces and currents, impedance, inductance, capacity and frequency. Other problems relate to the calculation and making of winding tables and drawings for direct and alternating-current armatures, and field windings, winding and operation of transformers, rotary converters and induction motors, testing of dynamos and transmission of power. Answers are given to all the problems, many in the form of curves, showing the effect of varying the various constants involved. The text contains about 40 explanatory diagrams.

Boston Capital Invested in Electric Railways in Ohio.

Tucker, Anthony & Co., bankers and brokers of Boston, are the owners of the Canton-New Philadelphia Railway Company, which has just opened an electric railway between Navarre and New Philadelphia, Ohio, a distance of 23 miles, and they expect to obtain control of the Tuscarawas Traction Company, which owns the electric railway between New Philadelphia and Uhrichsville, Ohio, a distance of 15 miles. The same firm controls the Canton and Akron company, which operates an electric railway between Navarre and Akron, a distance of 53 miles.

CORRESPONDENCE.

London Letter.

London, May 16.—A little better understanding appears likely to arise between the electrical contractors in Great Britain and those municipalities which have hitherto been anxious to enter the field of wiring premises for the electric light. A conference has been held between the parties, and it is quite clear that if the local authorities, when applying to Parliament for powers to spend money upon wiring consumers' premises, will give an undertaking not to actually do the work of installation themselves, the contractors will support and not oppose such application. In the latter case, of course, it is obviously to the contractors' advantage, and the little obstinacy hitherto on the part of the municipalities in refusing to give way upon this point has done a good deal of harm to the electrical industry, inasmuch as the Local Government Board, which has to do with the sanction of electric-lighting loans, has refused to lend money for the purpose in question until Parliament should sanction competition with the contractors. As Parliament has steadfastly refused to do this, it is quite obvious that the introduction of the electric light into the houses of the poorer classes whose tenants cannot afford to pay spot cash for the initial installation, has been greatly retarded.

In connection with the sittings of the Home Office Committee, which has been inquiring for some months into the use of electricity in mines in Great Britain, and the formulation of rules concerning it, we have had it brought home to us more forcibly than ever how far behind other countries we are in the application of electricity to mining operations. The later witnesses have all had one long tale of what can be seen on the continent of Europe and what cannot be seen at home, and some have even gone so far as to say that we cannot make the machinery ourselves. Others, however, have somewhat indignantly repudiated this latter statement. What the result of the committee's work will be remains to be seen, but seeing the multitude of views which have been put before it, the task of framing regulations will be no easy one. Hitherto the applications of electricity in this direction have been so few that no special rules have been deemed necessary.

An interesting proposal has just been sanctioned by Parliament. In a tramway bill seeking powers to construct electric lines in Gloucestershire, a clause was included for the provision of motor cars with trolley arms and wires, but no rails, in the less congested portions of the area, until the population grew to sufficiently large proportions to warrant the construction of the tramways.

Two new large turbo-generator sets are to be installed in the works of the Newcastle-on-Tyne Electric Supply Company, in order to provide for a supply of current to the Northeastern Railway Company, when its lines are converted to electric traction.

W.

New York Notes

New York, May 23.—John C. Brackenridge, chief engineer of the Brooklyn Rapid Transit Company, who won the prize offered for the largest potatoes and tomatoes among the residents of Richmond Hill, L. I., is again laying his wires to capture the prize this year. Mr. Brackenridge hoodwinked his neighbors last year, it is said, by fitting up his vegetable garden with incandescent lamps, so that his plants could grow both day and night. By working them overtime he outdistanced every competitor. Mr. Brackenridge has placed wires underground in his garden and will send a slow current of electricity through the ground and force his plants. Then, by shedding light upon them at night, he will force them to develop rapidly. Men interested in electrical matters are watching Mr. Brackenridge's experiment with much interest.

The special franchise-tax amendments to the tax law were an issue this week before the Court of Appeals, when counsel for the Consolidated Gas Company, the Brooklyn City Railroad Company and the Coney Island and Brooklyn company, opposed by Attorney-general Cunneen and Deputy Attorney-general William H. Wood, appeared to move for a reargument of the cases decided recently, in which the law was declared constitutional. Counsel contended that important matters were overlooked by the court in its decision. The attorney-general denied the reargument, and local authorities were advised to proceed with the collection of the tax under the recent decision of the Court of Appeals. The special-franchise taxes due for the last three years, since the passage of the law, in New York, is as follows: Bronx, $719,710; Brooklyn, $2,615,235; Manhattan, $11,400,940; Queens, $368,543; Richmond, $109,835.

The great possibilities of radium were commented upon at length by W. J. Hammer in a lecture delivered on Wednesday evening before the New York Electrical Society. Mr. Hammer's talk was illustrated with numerous lantern pictures, and the use to which radium can be put, both in scientific, practical, and medical ways, was shown. Mr. Hammer said that the treatment of 5,000 tons of mineral formation is necessary to produce a little in excess of two pounds, and when the product is at last forthcoming it is worth about $2,721,555 a pound. There is in the whole world to-day about 2½ pounds which is on the market.

The Interstate Electric Manufacturing Company has been incorporated, with headquarters in this city. The company is capitalized at $50,000. The directors are Randolph Hulsart, E. H. Adams and R. M. Clark, all of Brooklyn.

Commissioner Monroe of the Department of Water Supply, Gas and Electricity, has presented to the Board of Estimates a report in which he says that there are now in Manhattan 3,155 arc lamps and in the Bronx 1,822—a total for the two boroughs of 4,977. This number, he says, is insufficient, particularly for Manhattan. There should be at least twice as many in Manhattan; 10,000 is the minimum now required, and more would be better. The city now pays for lighting about 600 public buildings and places, such as markets, parks, schoolhouses, police stations, engine houses, hospitals, repair shops and yards, public baths, etc; about half of this lighting is by gas, the rest by electricity. All of this lighting should be electric. The equivalent connected capacity of all this public lighting is about 160,000 16-candlepower electric lights. In the near future large extensions of this lighting will be required. There is no satisfactory way to estimate the future requirements; hence central-station capacity has been provided only sufficient for all the present lighting of public buildings and places by electricity, eliminating gas entirely. The central-station capacity can easily be increased as the demand increases.

O.

New England News

Boston, May 22.—The Westerly and Hopkinton Railway Company has completed its plans for the construction of an electric railway between Westerly and Hopkinton, R. I., via Potter's Hill and Ashaway, and has let the building contract to the Eastern Electric Construction Company of Boston. The railway company was granted authority to carry freight. Its line will be 6¼ miles long, and it will connect with the Pawkatuck Valley Railroad at Westerly.

A final dividend from the assets of the Thomson European Electric Welding Company has been declared. It amounts to 52 cents per share and will be payable June 1st.

The Pittsfield Electric Street Railway Company has been granted authority to issue five per cent. refunding and extension coupon or registered bonds amounting to $200,000 and payable in 20 years.

The Connecticut Legislature has passed a resolution incorporating the Crystal Lake Railway Company with authority to build an electric railway in the towns of Ellington and Somers. The company has a capital of $150,000.

The Whitney Electrical Instrument Company's plant at Penacook, N. H., has been destroyed by fire. The loss is estimated at $50,000; partially covered by insurance.

The General Electric Company is preparing to erect three buildings at its River Works plant in West Lynn, Mass. The largest building will be 650 by 350 feet, built of steel, and will be used for the manufacture of steam turbines. The company has nearly completed three other buildings at the River Works. It has installed a new testing equipment for testing small motors and experimental work. The company has secured the contract for a complete arc-lighting system at Shanghai, China, and is furnishing the motors for the Kobe high-speed electric railway near Tokio, Japan.

The Hartford and Springfield Street Railway Company is developing a large combination of electric-railway companies in Connecticut.

The New York, New Haven and Hartford Railroad Company and the Connecticut Lighting and Power Company have withdrawn their bill repealing the Connecticut general railroad law, mention of which was made in a former letter. This ends one of the bitterest railroad fights in recent legislative history of the state, and removes all opposition to the building of the proposed third-rail line from Hartford to New Haven and Middleton which is planned as a parallel to the New York, New Haven and Hartford Railroad. The lower legislative house opposed the repeal bill and the chances for its passage were very small.

The Connecticut Railway and Lighting Company has voluntarily increased the pay of all its motormen and conductors. The pay now ranges from 19 to 21 cents per hour, according to length of service.

A fire occurred on Wednesday morning in the building Nos. 390-400 Atlantic Avenue, occupied in part by the Chase-Shawmut Company, manufacturer of electrical supplies. It is thought that the fire started in a room containing switchboards and other electrical apparatus, and the company estimates its loss at $10,000 to $15,000; insured.

The Old Colony Street Railway Company's power house at Hyde Park, Mass., was struck by lightning Tuesday, and the machinery was put out of commission for some time.

B.

Canadian Intelligence.

Ottawa, Ont., May 23.—The city of Woodstock, Ont., has issued a writ against the Woodstock, Thames Valley and Ingersoll Electric Radial Railway Company, declaring that the railway has forfeited its franchise and rights, and asking for an injunction restraining the railway company from operating its line in Woodstock.

The directors of the Mexican Light and Power Company have received a private message announcing that the Congress of the Mexican Republic had ratified the franchises given the company by the federal government. The importance of this action lies in the fact that the franchises cannot now be repealed by any subsequent government of the republic.

The entire plant of the Coaticook Electric Light and Power Company has been purchased by the town of Coaticook, Que., for $36,000, and the corporation will assume control on October 1st. This action has settled amicably and satisfactorily a long and bitter dispute.

Dr. Evaristo F. de Veiga of Sao Paulo, Brazil, who is on a visit to Canada, is enthusiastic over the electric-tramway service that Canadians have given to the city of Sao Paulo. He says that there is no question as to the success of the enterprise. The electric railway extends over a large and populous district and will become a still more profitable undertaking in the future.

A charter has been secured from the Canadian Parliament for the Sault St. Louis Light and Power Company to develop power from the Lachine Rapids and at Ile Heron, Ile au Diable and adjacent islands in the St. Lawrence River; also to connect Ile Heron by bridge, with the north and south shores of the river, and Ile au Diable with the south shore. The charter also provides for authority to manufacture calcium carbide and to operate vessels. The capital of the new company is placed at $1,000,000, and its headquarters are to be in Montreal, Que.

Arrangements have been made that will enable tourists, visiting Montreal this summer, to see the city and surrounding country to great advantage. A number of "observation cars" will be run over selected routes, passing all the points of principal interest in Montreal and suburbs. These cars are of the large, open style, and will accommodate a large company of sightseers quite comfortably. They will be leased and operated by the National Observation Car and Coach Company of Boston, Mass., which operates a similar service in several large cities of the United States. A lecturer will accompany tourist parties, to point out and describe places of historic or modern interest.

The Niagara Power Company is reported to have concluded arrangements for the construction of the tailrace to run from the power house of the company to the falls on the Canadian side of the Niagara. The contract, which calls for the construction of a tailrace 2,100 feet in length, and which is to cost $800,000, has been awarded to E. C. Douglas & Co. The capacity will be the largest in Canada, some 860,000 cubic feet per minute. The generator, which will be the largest ever manufactured in Canada, will be constructed by the Canada Foundry Company.

W.

From the Buckeye State.

Cleveland, Ohio, May 23.—The Loveland and Cincinnati Traction Company of Cincinnati has been incorporated with a capital stock of $50,000 by Henry Burkhold, S. E. Johnson, William S. Munsell and others. Mr. Burkhold is a well-known traction man of Cincinnati, and is at the head of this enterprise. It is the intention to build a line from Loveland to Madeira.

W. B. Francis of Steubenville has been granted a franchise to build and operate an electric line from Brilliant, Jefferson County, to the Belmont County line. This is an extension of the line from Steubenville to Brilliant.

The Zanesville, Marietta and Parkersburg Railway Company has changed its southern terminus to connect with the Parkersburg Bridge and Terminal Company and thus saves 21 miles of construction.

The Cincinnati, Milford and Loveland Traction Company has arranged to build an independent steel bridge across the Miami River at Milford.

The City Council of Dundee, Mich., has granted a franchise for an electric railway to J. H. Southard and L. L. Austin of Toledo and J. H. Clauss of Fremont. They are promoting an electric road to connect Toledo and Ann Arbor, Mich.

John M. Barr of Findlay and W. V. Coons are organizing a company to erect an electric-light plant at Findlay.

The Inter-state Traction Railway Company of Dayton has been incorporated with a capital stock of $100,000, for the purpose of building an electric line from Dayton to Indianapolis. John D. Boroff, D. M. Sanger, George W. Woodman, W. H. Heinz and E. R. Phillips are the incorporators.

The Ideal Electric and Manufacturing Company of Mansfield has been incorporated, with a capital stock of $50,000, by C. H. Voegelee, M. L. Branyan and others.

In reversing the decision of the Circuit Court of Crawford County in the case of the Big Four Railway Company against the Postal Telegraph Company the Supreme Court of the state decides that a telegraph company cannot condemn a right-of-way over railroad property for its lines. The decision is a very interesting one to all concerned in the railroad and telegraph business.

T. M. Riley of Zanesville has completed the survey of a line from Marietta to Barnesville, and right-of-way agents are now engaged in securing rights along the line. It is said the proposed road will cost about $800,000.

O. M. C.

Information from Indiana.

Indianapolis, May 25.—Severe rain and wind storms throughout Indiana, May 21st, occasioned considerable damage to the interurban lines, wires and property. Washouts occurred on the Indianapolis and Martinsville line, and trees were blown down on the trolley wires on several lines. At Lebanon the car barns of the Townsend-Reed Company were leveled to the earth and considerable damage done to the $350,000 power house now nearing completion.

The local street-car company and the interurban company at Richmond increased the wages of all employes during the week. Motormen and conductors are paid 17 cents an hour on the local lines and 18 cents on the interurban line.

The City Council of Crawfordsville has granted an exclusive franchise to the Consolidated Traction Company for the use of the streets in that city. The ordinance provides that any other company entering the city must pay two cents a passenger each way for the use of the tracks of the Consolidated company, half of which revenue will go to the city. It is claimed that the granting of the franchise puts an end to the contest between the Consolidated and the Townsend-Reed company for the use of the streets. However, it is likely to precipitate a legal fight, as the Townsend-Reed company proposes to build its line into the city, unless restrained, the council having previously granted a franchise and accepted a $10,000 certified check to insure good faith. The latter company objects to entering the city over the former company's tracks.

The Interstate Traction Railway Company, recently incorporated in Ohio, has filed its declaration in this state to build an interurban railway from Dayton, Ohio, to Indianapolis. The line will pass through the following Indiana counties: Union, Fayette, Rush, Shelby, Hancock and Marion. The capital stock is $100,000. John D. Boroff, G. W. Woodman, D. M. Sanger, W. H. Heitz and E. R. Philips are the incorporators.

The Brazil Electric Company has been incorporated with a capital stock of $60,000. The company's declared purpose is to promote, construct, maintain and operate street and interurban lines and plants for the distribution of electric light, heat and power, in Clay and adjoining counties. Brazil is the company's headquarters and Mayor Collins, H. D. Falls, P. D. C. Ball and O. E. Adams are the incorporators.

The Elwood council is considering the advisability of securing municipal ownership of the electric-lighting plant. Engineer Vincent, an Indianapolis expert, made an examination of the plant and made a favorable report. The value is placed at $170,000. The purpose is to cheapen the service to the people. F.

Michigan.

Detroit, May 22.—The engines of the uptown power house of the Edison Illuminating Company have been the cause of a vibration in the Home Bank Building, over two blocks distant. The foundations of both buildings are supposed to rest on the same strata.

The Brick Motor Company of Detroit has filed articles of association with a capital stock of $100,000, all paid in.

The Common Council of Monroe has refused to grant permission for the Detroit, Monroe and Toledo to use certain streets in that city.

Articles of association and incorporation of the Grand Rapids Electric Railway Company, capital $2,000,000, have been filed with the secretary of state by J. C. Boynton. The company proposes to build lines, in various portions of northern Michigan, including a line from Grand Rapids across the state, to Lake Huron.

The Grand Rapids, Grand Haven and Muskegon third-rail road is equipping the line with combination baggage and passenger cars and will allow the checking of baggage, the same as is done on steam roads.

All of the interurban lines running out of Grand Rapids are carrying mail and have postal boxes on the front of each car. Letters can be mailed at any point. This is the first city to be furnished with this class of mail service, and Grand Rapids and vicinity has the finest rural mail-delivery system in the country. C. G. W.

Northwestern Notations.

Minneapolis, Minn., May 23.—Electrical contractors of Minneapolis have secured temporary injunctions against electrical workers' unions restraining them from interfering with their employes. A strike is on, and the companies, in bidding on certain work, find that the unions have threatened the prospective customers with loss of help in other directions should they accept bids from the firms whose employes are striking.

The properties of the Stillwater Gas and Electric Light Company and of the Apple River Power Company, at Stillwater, Minn., have been transferred to the Western Gas and Improvement Company. The new owners will make many improvements to the systems.

The New Ulm (Minn.) Electric Light Company has transferred its pole lines and wires to the city, and the municipal plant is now supplying the current for the city.

The council of Winona, Minn., is dissatisfied with the demands made by the local lighting company for a 10-year contract for lighting, and proposes to renew its steps toward installing a municipal plant.

The Western Construction Company has been incorporated at Davenport, Iowa, to engage in the construction of street railroads and other lines of construction. The incorporators are E. J. Daugherty, E. Steffen and C. G. Hipwell. These same parties are interested in the proposed Davenport and Western interurban line.

Eastern capital has secured control of the various falls in the Zumbro River, in southeastern Minnesota, and expects to develop it and transmit power to Red Wing, Minn. It is estimated that the river will develop about 4,000 horsepower.

The Nevada Electric Light Company of Nevada, Iowa, seeks a 25-year extension of its franchise, although the document has still nine years to run. The company plans extensive improvements to its system, which cannot be undertaken unless the extension is granted.

W. E. Reed contemplates establishing an electric-light plant for Wellsburg, Iowa.

The Western Iowa Interurban Railway Company has been formed at Des Moines with a capital of $1,000,000. The company proposes to build a line from Des Moines to Council Bluffs. The new line will have very close relations with the J. S. Polk interests, which now run out from Des Moines.

The Twin City Rapid Transit Company is working along quite rapidly in the construction of the new power station in Minneapolis, and expects to begin installing the machinery about the middle of June. The building housing the plant will be the largest steel and iron structure in the Northwest. R.

Among the Rockies.

Butte, Mont., May 23.—The contractors are rapidly pushing the work on the power house for the Havre (Mont.) Light and Power Company. A. R. Robertson and Roy Fulkerson of St. Paul are installing the machinery. Wires have been strung on all the principal streets of the town and arc lights put in at the crossings. Everything will be in operation by June 15th.

The City Council of Bozeman, Mont., has just concluded a contract with the Electric Light and Power Company by which that company agrees to furnish 1,200-candlepower arc lights at rates varying from $6 to $12 per month, according to the number of hours the lights are used. The flat rate for incandescent 16-candlepower lights is from 50 cents to $1 per month.

The Graetna Electric Light Company of Dillon, Mont., is pushing the preliminary work on its plant with great energy. Orders have been placed in the East for the necessary machinery and wire, part of which is already en route. The dam and power-house construction has been commenced. The dam is to be 230 feet long and 19 feet high at the highest point, forming a lake of several acres' area. The machinery is to consist of a 275-horsepower impulse waterwheel, belted direct to the high-speed alternating-current generator of 200-kilowatt capacity. The pole line will be nine miles in length. It is intended to have the plant in operation by October 1st.

The shops of the Union Pacific Railway Company at Cheyenne, Wyo., are to be enlarged at an expense of about $500,000. The prospective improvements include the construction of a large central power house, the installation of an electric plant and an extension of the machine shops. H.

PERSONAL.

A bust of the late Dr. John Hopkinson, F. R. S., who, it will be remembered, was killed some years ago on the Alps, was unveiled in Cambridge University a few days ago.

G. Stuart Johnson, vice-president of the Grand Rapids (Mich.) Railway Company, has been compelled to undergo an operation on his tongue, necessitated, it is said, by a malignant growth caused by the execessive use of tobacco.

At the meeting of the American Institute of Electrical Engineers in New York on May 19th M. J. Wightman of New York, Charles O. Poole of Denver, Herbert T. Hartman of Philadelphia and R. S. Kelsch of Montreal were transferred to full membership.

President Barney Mahler, at a meeting of the directors of the Lake Shore Electric Railway Company, held in Cleveland, Ohio, last week, again requested that his resignation be taken up and accepted, and this was done. At the last previous meeting his resignation was returned unaccepted. Mr. Mahler says he does not intend to abandon the company. Horace W. Andrews, H. A. Everett, Will Christy and Warren D. Bicknell have been spoken of for the position, but as yet no selection has been made.

General Andrew J. Hickenlooper, president of the Cincinnati Gas and Electric Company, has tendered his resignation on account of ill-health. He was president of the gas company before it was merged with the electric-light interests and has been president of the larger company since that time. He is known throughout the country through his large business interests and his genial personality. General Hickenlooper has requested that Vice-president Norman G. Kenan be made his successor. The board of directors has not acted upon the resignation as yet.

Frank S. Gannon has been elected vice-president of the Interurban Street Railway Company, New York city. He has been successively master of transportation on the Long Island Railroad, president of the New Jersey Midland, general superintendent of the New York and Northern and of the Staten Island Rapid Transit, and third vice-president of the Southern Railroad.

ELECTRIC RAILWAYS.

The Kansas City Railway and Light Company has been organized, to consolidate the street-railway and lighting interests of Kansas City. The company is capitalized at $25,000,000. Chicago capitalists are said to be mainly interested in the deal.

The Tucker-Anthony syndicate has purchased the property of the Tuscarawas (Ohio) Traction Company, consisting of lines from Canal Dover, Ohio, to Uhrichsville, Ohio, and from Uhrichsville to Dennison, Ohio. The purchaser assumes a bonded indebtedness of $250,000, which the Mandelbaum-Pomerov syndicate had on it.

E. C. Faber, general manager of the Elgin, Aurora and Southern electric railway, says that the outlook for a greatly increased traffic on his line this summer is extremely good. The opening of the Elgin branch of the third-rail system will add another feeder which will be very valuable. Arrangements are now under way for the sale of excursion tickets over the entire circuit from Chicago to Elgin, and then over the Elgin, Aurora and Southern to Aurora, returning over the Aurora, Elgin and Chicago to Chicago.

Residents of the southwest portion of Chicago have organized the Southwest Universal Transfer Association and it is likely that the courts will be called on to decide whether traction companies shall be required to issue interchangeable transfers. The Chicago General Railway, which operates in Twenty-second Street, gives transfers for any intersecting line and accepts transfers from any cross line, but its patrons complain that the City Railway and the Union Traction Company refuse to receive or give transfers for the Twenty-second Street line. Residents along the street believe that they are entitled to an arrangement by which they can reach the down-town district for a single fare.

Articles of incorporation were filed at Springfield, Ill., recently for the Chicago and Momence Railway Company, with principal offices in Chicago and a capital stock of $100,000. The company proposes to build 50 miles of double-track electric lines of the overhead-trolley system from Chicago southerly through Chicago Heights and the counties of Cook, Will and Kankakee, and from a point between the limits of Chicago and Chicago Heights in a westerly direction to Harvey, Cook County, and from a point between the limits of Chicago and Chicago Heights in an easterly direction to the state line, near Hammond, Ind. The incorporators and first board of directors consist of Howard M. Carter, Sidney W. Worthy, Arthur Byrenforth, Frank L. Hupp and George A. Critton, all of Chicago.

AUTOMOBILES.

The Canadian customs officials have issued an order requiring American automobilists who go into Canada with their machines to pay the full duty of 25 per cent. of the assessed valuation of the machine, and the duty will be collected each time a machine is taken into Canada. The duty is placed not only on machines of American make, but on all makes that are in use in this country and that may be taken into Canada by their owners for any purpose whatsoever.

Eight persons are dead and about 12 more, some of whom will die, were seriously injured as a result of the Paris-Madrid automobile race, the first stage of which was run on May 24th. Of the 314 machines which started, 111 made the first stage, a distance of 343 miles. Many machines were demolished, in some cases not only the occupants were killed or injured, but spectators are also in the list of casualties. The French and Spanish governments have united in forbidding the further progress of the race.

SOCIETIES AND SCHOOLS.

At a recent reception given to the civil and mechanical engineers by the Cincinnati chapter of the American Institute of Electrical Engineers at Cincinnati, plans were discussed for a scheme for bringing the engineers together periodically to discuss problems of general interest. Bion J. Arnold of Chicago was present and gave an interesting address on the street-railway situation in Chicago.

The next convention of the Pacific Coast Electric Transmission Association is to be held at San Rafael, Cal., about an hour's ride from San Francisco, on June 16th and 17th. The executive committee is at work arranging the details of the programme. It is probable that the constitution will be so amended as to permit of the selection of a meeting place from year to year instead of having San Francisco as the permanent annual meeting place, as at present.

Among the papers to be presented at the meeting of the American Society of Mechanical Engineers

which begins at Saratoga Springs, N. Y., on June 22d, are the following: "Rational Train Resistance Formula," by J. B. Blood; "Alternating-current Motors for Variable Speed," by W. S. Slichter; "Performance of Internal-combustion Engine Using Kerosene and Gasoline Fuel," by H. F. Halladay and G. O. Hodge; "Test of a 12-horsepower Gas Engine," by C. H. Robertson; "Metric System"—Halsey's paper and report of committee.

The Western Society of Engineers held a special meeting in Chicago last week to hear a paper on "Timber Treating Plants," by W. W. Curtis. Mr. Curtis gave a brief history of the growth of the industry and outlined the various preservative processes. There are at present 16 treating plants in the United States, and it is estimated that in 1903 10,000,000 ties will be treated. The speaker gave a description of the treating plant now being constructed at Carbondale, Ill., and showed some interesting lantern-slide pictures of the plant and of timber in the process of treatment.

PUBLICATIONS.

The Allis-Chalmers Company has just issued Catalogue 61, giving a list of users of the Reynolds-Corliss engines. This very well-known engine is used in electric-railway and lighting plants, mills, foundries and manufacturing plants of every description, and is in use in nearly every country in the world.

The publishers of Cassier's Magazine, New York, have issued in pamphlet form the article on the bonus system of encouraging increased production among workmen, which appeared in a recent number of the magazine. The pamphlet treats of the various systems and recites the satisfactory results produced by the bonus system, both to employe and employer. The article has attracted attention among works managers. A nominal price is charged for the pamphlet.

The American Spiral Pipe Works, 1173-1201 South Paulina Street, Chicago, is sending out its May, 1903, catalogue of spiral riveted steel pipe and fittings. The catalogue is one of the most complete ever published on this kind of pipe and is well gotten up and attractively illustrated. About 12 pages of valuable tables and information of interest to hydraulic engineers and others are given. The company is manufacturing this pipe in larger sizes than heretofore, the sizes now ranging from three to 40 inches in diameter. It is especially adapted for exhaust steam, water lines, etc.

An 80-page catalogue, beautifully illustrating the different types of Emerson fan motors and ceiling fans, has been published by the Emerson Electric Manufacturing Company of St. Louis. The catalogue shows the many minor improvements resulting from the special attention given to the manufacture of desk and ceiling fans by the company. The assortment of Emerson fans for 1903 is much more extensive than in past seasons.

TELEGRAPH.

The Pacific cable is progressing toward completion. The cable steamer Anglia anchored the Manila end on the beach on May 25th and started to pay it out to Guam, the next station. No submarine obstacles are anticipated, but the vessel is likely to run into typhoons at this season.

MISCELLANEOUS.

Among recent patents was one issued to Charles G. Curtis of New York and assigned to the Curtis Steam Turbine Company to provide means for reversing compound steam turbines. It was applied for on July 31, 1897, and issued May 12, 1903.

A London scientist, returning from a tour of Italy, says he saw at an observatory near Rome specimens of a new system of electric photography by which clear pictures can be obtained of persons and scenes at least 20 miles distant. He thinks it conceivable that the system can be developed so as to enable the making of photographs of friends in distant lands while conversing with them etherically.

TRADE NEWS.

The General Incandescent Arc Light Company has moved its Chicago office to 1218-19 Marquette Building.

The Northwestern Electric Company has been incorporated for the purpose of manufacturing electrical supplies. The capital is $5,000, and the headquarters will be in Chicago. Henry D. Cheney Peter L. Evans and James R. Deane are the incorporators.

Sealed proposals will be received until June 15th for the installation and maintenance of an electrical burglar-alarm device on certain vaults and safes in the United States Treasury Building, Washington, D. C., which device must be connected with a central station in that city. A copy of the general information regarding the service required, etc., may be obtained upon application to James Knox Taylor, supervising architect, Treasury Department, Washington, D. C.

The American Blower Company of Detroit, Mich., reports business excellent in all its lines. Among the larger orders recently received it mentions heating and induced-draft apparatus for the Ironton (Ohio) Engine Company, and outfits for the Illinois Sugar Refining Company, Pekin, Ill.; Michigan Starch Company, Traverse City, Mich.; Mengel Box Company Louisville, Ky.; Brooklyn Cooperage Company, New York; Buckstege Furniture Company, Evansville, Ind.; Evansville (Ind.) Desk Company, and Cadillac Cabinet Company, Detroit.

E. O. Edson has been made secretary and treasurer of the Bendit Mercantile Engineering Company of St. Louis. F. C. Laufketter retires to become president of the Victor Manufacturing Company of St. Louis. The Bendit company will continue to act as sales agent for several manufacturers of steam machinery.

The Chicago Engineering and Constructing Company, with a capital of $250,000, has acquired the engineering and contracting business of the firm of Weston Brothers of Chicago. The officers of the company are: President, Charles V. Weston; vice-president, George Weston; secretary and general manager, George A. Yuille; counsel, Harvey B. Hicks. Addison E. Wells, Fred A. Wells and Edward B. Burling, all of Chicago, together with the above-named officers, will make up the board of directors. Mr. Yuille will be recognized as the former vice-president and general manager of the West Chicago Street Railroad Company and an officer of other street-railroad properties in Chicago. His service has covered both the construction and operation of properties, and he is known to those familiar with this field as a manager of great force, tact, skill and ability. The Chicago Engineering and Constructing Company is now carrying on the supervision of construction of electric railroads, among which may be mentioned the line from Rockford to Freeport, Ill., and is preparing plans and specifications for extensions of existing properties.

BUSINESS.

The Pittsburg Sewer Pipe and Conduit Company of Pittsburg, Kan., manufacturer of every size and style of sewer pipe, electric conduits, hollow building blocks, vitrified drain tile, etc., is utilizing the shale deposits of Pittsburg, Kan., for the manufacture of its products. This shale is said to be the best to be found anywhere, and the company reports that the conduits which it manufactures from this material for electric wiring are pronounced by competent electricians to have no superior.

W. C. Sterling & Son of Monroe, Mich., dealers in poles, cross-arms, etc., report a flourishing business. The firm was organized 22 years ago, and now enjoys the distinction of having shipped poles and ties into nearly every state in the Union, as well as to Egypt, South America and several other foreign countries. It has ready for shipment from 80,000 to 100,000 poles and thousands of ties. It has 11 different sorting yards, located in the northern part of Michigan, and employs a large number of men, loading, unloading, sorting, etc. Omer is the main distributing point, the waterpower there giving this place the advantage over others.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 19, 1903.

728,189. Process of Making Battery Plates. Joseph Bijur, New York, N. Y. Application filed August 14, 1900. Renewed September 26, 1902.

The parts adapted to become active are held in a suitable mold with at least one interval or space for the molten metal. Superheated melted lead is directed downward to the bottom of the interval or space to be filled. The freshly incoming portions of the melted lead are progressively directed to the successive portions of the interval or space from the bottom to the top as the interval or space is gradually filled up, whereby the superheated lead is deposited directly against the portions of the parts where it is to remain and solidify.

728,202. Storage Battery. Alfred W. Charlton, Toronto, Canada, assignor of one-half to Peter Ryan, Toronto, Canada. Application filed October 6, 1902.

An electrode comprises an open-ended rectangular-sectioned perforated tube of conducting material, and this is combined with a conducting core having four wings integrally connected and extending one into each angle of the tube from end to end. A filling of active material is added.

728,210. Electrolytic Arc Light. William T. Dean, Chicago, Ill., assignor to the General Electric Company. Application filed November 15, 1901.

A regulating magnet and clutch are combined with a composite electrode, one part of which is a conductor when cold and the other only when heated, the two being in close relation and movable relatively to one another and to the co-operating electrode of the lamp. Means are provided for limiting the extent of relative movement. (See cut, next page.)

728,222. Brush Holder. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 19, 1900.

A carrying device for the brush spring is perforated for the reception of the brush spring. A support is provided with a downwardly extending guide which projects through the perforation in the carrying device. The brush spring is mounted on the guide, and upward projections from the brush-carrying device, which extend adjacent to the support to guide the latter.

728,231. Laminated Lever Switch. Edward M. Hewlett and Charles C. Badeau, Schenectady, N. Y., assignors to the General Electric Company. Application filed December 16, 1898.

A switch for heavy currents is described. Fixed terminals have flexible blades making side contact therewith. The blades are fixed to a pivoted bar. Supplementary terminals make and break contact upon the bar.

728,243. Wireless Telegraphy. James F. King, New York, N. Y. Application filed February 5, 1902.

A source of electricity is combined with an induction coil receiving its primary current from the source. An oscillator is connected directly in the secondary circuit of the induction coil, and a transmitter having an electromagnetically operated make-and-break liquid contact is located in the primary circuit of the induction coil. Means are provided for operating the transmitter, to cause it to make and break the primary circuit through the liquid contact.

728,254. Facsimile Telegraph. Hans Liebreich and John C. Francis, Detroit, Mich., assignors to August Helbig, Detroit, Mich. Application filed June 14, 1900.

This device comprises a disk rotating on an axis with a series of transmitting points and a series of receiving points mounted thereon. Paper feeds are provided in planes at right angles to the axes. Two trains of gearing connect a motor with the paper feeds respectively. There are switches in the transmitting and receiving circuit of the instrument and also a common means for throwing one or other trains of gearing into action and simultaneously operating the switches for the points whose paper feed is thus brought into play. (See cut, next page.)

728,256. Brush for Dynamo-electric Machine. Walter D. Litchfield, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 23, 1900.

A holder is provided with a brush box and a plurality of independently movable brushes located in the box and having their adjacent edges overlapped.

728,259. System of Electrical Distribution. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric Company. Application filed November 30, 1900.

A set of transformer windings is connected together so that the terminal electromotive forces have a six-phase relation to each other. Other sets of transformer windings with the terminal electromotive forces are provided in six-phase relation to each other. The electromotive forces of one set, however, are displaced in phase from the electromotive forces of the other. Connections are provided between the machine and the transformer windings.

728,273. Brush Holder. Edgar W. Mix, Paris, France, assignor to the General Electric Company. Application filed March 22, 1900.

This device comprises a guide for the brush with a spring adapted to force the brush along the guide. Means are carried by the brush for adjusting the tension of the spring.

728,274. Electrolytic Cell. Hugh K. Moore, Lynn, Mass., assignor to the Moore Electrolytic Company, Portland, Maine, and Boston, Mass. Application filed August 29, 1901.

A cell receptacle has a chlorine space and a cover above the space. A carbon anode has a socket with a copper block in the socket. A casing in the block has a coefficient of expansion between that of copper and carbon. A conductor passes through the cover and has a threaded connection with the block. A terminal block on the end of the conductor is enclosed in a glass tube which is clamped between the blocks.

728,278. Telephone-wire Hanger. Herman F. Neslage and Harry H. Watson, St. Louis, Mo. Application filed July 14, 1902.

A bearing is provided for the messenger wire, and there is a cap to the bearing and wire. The cap extends beyond each end of the bearing and has its top longitudinally convex. Ears depend from each end of the cap, and a lug dependent from the cap enters a slot in the hanger. Additional means are provided for fixing the cap to the hanger.

728,292. Electric Elevator. Frank B. Rae, Chicago, Ill., assignor to John A. Roche, Chicago, Ill. Application filed November 16, 1895.

In the device described a hoisting motor has the usual armature and field coils, an auxiliary field coil, a pilot motor arranged to cut out the auxiliary field coil, and means are provided for controlling the pilot motor from the car.

728,293. Circuit-breaker. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 27, 1901. Renewed November 20, 1902.

This means for extinguishing electric arcs comprises separable contacts, one at least of which is tubular, a closed chamber around the engaging terminals, a pressure generator, means for operating the same preliminary to the separation of the contacts, and ducts for communicating the pressure to the chamber around the terminals.

728,297. Regulating Device for Internal-combustion Engines. Fritz Reichenbach, Berlin, Germany. Application filed November 26, 1902.

An electrical igniting device in combination with the regulating device is described.

728,299. System of Electrical Distribution. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company. Application filed January 2, 1901.

Reactances of opposite sign are connected across two of the multiphase mains. A constant-current circuit is operatively connected between the junction of the reactances and another of the mains. A rectifying commutator is placed in series with the constant-current circuit, and

means are provided for synchronously driving the commutator.

728,300. Electric Regulator. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company. Application filed November 5, 1902.

A regulator-controlling mechanism consists of a main contact responsive to the quantity to be regulated. Two co-operating contacts are also responsive to the quantity to be regulated but subject to less movement than the main contact for any given variation of the quantity. There are means for causing the co-operating contacts to return to normal position at a slower rate than the rate of return of the main contact.

728,309. Coin Collector for Telephone Pay Stations. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 29, 1901.

Two pins project into the coin chute and are adapted to support a coin between them. There are two paths for the coin, one below each of the pins, and means are provided for alternatively withdrawing either of the pins to direct a coin into either of the paths.

728,312. Weed Exterminator. Budd Smith, Austin, Minn. Application filed July 21, 1902.

With a mowing machine cutter bar and knife are combined electrodes pivotally connected therewith and insulated therefrom. The electrodes are arranged one in advance of the other in the rear of the knife. Suitable connections are provided between a generator and the electrodes.

728,313. Trolley. George E. Smith, Exeter, N. H. Application filed April 5, 1902.

The main yoke has a journal therein with a main wheel on the journal. A second or auxiliary wheel is also provided with a journal. A frame supports the journal, which frame has widely diverging arms to catch the wire. A spring is coiled about and attached to the journal of the main wheel, and has one end engaging the frame of the second wheel.

728,315. Instrument for Locating Overbalance in Revolving Bodies. Oscar Snell, Chicago, Ill., assignor of one-half to Alexander E. Keith, Chicago, Ill. Application filed August 21, 1901.

A shaft is yieldingly mounted in a frame. An indicator revolves in unison with the shaft. A stationary co-operating indicator is carried by the frame and a ring is arranged above the last-named indicator. An electric circuit has its terminals connected to the ring, and means are mounted on the ring and included in the circuit for producing flashes of light. Means are provided whereby as the shaft is rotated the circuit is broken and made alternately.

728,321. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 2, 1901.

A conductor leads from each of three alternating-current mains to a common point. An inductance device is in circuit with one of the conductors, a condenser in circuit with another of the conductors, and an energy-consuming device in circuit with the remaining conductor.

728,322. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 2, 1901.

Means are provided for maintaining a constant field excitation for a multiphase alternating-current generator. A consumption circuit is connected to the terminals of the generator. There are means in shunt to the terminals of the generator for co-operating with the effective or synchronous reactance of the generating winding or windings to produce a constant current in the consumption circuit.

728,324. Third-rail Electric Railway. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company. Application filed July 5, 1902.

A block of insulating material has a slot in its upper surface adapted to receive and hold a third rail, and also has a recess or recesses for receiving the ends of rods or pipes which act as a foot-guard for the third rail to prevent injury from contact therewith.

728,325. System of Electrical Distribution. Charles W. Stone, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 23, 1901.

A multiple-conductor system of electrical distribution is described for which electromagnetically tripped circuit-breakers are provided, one for each of a plurality of the conductors of the system. There are circuit-closing devices for those conductors of the system for which circuit-breakers are provided, and connections whereby the operation of any one of the circuit-closing devices energizes the tripping coils of the circuit-breakers.

728,342. Telephone Receiver. George E. Wheeler, Burlington, Iowa, assignor to the Modern Electric Company, Burlington, Iowa. Application filed June 19, 1902.

Pole-pieces are connected to a permanent magnet and support the coils. The pole-pieces have their tips deflected inwardly beyond the coils so as to lie in close relation, and are provided with T-heads.

728,343. Magneto-generator. George E. Wheeler, Burlington, Iowa, assignor to the Modern Electric Company, Burlington, Iowa. Application filed June 19, 1902.

An armature composed of a rectangular frame, consists of a plurality of parallel pieces, each having a central perforation for the armature shaft and a T-head at one end. The heads are alternately arranged at opposite sides of the frame, and fastenings detachably connect the ends of the pieces, together with rectangular spools upon the frame.

728,344. Telephone Transmitter. George E. Wheeler, Burlington, Iowa, assignor to the Modern Electric Company, Burlington, Iowa. Application filed July 31, 1902.

The device described consists of a relatively stationary holder for the electrodes and granular material. A member movable under the impulses of the diaphragm to regulate the sensitiveness of the granular material is provided. A resistance spring acts on the movable member, and there are means for adjusting the tension of the spring.

728,350. Telephony. Robert H. Yurgae, Milwaukee, Wis., assignor to the Signalphone Company, Milwaukee, Wis. Application filed November 24, 1902.

A station is equipped with an electric-telephone apparatus, a calling mechanism and a call-receiving mechanism, with an adjustable hanger for the telephone receiver, a locking means and an indicator with the hanger. A selective switch is operated by the hanger and is electrically connected to a similar switch at each of a plurality of stations in the same system, whereby the movement of the hanger in an upward direction and removal of the receiver cuts in the desired station and locks the hanger in adjusted position. Hanging up of the receiver serves to unlock the hanger and restore the switch to home stop directly by the action of gravitation.

728,357. Illuminator for Surveying Instruments. Carl M. Bernegau, Hoboken, N. J., assignor to the Keuffel & Esser Company. Application filed March 20, 1902.

In an illuminator an electric lamp has a portable holder, with a reflector removably clamped thereon, and a lens is held in position to bring its focus practically into coincidence with that of the reflector.

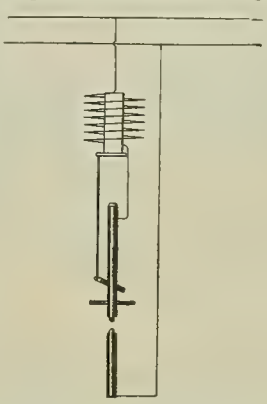
728,367. Electrically Operated Latch and Door. Joseph Chambers, Jr., Dallas, Texas. Application filed February 27, 1903.

A latch is adapted to retain a movable door in a closed position. An electrically operated door-opening mechanism is provided, and there are electrical means for preliminarily disengaging the latch and in the subsequent movement thereof establishing circuit to the door-opening mechanism.

728,372. Pole-changer. John Crawford, Denver, Colo. Application filed April 26, 1902.

A pole-changer for transforming direct, constant, currents into alternating currents and pulsating currents of positive and negative polarity is described.

728,381. Storage Battery. Mary Emmé, New York, N. Y., assignor of one-fourth to Sigrid Ringhdahl, Chicago, Ill. Application filed March 11, 1902.



NO. 728,210.—ELECTROLYTIC ARC LIGHT.

The device consists of electrodes of suitable material (for instance, lead electrodes prepared with peroxide of lead), put down in ground or earth of any kind, and a solution of suitable chemical material used as an electrolyte for exciting the electrodes.

728,428. Elevated Electric Railway. Wassily Varzar, St. Petersburg, Russia. Application filed October 27, 1899.

An overhead railway track is provided with a wheeled truck. A car is placed on each side of the truck and resilient suspension devices are connected with the truck from which the cars are independently suspended.

728,442. Electric Insulator. Edward J. Burke, Olyphant, Pa., assignor of one-half to John F. Cummings and Peter W. Anderson, Olyphant, Pa. Application filed May 22, 1902.

A body portion petticoated has screw-threads for attachment to a peg. A recessed groove is provided in the upper end of the body portion, and wire-holding members are insertable within the recess of the body portion and arranged to be held in position by gravity.

728,478. Telephone Lock. Edward G. Lewis, St. Louis, Mo., assignor to the Controller Company of America, St. Louis, Mo. Application filed June 20, 1902.

A new telephone lock is described.

728,523. Circuit-breaker for Hoists. Samuel S. Wales, Munhall, Pa. Application filed February 19, 1903.

A hoist having a motor circuit has a combined circuit-breaker and a stop-switch arranged as a single instrument which contains mechanism for simultaneously actuating the stop-switch to convert the motor into a generator whenever the circuit-breaker is opened.

728,531. Prepayment Attachment for Electric Meters. Theron L. Arnold and Frank E. Brown, Three Rivers, Mich. Application filed July 21, 1902.

The coin-carrier is adapted to be rotated or swung. The pivoted spring-controlled interlocking lever therein is adapted to be pushed out by the insertion of the coin. There is a toothed wheel in position to be engaged by the end of the interlocking lever when thus pushed out, and to be revolved when the coin-carrier is swung. Clutch gears are provided between the toothed wheel and windlass, and the escapement operator is adapted to be swung by the tilting of the armature and is provided in the upper end with an oblique slot. The ends of the escapement are adapted to play in and out between the cogs of the escapement wheel on the shaft of the clutch-gears, and its lower end is extended loose in the slot of the escapement operator. Electrically operated means are provided for operating the escapement operator, all combined, whereby the weight is raised and permitted to lower by the independently acting but connected mechanism.

728,535. Device for Actuating and Controlling Electric Motors. Otto C. Britsch, Maspeth, N. Y., assignor to David Wald, New York, N. Y. Application filed November 28, 1902.

Devices normally applying tension brake an electric motor. Means are operated by foot-power to release the devices. Devices are actuated simultaneously by the means for completing an electric circuit through the motor and for progressively increasing the current therein. There are means for momentarily retarding the return movement of the latter devices and insuring a quick motion at the end of the movement for breaking the electric circuit so as to prevent the possibility of arcing.

728,540. Motor-control System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 6, 1902.

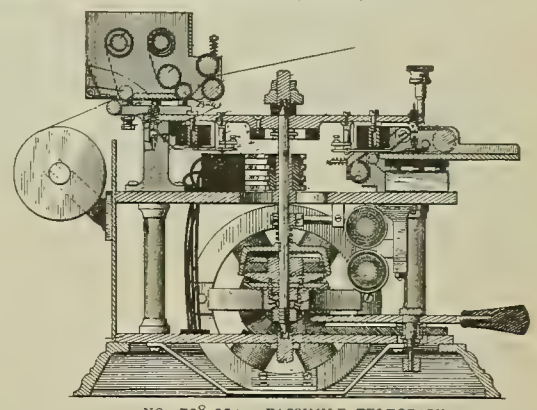
A plurality of controllers each comprises a plurality of sets of contacts, and electromagnetic means are provided for operating the contacts of each controller. There is a system of conductors to which the electromagnetic means are connected in multiple. A master controller is constructed and arranged to connected the system of conductors to a suitable source of current supply. Means are provided in each controller for preventing the operation of the contacts of one set until after the contacts of the other set have been operated.

728,544. Electric Signaling Device. George E. Clark, Northampton, Mass. Application filed August 16, 1902.

This apparatus comprises a plurality of signaling mechanisms, one for each station. Two normally closed electrical circuits have independent operating means. Magnet-actuated means are associated with each mechanism for operating the same and the magnets of which are included in one of the circuits. Separate magnet-actuated means are provided whose magnets are included in the other of the circuits and which are associated with each signaling mechanism to permit and prevent the operation thereof.

728,546. Maximum-demand Indicator. Frank P. Cox, Lynn, Mass., assignor to the General Electric Company. Application filed March 2, 1899.

An indicating means is moved by the action of the current flowing in the system and is incapable of automatically returning to its initial position. Means are controlled by the current flowing in both sides of the system for actuating the indicator. (See cut.)



NO. 728,254.—FACSIMILE TELEGRAPH.

728,564. Electric Resistance Structure. Henry Geisenhöner and Tycho Van Aller, Schenectady, N. Y., assignors to the General Electric Company. Application filed November 10, 1900.

This device comprises a hollow core surrounded by an open structure of alternate windings of resistance wire and insulating cord. A jacket of heat-insulating material is provided for concentrating the heat upon the core. A protecting casing has an opening registering with the axis of the core to permit the insertion therein of articles to be heated.

728,565. Brush-holder. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company. Application filed December 20, 1900.

A holder is provided with a brush box, and there is an opening from the box to a space between the sides of the holder, the opening being narrower than the box. A device extends through the opening to press the brush against the box.

728,567. Apparatus for Applying Terminal Wires to Electric-lamp Glowers. Joseph M. Gulentz, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 10, 1902.

A frame is provided at its respective ends with clamps for terminal wires. A two-part block is mounted to slide in the frame and is adapted to hold an unbaked glower in alinement with the terminal wires which are held in and project from the clamps.

728,568. Method of Applying Terminal Wires to Electric-lamp Glowers. Joseph M. Gulentz, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Original application filed April 10, 1902. Divided and this application filed July 16, 1902.

The method described consists in forcing the ends of the terminal wires into the ends of the glower blank when the latter is in a comparatively soft condition and subsequently baking the glower to fasten the terminal wires in position.

728,570. Regulator for Alternating Series Arc-light Systems. Josef H. Hallberg, New York, N. Y., assignor to the General Incandescent Arc Light Company, New York, N. Y. Application filed September 30, 1902.

A coil on a body of iron is connected across the main conductors. A second coil is placed on the body of iron, the ends of which are closed to form a circuit. A number of lamps are connected in series with the coil, and a solenoid is also connected in series with the coil and is adapted to be moved in relation to the body of iron to introduce or remove impedance from the circuit of the second coil and lamps. Means are provided for counterbalancing the weight of the coil and the attractive influence exerted by the coil relative to the body of iron.

728,575. Transformer. George H. Hill and Sydney G. Brown, Montreal, Canada, assignors to Michael Joseph Doherty, Montreal, Canada. Application filed June 7, 1902.

Means are provided for connecting a pair of primary coils to the source of energy. A single secondary coil encircles

one of the primary coils, and a pair of secondary coils are wound one upon the other and encircle the other of the primary coils. A pair of leads is connected to each of the secondary coils, and means are provided for adjusting the single and compound secondary coils longitudinally of the primary coils.

728,557. System of Dynamo-electric Machines. Frank H. Jeannin, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 28, 1901.

Sources of electromotive force are provided in series with each other. There are means responsive to the difference of potential across points in the connections between the sources for regulating the electromotive force of one or more of the sources, and there are translating devices in series between the sources.

728,581. Traction System. Ernst L. K. F. Kahlenberg, Charlottenburg, near Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed February 27, 1899.

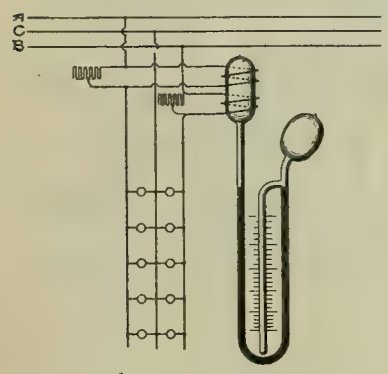
A motor car is provided with an induction motor. A resistance of predetermined value is mounted on the same car with the motor for which it is designed and is permanently included in circuit with the armature thereof. A source of current supply is provided for normally operating the induction motor, and there are means associated with the current supply for increasing the pressure thereof when the car requires more than the normal amount of torque to propel the same.

728,590. Lock for Controller Handles. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 29, 1901.

A motor controller having low-speed and high-speed operative positions is combined with a device for preventing the movement of the controller into a high-speed position, and there are means separate from the controller for rendering the device inoperative.

728,596. Equalizing Brush-holder. Edwin J. Murphy, Lynn, Mass., assignor to the General Electric Company. Application filed October 4, 1901.

Brushes bear on a commutator. A support is provided to which the brushes are secured, and there are means for permitting movement of the support in response to inequality of pressure of the brushes on the commutator.



NO. 720,546.—MAXIMUM DEMAND INDICATOR.

728,611. System of Motor Control. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company. Application filed January 24, 1901.

A valve casing having two chambers with an admission port between them and an exhaust port leading out of one of them is combined with a freely movable valve having two heads, one on the admission side of the admission port and the other on the exhaust side of the exhaust port, and electromagnetic means are provided for actuating the valve to close the exhaust port and open the admission port.

728,612. Means for Compensating Temperature Changes in Electrical Measuring Instruments. William H. Pratt, Lynn, Mass., assignor to the General Electric Company. Application filed December 12, 1902.

This device comprises a thermo-electric couple having the joints exposed to the same temperature conditions as the shunt-joints and connected with the instrument terminals so as to provide an opposing thermo-electromotive force.

728,616. Signal System. John K. Reid, Montreal, Canada, assignor of one-half to John Ernest Hardman, Montreal, Canada. Application filed September 29, 1902.

This system consists of a key signal device and a series of signal devices permanently grouped adjacent to the key signal device. A pair of code signal devices are placed one above and one below the key signal device, and there are means for animating the signal devices individually, in groups or collectively.

728,621. Railway Switch-operating Mechanism. John E. Ruby, Indianapolis, Ind. Application filed June 28, 1902.

A switch tongue is combined with a crank-shaft mounted longitudinally of the track between the rails. A connecting rod from the crank of the crank-shaft is pivoted to the switch tongue, and the crank of the shaft is of such dimensions that at each throw of the switch tongue it will pass below the horizontal position. Means are provided for engaging the crank of the shaft to stop it in its downward movement, and there are means independent of the crank of the shaft for oscillating the crank-shaft.

728,632. Contact-breaker. Charles F. Splitdorf, New York, N. Y. Application filed September 19, 1902.

A vibrator spring carries an armature and contact point and a support for the spring. A slot in the vibrator spring receives a narrowed screw portion. A threaded orifice in the slotted body receives the screw member, and a lock screw is threaded through the slotted body to contract its members.

728,647. Heater Cut-out for Electric Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse Pittsburg, Pa. Application filed July 7, 1900.

This device comprises a solenoid, a core therefor, two stationary terminals, a flexible and substantially non-resilient metal ribbon rigidly attached at one end to one stationary terminal, and to the solenoid core at a point between its ends. It also has a contact-piece that is held in engagement with the other contact terminal by gravity when the solenoid is de-energized.

728,648. Electric Lamp. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 19, 1901.

An electric lamp having conductors that become more or less decomposed or disintegrated in use is provided with a non-conducting holder or support for glowers and heaters provided with grooves in the surface which is adjacent to the glowers and heaters. The grooves are located between conductors having differences of potential.

728,659. Collector for Use on Electrically Propelled or Lighted Vehicles. Benjamin H. Bedell, London, England, assignor of nine-tenths to William Griffiths, London, England. Application filed May 16, 1902.

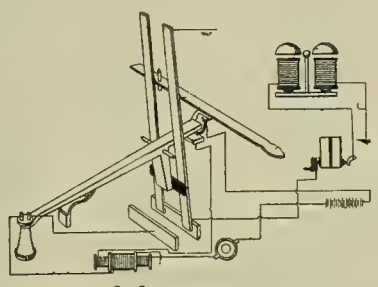
A collector for electrically propelled or lighted vehicles consists of a piece of magnetic material movably mounted on the pole-piece of a magnet so that in moving outward to collect current from the studs or rails it decreases the magnetic reluctance of the magnetic current of which it forms a part. Means are provided for normally holding the collector toward the pole-piece.

728,667. Storage Battery. John C. Brocksmith, Chicago, Ill. Application filed January 14, 1902.

A plurality of plates each comprises a frame having conductor rods of relatively less diameter than the depth of the frame. An active material is supported within the frame and surrounds the conductor rods. Insulating washers are interposed between and space apart the plates. Insulating connecting rods pass through the plates and interposed washers, thereby uniting the plates. Separating material is located between adjacent plates within the space formed by the washers to prevent the dislodgment of the active material and its contact with plates of opposite polarity.

728,730. Photocopying Machine. Paul Latta, Berlin, Germany. Application filed July 11, 1901.

An electric light or lights are included in a normally broken circuit of conductors. A stationary contact-piece is composed of a plurality of removable sections by which the period and time of the closing of the circuit may be varied. A frame incloses the light or lights. A slotted link forms a connection between the crank-shaft and the cover, and a rotating contact-piece rotated by the crank shaft is adapted to intermittently close the circuit by contacting with the stationary contact-piece so as to light the lamp or lamps during the time that the cover is lowered.



NO. 728,785.—TELEPHONE SYSTEM.

728,731. Illuminated Sign. Charles E. Lee, Chicago, Ill. Application filed October 6, 1902.

This device comprises a backing sheet of transparent material, a body of a substance normally opaque but transparent when heated, supported thereby, and an electrical conductor adapted to become heated when an electric current is passed therethrough, embedded in the body.

728,747. Electric Igniter for Hydrocarbon Engines. Harry M. McCall, Pittsburg, Pa., assignor to the Pittsburg Gas Engine Company, Pittsburg, Pa. Application filed February 27, 1902.

An improved igniter is described.

728,752. Electrical Distribution. Samuel L. Naphtaly, Edward C. Jones and Frank H. Varney, San Francisco, Cal. Application filed September 12, 1901.

Primary and derived circuits of a system of electrical distribution are combined with a local circuit, including a battery, a pair of magnets in the local circuit, a common armature for the pair, and a double switch operated by the armature. Switch contacts are connected through a transformer to the primary and derived circuits. There is a pair of terminal contacts of the local circuits and a lagging spring between the armature and the terminal contacts. Means operated by variations in the load on the derived circuit for controlling the local circuit are provided for cutting the transformer in or out. The lagging spring is adapted to maintain a contact with one terminal of the local circuit, until caused to follow the armature in its motion between the magnets and to cut out the local battery by such following movement in either direction.

728,766. Winding for Electrical Machines and Appliances. Raymond Rougé, Paris, France. Application filed October 10, 1902.

A bobbin for the windings of electric machines is constituted by a certain number of conductors all arranged in series, which are distributed in such a manner that if they are assumed to be cut by a plane at right angles to the axis of the winding, the centers of all the sections of conductors are situated approximately upon a portion of sinusoid from summit to summit, the length of which is equal to the distance which separates two poles of the winding, while the projections of these sections upon a line perpendicular to the axis of the sinusoid are superposed without interruption or overlapping.

728,785. Telephone System. Ernest Umdenstock, Reading, Kan. Application filed April 21, 1902.

Combined with line-wires is a telephone having a signal circuit provided with a contact. A local talking circuit contains a transmitter and is provided with a closing switch. Main talking-circuit connections include a receiver and a contact, the latter being located in juxtaposition to the signal-circuit contact. A switch hook is provided for operating the switch to close the local talking circuit when the receiver is removed. Contacts are connected to the line wires and are arranged between the main-talking and signal-circuit contacts, the line-wire contacts being held in engagement with the signal-circuit contact by the switch hook when the receiver is on. A reversing device is provided for moving either line-wire contact into engagement with the main talking-circuit contact when the receiver is removed. (See cut.)

728,789. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed January 3, 1903.

A casing on one end of an electric car and a primary coil within the casing having a central opening are combined with a head-light casing having a depending chamber, a secondary coil located within such chamber. A core extends through the secondary coil and is designed to project through the primary coil when the headlight is positioned on the casing of the latter. A base piece for the chamber is removably secured thereto and to the core, and there is an incandescent lamp in circuit with the secondary coil.

728,797. Circuit-breaker or Switch for High Potentials. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 11, 1899. Renewed April 3, 1902.

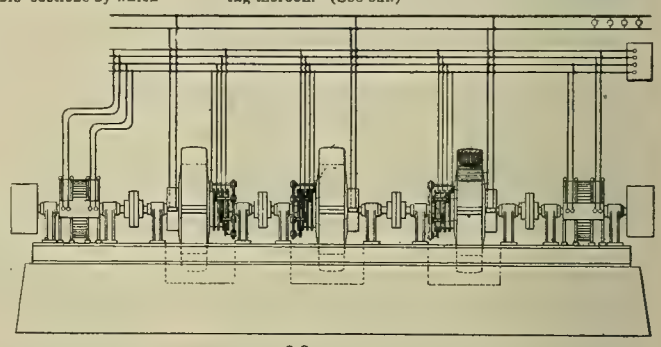
Closed chambers contain terminals, and tubes extend from the chambers. A U-shaped bridge is inclosed in the tubes and makes contact with the terminals in the chambers, with a current-measuring device, and a trip is actuated thereby for releasing the movable terminal which is free to take an accelerating motion.

728,805. Insulator. Fred M. Locke, Victor, N. Y. Application filed January 29, 1902.

This insulator has an upper surface in the form of a flattened cone. A substantially vertical flange about its edge forms a gutter for collecting and discharging the water from the surface.

728,812. Rectifier. William Stanley, Pittsfield, Mass., assignor to the General Electric Company. Original application filed March 10, 1897. Divided and this application filed October 28, 1897.

Combined in this device is a core with a winding thereon. A keeper is secured over the winding and a commutator has its segments connected to the winding, and collecting rings are also connected to the winding. There is a synchronous motor for revolving the core and the winding thereon. (See cut.)



NO. 728,812.—RECTIFIER.

728,814. Device for Automatically Cutting Out Starting Resistances of Electric Motors. George H. Whittingham, New York, N. Y., assignor to the Automatic Switch Company of Baltimore city. Application filed July 8, 1902. Renewed April 15, 1903.

A contact governs the admission of current to the motor and a clutch device is actuated by the current to make connection with the contact. Means are provided for moving the clutch device to move the contact and vary the strength of the current passing through the motor. There are means for de-energizing the clutch device to release it from the contact.

728,817. Starting Alternating-current Machines. Jonathan E. Woodbridge, Schenectady, N. Y., assignor to the General Electric Company. Application filed October 11, 1901.

Combination of windings constitute sources of current. Leads extend from the windings. Reactive coils are in circuit with some only of the leads. A switching mechanism is provided for connecting to a dynamo-electric machine, either leads including the reactive coils or leads not including the reactive coils.

728,820. Circuit Making and Breaking Device. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 17, 1901.

An electromagnet and a stationary contact terminal are combined with a contact member suspended and solely supported from one end and actuated by gravity to close the circuit, and by magnetism to open the circuit, and so disposed that the angle between the lines of magnetic and gravity pull thereon is less than 90 degrees, and the magnetic pull serves to hold the member freely suspended

728,821. Heater Cut-out for Electric Lamps. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed March 14, 1901. Renewed August 4, 1902.

An armature of an actuating magnet has a pivotal support above converging heater circuit terminals. Its center of gravity is below the support in all of its operative positions. The armature is moved by magnetism away from the circuit terminals and by gravity into engagement therewith.

REISSUE.

12,113. Railway Signal. Jonathan D. Price, Aurora, Ill., assignor to the Miller Signal Company, Chicago, Ill. Application filed July 18, 1902. Original No. 672,626, dated April 23, 1901.

A battery is connected with two of a number of insulated track-rail sections of different blocks. A magnet is provided for making and breaking the partial circuit thus formed and is normally energized to hold the partial circuit closed. Conductors lead from the magnet and through these the magnet is energized and de-energized.

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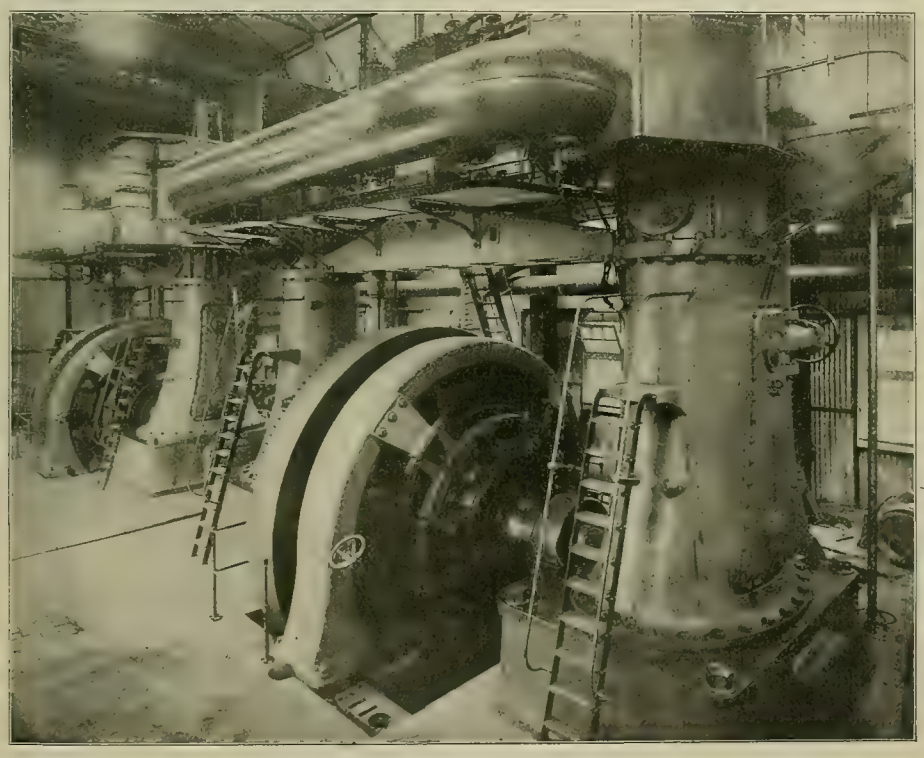
The London County Council's Tramway System.

[From a special correspondent of the Western Electrician.]

The early history of tramway locomotion in London will hardly prove of absorbing interest to the American. It is sufficient for the purpose to say that under the Tramways Act of 1870 local authorities have the option of purchasing the tramways in their localities at the end of a term of years, and this period has drawn to a close in respect to many lines in London, and will shortly expire with regard to all the remaining lines. In the north of London an agreement was made in 1896 with the companies owning the lines to purchase their undertaking and to lease it back again for 14 years at a fixed rent of $225,000 yearly and 12½ per cent. of the increased profits arising in subsequent years over the revenue of 1895. These lines are still being worked by horses, but the company, by agreement with the council, is about to convert them to electric traction. On the south of the Thames a large proportion of the horse tramways have come into the hands of the London County Council by the expiration of the concessions under the Tramways Act of 1870, and others have been bought out, and at the present time the whole of the South London lines are under the control of the council. The actual transfer of a large proportion of the lines took place on December 31, 1898.

The council employed Dr. A. B. W. Kennedy to advise as to the most suitable system of mechanical traction for London streets. This expert, after a special visit to the United States, reported emphatically in favor of the conduit system for the congested parts of London, and eventually the council decided to apply to Parliament for powers to reconstruct for electrical traction the whole of the tramways which it had already acquired, or might hereafter acquire. The first line to be reconstructed was that which runs from Westminster Bridge to Tooting, a distance of six miles, and this is the section which was opened by the Prince of Wales a few days ago.

Car on Line at Clapham.



Temporary Power Plant at Loughborough Junction.
LONDON COUNTY COUNCIL'S TRAMWAY SYSTEM.

Conduit Construction.

The system adopted on the Tooting lines represents an improvement upon that adopted elsewhere, it having been found practicable, for instance, to adopt a much narrower slot than is usual. A double track of four feet 8½ inches is employed throughout. The running rails are of steel, and of the girder type, weighing 102 pounds per yard. The slot rails are also made of steel, and each rail weighs 62½ pounds per yard. The opening between the slot rails, forming the slot through which the plow works, is three-fourths inch wide. The conductors are T-shaped rails of soft steel, with specially high conductivity, carried within a concrete conduit, the weight beig 22 pounds a yard, and being carried on insulated supports 15 feet apart. Cast-iron yokes carry the slot rails, which are bolted through the bottom flange to the tops of the yokes, and further stiffened by a tie-bar bolting the slot-rail web to a lug on the yoke head. The yokes are three feet nine inches apart. The normal depth from the top of the slot rails to the floor of the conduit is 24 inches, and the base of the yoke, which is buried in concrete, is six inches lower.

Access from the street to every insulator is given by cast-iron boxes, consisting of frame and cover. The opening is one foot four inches by one foot two inches. Means of draining the conduit are provided by deepening the insulator pits at every 50 yards, and laying pipes from the deepened pits to a sump in the margin, which in turn is connected with the sewer.

The conductors are divided by section insulators into sections not exceeding half a mile in length, each section consisting of a positive and negative length in each conduit. Normally, the two conductors of the same polarity in each section are electrically connected at a switch pillar, and each section is supplied with current by a separate feeder from the sub-station. Switches for cutting out the various sections are provided on the feeder pillar. Automatic cut-out and change-over switches are provided in the sub-stations for each section, which are so arranged that in the event of a fault occurring and persisting on the positive of any section, the polarity of the two conductors in that section can be reversed so as to throw the fault on to the negative, where it can remain until the stoppage of traffic at night allows it to be located and removed. The normal difference of potential of the conductors is 550 volts, and the insulated feeders for each section are drawn into stoneware ducts, which are laid either under the footpaths or under the road, according to circumstances.

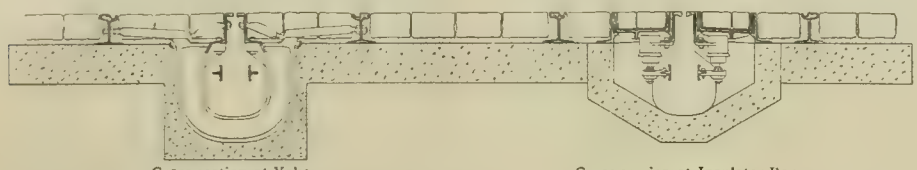
The conductor tees in the conduit are supported by a specially heavy form of insulator. These insulators are bolted to the under side of the slot rails at 15-foot centers, in such a way that they are readily accessible for inspection and removal. To them are attached by a special form of adjusting clip the conductor tee rails. The method of installing the tee rails is worthy of notice. Gaps are left in the conduit at certain intervals for the feeding in of the tees. As a matter of fact, the sump holes for draining the conduit to the sewers afford this facility, without, as a rule, special provision having to be made. The conductor tees are fed into the conduit at these openings and are suspended by means of special tools to small carriages running on the tables of the slot rails, and in this way are carried to the point where they are required, and secured to the insulators at each insulator box; the necessary bonds for connecting electrically the adjacent tee rails are fixed in position by a special hydraulic press, which can be used through the insulator-box opening.

Car Equipment.

The system will commence with 100 bogie cars. Since this order was placed a further order for 100 single-truck cars has been placed with Dick, Kerr & Co., and these are now being delivered. There are, of course, many interesting features in connection with the cars, not only by reason of the fact that they are used in conjunction with the conduit system, but there are modifications of detail which are not without interest. The bogie cars are carried on Brill maximum-traction trucks. They are of the reversed-stairway, "double-deck" type, and are designed to carry 66 passengers. The overall length of the cars is 31 feet six inches over the buffers, the extreme width being seven feet one inch. One plow is carried on each car, a plow carrier being carried

on an extension of one of the trucks. This consists of a strong rectangular frame, having a central rail on which the plow is free to move in a lateral direction.

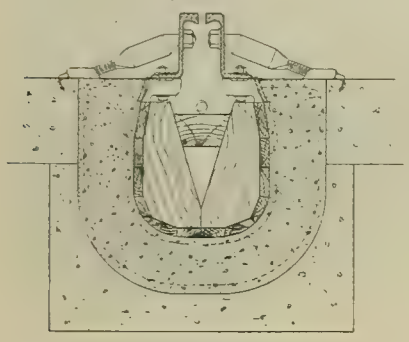
The electrical equipment on the cars consists of two motors which give nominally 37 brake horsepower. This motor, while being extremely efficient, has high acceleration properties, and has been designed to meet the special conditions obtaining in London. On account of there being no earth return on the London County Council system, it has been necessary to adopt double-canopy switches and automatic circuit-breakers on the cars.



Cross-section at Yoke. Cross-section at Insulator Box.

LONDON TRAMWAY SYSTEM.—CONDUIT CONSTRUCTION.

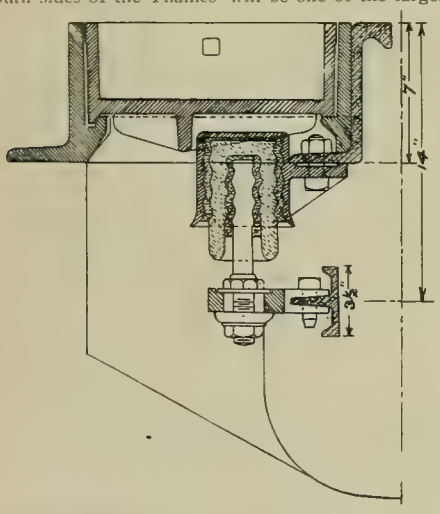
One of the most interesting features in connection with the cars is the new form of controller which has been adopted, and as this possesses some very special features, it will be interesting to give a description of it. This controller presents several important progressive deviations from the class of apparatus hitherto employed. The main features of novelty are the form of arc-disrupting device, and the arrangements for rheostatic braking. The controller itself is smaller than others fulfilling similar functions, while it is evident this end has not been obtained by crowding the parts together; in fact, the spacing is most liberal.



LONDON TRAMWAY SYSTEM.—SECTION OF SHUTTER FOR CONDUIT.

GENERATING STATIONS.

The council's main generating station is to be at Greenwich. This station, which is intended to supply current for the lines on both the north and south sides of the Thames will be one of the largest in the kingdom. It will ultimately have plant amounting to about 40,000 horsepower, the main generators being of about 5,000 horsepower each. Steam will be produced by means of water-tube boilers, and coal will be brought directly to the wharf outside the station by water. The position of the site on the river will also enable condensing plants to be used. Current will be generated at about 6,600 volts on the three-phase alternating system, and transformed at sub-stations to 550 volts direct. In connection with the Tooting lines, three sub-stations have been provided.



LONDON TRAMWAY SYSTEM.—SECTION OF SURFACE BOX.

The generating station at Greenwich is not yet built, and a temporary station has been erected on the works of the South London Electric Supply Corporation, which supplies the necessary steam. Although the electrical machinery at present in position in this temporary station serves only that portion of the line which extends from Westminster Bridge to Tooting, the order already placed for generating plant includes two 1,500-kilowatt, direct-current machines and three-phase machinery, consisting of two 1,500-kilowatt generators and 11 300-kilowatt motor-generator sets, and various other small auxiliary sets, including small motor-generator sets and steam-driven exciters. The two 1,500-kilowatt, direct-current machines are coupled direct to Ferranti vertical engines. The generators are 12-pole type, compound-wound, and when running at a speed of 150 revolutions per minute develop at full load 2,400 amperes at 625 volts.

Another huge generating station will be built at Pimlico, for the site of which $400,000 has recently been paid.

May other portions of the lines in South London have been selected for reconstruction, and estimates amounting to over $4,000,000 have been approved by the council. The length of the lines so to be reconstructed is about 19¼ miles.

The inauguration of the working of the Tooting lines by electrical traction represents, therefore, the completeness of only a small portion of the task which the London County Council has set itself—a task which will be carried out with the greatest possible dispatch, so that in a no distant future London may take a leading position in the provision of facilities for its vast traveling public. W.

National Fire Protection Association.

The seventh annual meeting of the National Fire Protection Association was held at the rooms of the Chicago Underwriters' Association, May 25th, 26th and 27th. This body comprises in its membership the leading stock fire-insurance organizations of the country, together with their representatives and individuals connected with the fire-insurance business. Its objects are promotion of the science and improvement of the methods of protection against fire, and circulation of information on allied subjects.

Reports were presented to the association by special committees on steam fire pumps, uniformity of requirements, gas engines for fire pumps supplying high-pressure fire service at Philadelphia, fireproof construction, standards for grading towns, public fire protection, rotary fire pumps, construction of metal waste, ash, refuse and oil cans, thermoelectric fire alarms, heavy-current protectors on wires of signaling systems, relative fire hazard of cotton as baled by various methods, specifications for cast-iron water pipe and fittings, automatic sprinkler requirements, devices and materials, hose and hydrants, mill-yard hose houses, electrically driven fire pumps, field practices, special hazards and fire record, fire protective coverings for window and door openings, and municipal fire-signal systems and their auxiliaries.

F. E. Cabot of the Boston Board of Fire Underwriters, chairman of the committee on thermoelectric fire alarms, presented proposed specifications for installation of automatic journal alarms

The committee on municipal fire-signal systems and their auxiliaries presented requirements for installation of auxiliary fire-alarm systems, the report being read by Ralph Sweetland of the New England Insurance Exchange, Boston, representing C. M. Goddard, the chairman of the committee. This report was referred back to the committee for an amendment of Article 5 to provide for inspection by the installing contractor of systems in which an alarm is transmitted to a central station, and from there to the fire-alarm system, and was then accepted and the requirements adopted.

Recommendations of the committee appointed to draw specifications for electrically driven fire pumps were read by Mr. Sweetland, representing Chairman Goddard of the committee. An animated discussion of the report took place, and the requirements as presented were referred back to the committee for extension to cover several details which had not received especial consideration.

The business session closed on Wednesday, May 27th, with the election of the following-named officers to serve during the coming year: President, Charles A. Hexamer, manager Philadelphia branch, Hartford Fire Insurance Company; vice-president, William A. Anderson, superintendent of inspections, New York Board of Fire Underwriters; secretary and treasurer, William H. Merrill, Jr., secretary Underwriters' Laboratories, Chicago.

On Tuesday evening members of the association were the guests of officials of the Western Factory Insurance Association at Midlothian, and Thursday was spent at the Underwriters' Laboratories in witnessing tests of fire-retardent and protective materials and apparatus. The convention was largely attended and was of more than usual interest to those present. The association has shown a considerable increase in membership since the last annual meeting, and is growing in influence as its field of usefulness is extended.

Testing Outfit for Small Central Station.

[From the Question Box of the National Electric Light Association.]

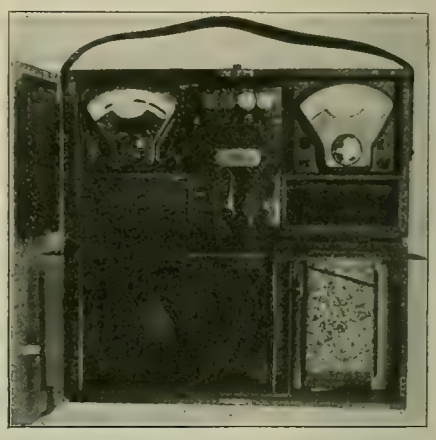
These were the questions: "Of what should the testing outfit consist in a small central station supplying direct current for arcs and alternating current for incandescents? What would be the cost?"

Here are the answers:

A. O. Fritz, Doylestown, Pa.: The testing outfit should consist of a lamp-testing wattmeter, a portable wattmeter, a portable voltmeter, a portable ammeter, a stop-watch and a photometer. The cost not definitely known, but about $250.

Edison Electric Illuminating Company of Boston: Ammeters, voltmeters and indicating wattmeters of suitable capacities to suit the capacity of the various generators and feeders in the station. The prices of such instruments vary with capacities, and it is suggested that the catalogues of the manufacturers will give this information accurately. Cost should be under $500.

E. B. Greene, Altoona, Pa.: We think we have a novel arrangement for taking care of and transporting our testing outfit for meters. It consists of a box similar to a dress-suit case, 20 inches long inside, 9½ inches wide, and 3½ inches deep on each side, with a fiber division, hinged, which serves as a deck when testing. The accompanying cut shows the arrangement with the case open, showing the little shelf with hook to attach to meter base, and the magnet-adjusting wrench.



TESTING OUTFIT FOR SMALL CENTRAL STATION.

The contents of the case are as follows: One Weston voltmeter; two scales, one reading 0 to 150 and the other reading 0 to 300; one milliammeter with shunts, 1.5, 15 and 75 amperes. Adjoining the voltmeter is a small box for carrying the Thomson pocket repair outfit, meter seals, and other sundries; the other small box has a receptacle for the stop-watch, extra plugs, and such sundries as are found necessary in testing and adjusting meters. On the opposite side of the case there is a receptacle for the books and blank paper, a receptacle for the sealing tool and magnet wrench, and a larger space to carry the flexible cables, voltmeter cords, and a small Davidson syringe for cleaning commutators. This outfit, including everything, cost $220.50, and, as equipped, is suited for direct-current work only.

For alternating-current testing, we use a Thomson inclined-coil, direct-reading, portable wattmeter, and a Weston alternating voltmeter, which instruments take the place of the direct-current instruments as shown in the carrying case, taking out the direct-current shunt, using the same cables and voltmeter cords. The alternating set cost $97.50.

In connection with the above, we have three banks of test lamps, which are carried with the outfit to make a fixed load on the meter to be tested.

No Southwestern Convention This Year.

Frank E. Scovill of Austin, Texas, announces that it has just been decided not to hold any annual convention of the Southwestern Gas, Electric and Street Railway Association, of which he is secretary, this year. The convention will be held at Dallas, Texas, in May of next year. The postponement was due principally to the illness and removal from the state of H. A. Evans, who preceded Mr. Scovill as secretary. Mr. Scovill says that he found that he could not get the books of the association in time for the proposed convention, and this fact, together with other occurrences affecting the organization, led to the decision not to hold a convention this year.

Boiler and Furnace Efficiencies.[1]

By A. Bement.

It will be interesting to make a comparison of the principal losses that occur with boilers and furnaces. For this purpose Figs. 1 and 2 have been prepared. These diagrams are designed to be pictorial illustrations showing the relations that these individual losses bear to each other, and would be best shown by one diagram if it were not for the complication of a large number of lines in one figure. For this reason the boiler loss is shown in Fig. 1 and that of the furnace in Fig. 2. With the former the performance of boiler No. 3 is selected to represent the loss owing to decreasing cooling effect with a very efficient boiler, and No. 2 for a much less efficient boiler.

[Earlier in the paper these boilers are thus described: No. 2 is 17 tubes high and 19 wide. The

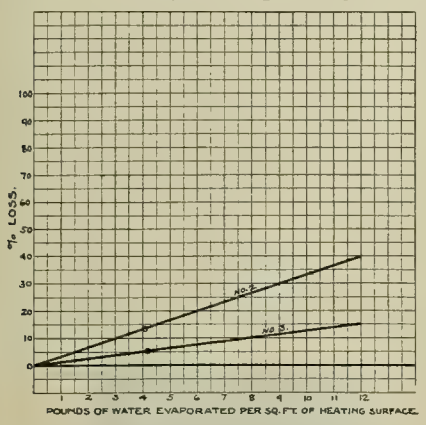


FIG. 1. BOILER AND FURNACE EFFICIENCIES.

gases travel from the bottom of the back and diagonally across the tubes to the upper front end, thence back between the drums to the flue. No. 3 adjoins No. 2 in battery, and is identical with it, except that the path of the gases from the back end is forward among the lower tubes of the second to the seventh rows; thence to the front end of the boiler, then back among the next five rows and finally forward among the upper five rows, where they pass between the drums to the flue. In this arrangement the gases traverse the length of the tubes three times, in place of the one diagonal travel of boilers No. 2. The furnaces under these boilers are identical, and each is fitted with a chain-grate stoker of 72.2 square feet. The tubes in the lower row of the boiler are entirely encircled with a firebrick tile from the front to a point back of the bridge wall; for the remainder of the distance to within four feet of the back end the usual tile furnished by the maker of the boilers is used.]

The zero of loss is taken at the steam temperature, because below this point no further cooling of the gases can take place; the range of capacity is carried up to the evaporation of 12 pounds of water per square foot of heating surface per hour, and the

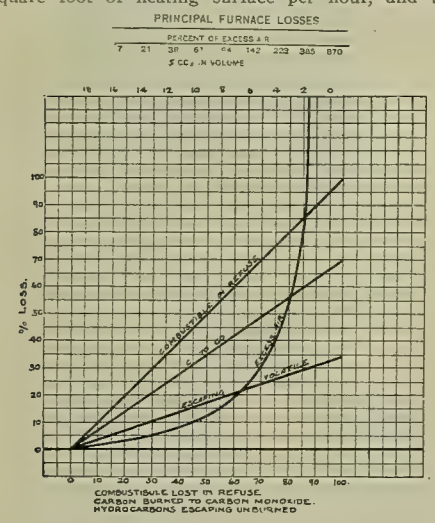


FIG. 2. BOILER AND FURNACE EFFICIENCIES.

location of the lines is governed by the performance of the two boilers in tests. These two losses are represented as straight lines, which is not entirely correct, because as such they will intersect the line of 100 per cent. loss if capacity be carried far enough, but a boiler could never be driven so hard that its efficiency would become zero. The representation by straight lines is sufficiently correct, however, for the purpose in hand.

Referring to Fig. 2, the losses owing to combustible in the refuse, carbon burned to carbon monoxide, and to escaping volatile combustible, are each carried to the theoretical maximum. It is, of course, impossible that all of the volatile matter could escape unburned; or that all of the carbon could be oxidized to carbon monoxide, as this is unattainable, even in a gas producer. Neither would it be possible for all of the combustible to be lost in the ash pit, because then there could be no fire. But it is useful to represent these three losses through this entire range for purpose of comparison with that owing to excess of air. The calculation of the loss of escaping volatile matter is based on Pittsburg coal. The curve of excess of air is based on final temperature of 550 degrees Fahrenheit, and a combustible of 14,000 British thermal units per pound. As mentioned, the combustible losses can never be as high as 100 per cent., but the loss by excess of air can be as high as that, because with a small fire and large enough air supply, the initial temperature may be as low as that of the boiler. For this loss to be over 100 per cent., however, requires that stored heat from brickwork and furnace walls be given up to the air and gases in the furnace in addition to the heat from the fuel; such loss can exist for only a short time because the brickwork would soon become cooled. But that it is possible is proven by measurements showing a final temperature of 520 degrees with one per cent. of CO_2.

1. Conclusion of a paper read before the National Electric Light Association at Chicago on May 26, 1903.

Electric Pumping on California Farm.

G. W. Rowe has installed an electric pumping plant on his fruit and berry farm on the San Juan Road in Monterey County, Cal. The electric power used is generated at Big Creek, 40 miles distant, and from that point starts with a voltage of 22,000. In Pajaro the voltage is stepped down to 2,200, and the current is transmitted at that potential to the point of operation, where it is again stepped down to 200. With this voltage it operates a Westinghouse two-phase, alternating current, 10-horsepower motor to run a six-inch centrifugal pump at the speed of 1,200 revolutions, throwing 30 miner's inches, or 300 gallons a minute.

The operation of the motor does not call for any extra service. On the contrary, when once started, it requires no attention, and will pump incessantly until stopped, unless some interruption occurs in the main service. The cost of installing the electrical service was $500, it is said, and the cost of operating at the present time is placed at 27¾ cents an hour. The current, according to the accounts, is figured at the low rate of five cents a kilowatt-hour. The installation of the pumping is due to the efforts of Assistant Superintendent W. A. White of the Watsonville Water and Light Company, who for a long time past has been endeavoring to impress upon our orchardists the convenience, reliability, safety, and, above all, the economy, of electricity for pumping purposes. Mr. Rowe is unstinted in the expression of his praise of the way in which the pump does its work. He states it is his intention to loosen the throttle on the pump and allow the motor to run nearer to its full capacity. A cut-off and return pipe will be attached, and the surplus above the demand of the fields will be returned to the well. The owner believes that the wear on the pump will be reduced to a minimum by allowing it to work unhampered, and that the use of power will not be materially increased.

Indianapolis Lighting Specifications.

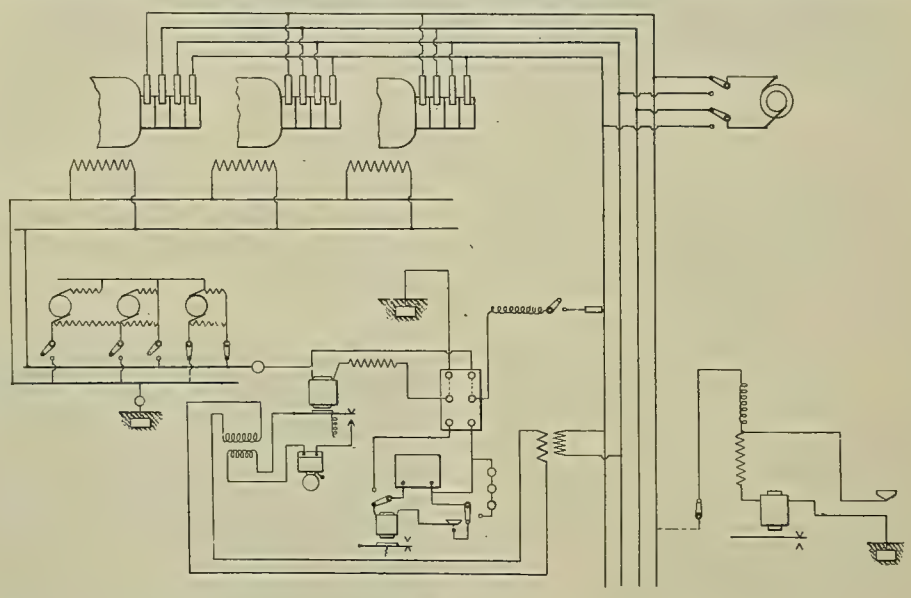
The Indianapolis Board of Public Works has completed the specifications for the electric-lighting contract, which provides for a 10-year term, beginning January 1, 1905. The purpose of postponing the date to 1905 is to give the successful bidder time to construct a plant. The present contract expires in July. As a consideration in the bids, the city offers to award a franchise for private lighting for a period of 25 years to the successful bidder for public lighting, the charge for the private use not to be over 10 cents a kilowatt, and the city to receive five per cent. of the gross receipts. Sealed bids must be accompanied by a $10,000 certified check, and the successful bidder will be required to furnish a surety-company bond for $50,000. The city reserves the right, under equitable provisions, to buy the plant. The specifications of the contract are now ready to be sent to those who wish to examine them with a view to bidding.

A New Ground Detector.

Among the United States patents under date of May 12, 1903, was one (No. 727,865) issued to Thomas W. Varley of New York, for improvements in ground-detectors for electric circuits.

The object of the invention is to provide convenient, reliable and effective means for determining whether the insulation of any portion of the system has fallen below a predetermined standard, and, if so, for locating such faulty portion and also for affording a convenient method of intercommunication between different parts of the circuit and the central station.

The general plan of the invention may be described as follows: A source of current at the central station has its respective poles connected with bus-bars in the usual manner. One bus-bar (the positive) is connected with the earth through a high resistance. The negative bus-bar is connected through a resistance with two branch circuits, one leading through a protective resistance to one branch of the main bus-bars or to the distributing circuit, and the other through a circuit-controlling magnet and a suitable resistance to the earth. A signaling device is included in the circuit controlled by the magnet, so that a signal will be given when the armature falls away from the magnet.



A NEW GROUND DETECTOR.

Normally, both sides of the source are grounded through the resistance, and the current traversing the magnet will hold its armature forward. If, however, a ground occurs upon the main circuit with which the branch around the magnet is connected, the magnet will be to a certain extent shunted, and its armature will be released, causing the signal to be given.

Certain additional apparatus is provided, whereby an operator, by properly manipulating the circuit connections upon different portions of the system, may cause an indication to be made at the central station, showing when the faulty portion of the circuit is being manipulated.

The accompanying diagram will aid the reader in gaining an idea of Mr. Varley's invention.

Power Transmitted over 300 Miles.

The California Gas and Electric Company has placed contracts for electric machinery to cost $500,000, with the Stanley Electric Company. The latter company will fully equip two power stations at Nimshew and French Creek, Cal., the equipment to include four generators of 4,000 kilowatts capacity. The California Gas and Electric Company is a combination of the Bay Counties Company and the Valley Counties Power Company, its capital being $15,000,000. Recently the Bay Counties Company transmitted electric power over 300 miles and propelled cars by it, the power being generated by a Stanley machine.

New Western Members of the Institute.

At the regular monthly meeting of the directors of the American Institute of Electrical Engineers, held in New York city on May 19th, 140 new names were added to the list of associates. For want of space, only the names of those residing in that part of the United States lying west and south of Pennsylvania and the Virginias and those from foreign countries are here given. They are as follows:

Adelaide, South Australia, John P. V. Madsen, University of Adelaide.

Ames, Iowa—Herbert W. Dow, Iowa State College; Louis B. Spinney, Iowa State College.

Ashcroft, B. C., Can. Clement A. Cornwall, British Columbia Electric Railway Company.

Berwyn, Ill.—John M. Humiston, Chicago Telephone Company.

Boise City, Idaho—Frank J. Engelhorn, Capital Electric Light, Motor and Gas Company.

Budapest, Austria, Hungary. Joseph Hollos, Telegraph Department, Ministry of Commerce.

Chester, England.—John H. Woolliscroft, Sandycroft Foundry Company.

Chicago, Ill. Max A. Berg, Porter & Berg; Henry P. Clausen, American Electric Telephone Company; William L. Fergus, Charles G. Armstrong & Co.; William A. Fox, Chicago Edison Company; O. C. Hovland, Automatic Electric Company; Perry F. Miller, Postal Telegraph Cable Company; Charles W. Naylor, Marshall Field & Co.; Frank B. Spencer, with William D. Ball.

Cincinnati, Ohio. J. Herbert Steele, Bullock Electric Manufacturing Company.

Cleveland, Ohio.—Irving H. Sherwood, E. P. Roberts & Co.; Henry W. Woodward, Cleveland Engineering Company.

Columbus, Ohio.—Lucius B. Andrus, Westinghouse Electric and Manufacturing Company; Walter G. Jayne, Columbus Edison Company.

Darmstadt, Germany. Clarence Feldman, Polytechnical High School.

Davenport, Iowa.—Isaac N. Butterworth, Tri-City Electric Company.

Denver, Colo.—Philip Hamlin, Colorado Telephone Company; Bradford H. Locke, Locke Drill Company; Harold Lomas, Crocker-Wheeler Company.

Evanston, Ill. Albert L. Tucker, Western Electric Company.

Georgetown, British Guiana.—Harry G. Spain, Postoffice of Colony.

Glasgow, Scotland.—Ernest T. Goslin, Corporation Tramways.

Hamilton, Ont.—William G. Angus, Hamilton Electrical Light and Cataract Power Company.

Hertfordshire, England.—Arthur H. Lidderdale, Westinghouse Electric and Manufacturing Company.

Indianapolis, Ind.—Walter A. Royse, Royse & Batley.

Jalapa, V. C., Mexico.—Lynn S. Kedney, Jalapa Railroad and Power Company.

Kent, England.—Frank Gill, The National Telephone Company.

Lafayette, Ind.—George H. Morris, Purdue University; Clarence E. Reid, Purdue University; Earl D. Silver, Purdue University.

Lewiston, Mont.—Henry W. Fellows, Citizens Electric Company.

London, England.—Charles W. Clack, Western Electric Company; Sebastian Z. de Ferranti, Ferranti, Ltd.; Frank K. Jewson, Western Electric Company; Henry M. Pease, Western Electric Company.

Memphis, Tenn.—Frederick G. Proutt, The Memphis Light and Power Company.

Mexico City, Mex.—Martin G. Ribon, Mexican Gas and Electric Light Company.

Milwaukee, Wis.—Frederick S. Wilhoit, Cutler-Hammer Manufacturing Company.

Minneapolis, Minn. Edward H. Scofield, Twin City Rapid Transit Company.

Montreal, Quebec.—John G. Glassco, McGill University; John A. Walls, Shawinigan Water and Power Company.

Mt. Bullion, Cal.—Edwin T. Blake, Mariposa Commercial and Mining Company.

Newcastle-on-Tyne, England.—William McLellan, partner, Charles H. Merz.

Rugby, England.—Paul A. Mossay, British Thomson-Houston Company.

Solingen, Germany.—Schwennicke, Berginbe Electric Works.

Sacramento, Cal.—Clarence D. Clark, Sacramento Electric, Gas and Railway Company.

San Juan, Porto Rico.—James A. Pietsch, San Juan Light and Transit Company.

Springfield, Ill.—Albert V. Schroeder, Springfield Electric Light and Power Company.

St. Louis, Mo.—Will M. Dixon, World's Fair; Charles T. Malcolmson, Department of Machinery, World's Fair; Charles R. Meston, Emerson Electric Manufacturing Company, Henry L. Reber, Kinloch Telephone Company; Antoine R. Rivet, Globe-Democrat.

Stockholm, Sweden.—Gustav Lindman, St. Louis Transit Company; Robert Dahlander, Royal Government Railways of Sweden.

Sydney, N. S. W.—John J. R. C. Rogers, Lighting Station, Yaralla Concord.

Terre Haute, Ind. Carl L. Mees, Rose Polytechnic Institute.

Vancouver, B. C.—Marshall C. McKay, Vancouver Power Company.

West Didsbury, England.—William McClelland, with C. H. Wordingham.

Westeras, Sweden.—Johannes S. Edstrom, Allmanna Svenska Electric Company.

Western Springs, Ill.—William H. Beattys, Jr., Cutler-Hammer Manufacturing Company.

Westmount, Quebec.—Walter L. Macfarlane, Montreal Light, Heat and Power Company.

Artemieff's Protective Suit for Electrical Workers.

Writing from Eibenstock, Germany, under date of May 4th, United States Consul Ernest L. Harris makes this report: "Professor Artemieff, director of the Electrotechnical Institute at Kief, Russia, has invented a suit which is an effective protection against live wires. It was intended at first for the use of students in his laboratory, but proved to be so practical that the well-known firm of Siemens & Halske, Charlottenburg, Berlin, has taken up its manufacture and sale. The suit consists of a closely woven network of metal fibers, lined with linen, which completely covers the body from head to foot. It is worn outside of the ordinary clothing. The mask which covers the head does not materially influence the eyesight. The outfit is especially valuable to those whose business is the mending of live wires. Experiments show that 200,000 volts make no impression on either the wearer or the outfit."

Decorative and Sign Lighting.[1]

By Arthur Williams.

The electric light, depending in no measure on a fixed position, unable to communicate fire,[2] and self-protected from the elements, offers unrivaled and heretofore unattainable advantages for the purposes suggested in the title of this article.

One method of utilizing these advantages permits the lamps to be concealed, and light to be obtained by reflection. Illustrations are found in the lighting of a room from behind the cornices; of a window or showcase (the latter constructed wholly of plate glass or having a glass front), with the lamps concealed behind metallic reflectors; of an art gallery in which the lamps are held and all but concealed in semi-circular reflectors, suspended from the ceiling,

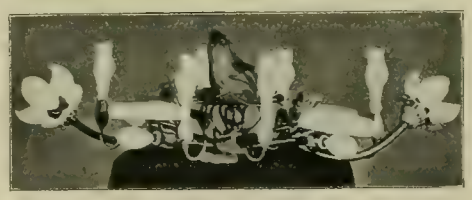
STAGE SETTING WITH ELECTRICAL EFFECTS.

projecting light to the pictures on the wall; or here the lamps may be placed on the larger frames of the pictures themselves, and the source of light entirely hidden.

The incandescent lamp permits the elimination of the conventional fixture creations of various orders and materials with which we have become familiar from infancy. Well designed fixtures have uses, but not as often as is supposed. One suggestion is found in church or auditorium lighting, in the substitution of an artistic, almost invisible, metal band, carrying the requisite number of lamps, around the upper part of the supporting column at or near the capitals, or following the lines of arches, windows or decorations. The removal of all fixtures oftentimes results in better acoustics, augments to the fullest extent the suggestion of size, and subordinates everything to the architectural design of the edifice.

These suggestions relate to necessary illumination made artistic—artistic because nothing is in evidence but the illumination. Decorative lighting is something else. Here the incandescent lamp has the best chance to show off, because it alone of all possesses the quality of availability. No other lamp is possible for the illuminated fountain now used indoors as well as out; for the tiny lights among flowers and smilax on the table, in bridal decorations, or for some great festival or other occasion.

It has been the custom on fete days to mark the outlines of the public buildings of Paris with myriads of gas jets, but their use is confined to good weather, and even then the effect cannot be said to compare with that in white or colors, produced frequently on our own public buildings, with incandescent lamps. Picture the wonderful scenic effects accomplished in



NEW DESIGN FOR ORNAMENTAL TABLE LIGHTING.

the illumination of the Pan-American buildings, the thousands of incandescent lamps first appearing at twilight with the slight heat discoloration of the filament and gradually increasing until the brilliancy of their full candlepower was reached. And with that incomparable scene consider the tameness of the effects produced at the Glasgow and Berlin exhibitions of the same year, where the use of electricity was confined to a few exhibits, and to still fewer electric signs.

The electric light, in its application to signs, serves possibly a more utilitarian purpose, but not necessarily one that is entirely inartistic. Those who have stood on the river embankment at London and there seen across the Thames a simple sign of immense proportions spelling in colors a single word, may have thought the view, in its many repetitions, monotonous, yet, shining alone in the darkness, it gave that entire section of the city an appearance of life that could not be otherwise obtained. Where is such another sight to be found as the vistas on our New York Broadway, looking in almost any direction in the evening hours, unless perchance in some of our other great electrical centers—Boston, Chicago, Philadelphia. The picture is artistic and interesting on a clear night, but in mist or rain all is greatly enhanced. These signs serve important commercial purposes; some, taken singly, may be anything but well designed or artistic, but taken altogether they give to the thoroughfare a wonderfully high degree of attractiveness.

Signs not only spell words, names or sentences, but serve the further purpose of illuminating the premises and the street, thereby giving a double value. The first is advertising, the second light; both are desirable. Each has a definite commercial value; one is a necessity, and in some form must be had at any price.

These features, beyond the mere giving of light, can be made of enormous commercial value in the electrical industry. One may not always find sufficient incentive to adopt electric light simply because of the difference in the quality of the light, but, adding convenience and cleanliness—features upon which I have not touched—and the further quality of artistic arrangement, alone or in conjunction with existing conditions, we have a combination that for health, comfort and satisfaction in living can hardly be equaled, much less surpassed. Decorative lighting, purely as such, is seldom remunerative, but it offers one of the best suggestions of the many uses of electric service, and has probably never been undertaken on any large scale, and artistically, without starting a great many lines of thought to the benefit of the supplying company. Electric signs not only advertise their user, but in the best sense, themselves.

ELECTRIC TOWER AND FOUNTAIN AT CONEY ISLAND.

The installation of one sign on a dark block will lead almost invariably to more signs or to better show windows and interior illumination. All of which is advertising—not lighting—primarily, and the lighting, being additional, practically doubles the normal revenues.

For sign illumination, originally plain or frosted lamps of 16 candles were largely used, but as the "use factor," if I may employ the term, averages 100 per cent., and is of long duration, the cost of electric current limited, and in many instances entirely prevented, the use of signs of this type. There was no necessity for light units of that size, and the practice soon changed to the general use of eight-candle lamps, and now even smaller sizes, such as four, five and six candles, are widely employed. Lamps of high efficiency, 3.1 watts per candle, are satisfactory for the larger sizes, but it is desirable, if not necessary, to lower the efficiency, and thus increase the durability, to 3.5, four or five watts per candle where the smaller lamps are used.

Lamps of 16 candles consume approximately 50 watts; of eight candles, 30 watts, and of four candles, such as are recommended where eight candles are not used, 20 watts. Were the life of each the same (the company making the renewals) the renewal cost a kilowatt-hour would almost double with lamps of eight candles and become nearly three times with the four-candle standard. In changing to the lower efficiencies, with corresponding increase in life, the supplying company obtains closely an even cost for lamp renewals, at any candlepower, and the lessened breakage rate means that fewer lamps are out of service simultaneously, and therefore is obtained a

1. Illustrated committee report presented to the National Electric Light Association at Chicago on May 28, 1903. Mr. Williams is general inspector of the New York Edison Company.

2. Omitting conditions under which the small degree of heat radiated from the bulb is stored and becomes effective accumulatively.

higher average or more even character of illumination throughout the sign.

Miniature lamps lend themselves especially well to artistic sign lighting, but first and renewal cost is high, and they are very much less efficient in the use of current than lamps made with standard filaments. Variation from standard sizes in filaments, as well as in bases, and the frequent use of several lamps in series, make it necessary for either the supplying company to carry a special stock, or for the consumer to carry a larger stock than he would, could he obtain these lamps directly from the supplying company. It is questionable whether these differences justify the use of miniature lamps under other than unusual conditions.

What is said of signs is also true in large measure of decorative lighting, more especially where that lighting is permanent. Almost without exception four and eight-candle lamps are sufficient, the larger sizes being required only where illumination is the primary, or at least an important, consideration.

[Mr. Williams' report was profusely illustrated. Five of the pictures are here reproduced.]

Institute Convention at Niagara Falls.

As previously announced, the annual convention of the American Institute of Electrical Engineers will be held at Niagara Falls, N. Y., on June 29th and 30th and July 1st, 2d and 3d next. The detailed programme is as follows:

MONDAY, JUNE 29TH (INSTITUTE AND PRESIDENT'S DAY).

1. (9:30 a. m.) President Scott's Address.
2. "Institute Branch Meetings—Their Organization, Development and Influence," by Calvin W. Rice.
3. "The Energy Transformations in the Synchronous Converter," by W. S. Franklin.
4. "Commercial Alternator Design," by W. L. Waters.

MONDAY AFTERNOON.

Visits to local points of interest, beginning at 2 p. m. No prearranged programme.

MONDAY EVENING.

5. An exhibition of the Hewitt converter and the mercury-vapor lamp, by P. H. Thomas.

TUESDAY (ELECTRICAL DAY).

1. (9:30 a. m.) "High-speed Electric-railway Problems," by A. H. Armstrong.
2. "Storage-battery Industrial Locomotives," by Frank L. Sessions.
3. "Predetermination in Railway Work," by F. W. Carter.
4. "Car Run Tests," by W. E. Goldsborough and P. E. Fansler.
5. "Some Recommendations Concerning Electrical and Mechanical Specifications for Trolley-line Insulators," by Samuel Sheldon and J. D. Keiley.
6. "The Storage Battery in Sub-stations," by W. E. Goldsborough and P. E. Fansler.

TUESDAY AFTERNOON.

Beginning at 2:15 p. m. Technical tour of inspection of electrochemical and other electrical installations operated by Niagara Falls power and the power houses of the Niagara Falls Power Company.

Reception by Niagara Falls Power Company on terrace of Power House No. 2.

TUESDAY EVENING.

Dance under the auspices of local committee at Cataract House.

WEDNESDAY (NIAGARA DAY).

1. 9:30 a. m. "On the Testing of Electrical Apparatus for Dielectric Strength," by P. H. Thomas.
2. "Choice Frequency for Very Long Lines," by P. M. Lincoln.
3. "Method of Entering Buildings with High-tension Wires," by C. E. Skinner.
4. "Y or △ Connection of Transformers," by F. O. Blackwell.

WEDNESDAY AFTERNOON.

Trolley trips to Niagara Gorge, Fort Niagara, Brock's Monument, Chippewa.

Technical visits to plants of Niagara Falls, Hydraulic Power and Manufacturing Company, Canadian Niagara Power Company and Natural Food Company.

WEDNESDAY EVENING.

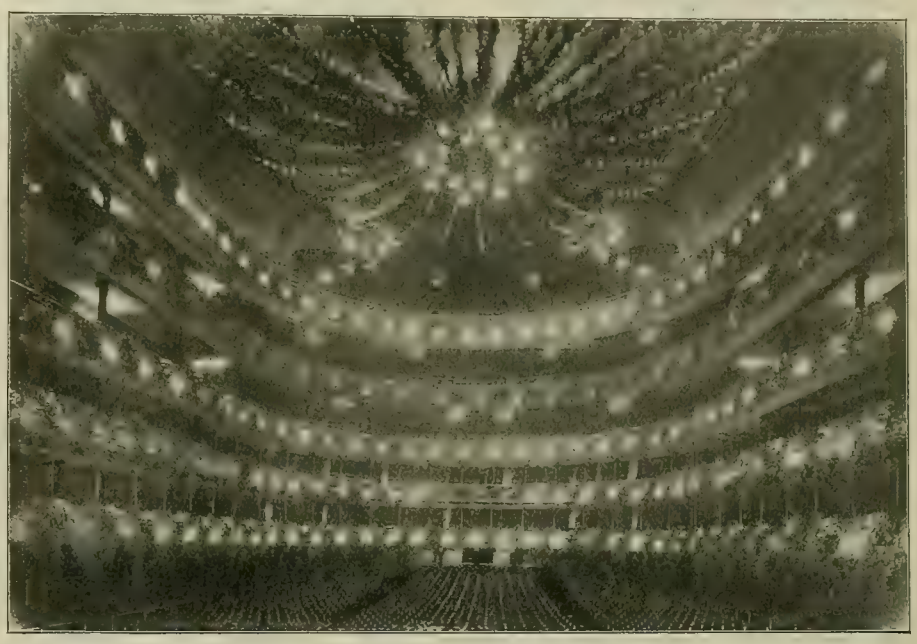
Entertainment at Cataract House under auspices of local committee and general committee.

THURSDAY (EXCURSION DAY).

1. "The Factors Which Affect the Energy Losses in Armature Cores," by J. Walter Esterline and Clarence E. Reid.
2. "Central-station Economies," by W. E. Goldsborough and P. E. Fansler.
3. "The Electrical Equipment of a Gold Dredge," by Ralph L. Montagu.
4. "The International Electrical Congress of 1904," by Elihu Thomson.
5. "The Legalized Standard of Electromotive Force," by H. S. Carhart.
6. "Symbols and Nomenclature," by Carl Hering.
7. "A Universal Telegraphic Code," by G. O. Squier.
8. "The Magnetic Units," by A. E. Kennelly.

THURSDAY AFTERNOON.

Technical excursions to Olcott Beach, St. Catharine's Lockport, Tonawanda sub-station.



INTERIOR OF METROPOLITAN OPERA HOUSE, NEW YORK, DECORATED WITH ELECTRIC LIGHTS AND SMILAX.

THURSDAY EVENING.

Illumination of Gorge Route.

FRIDAY (BUFFALO DAY).

Joint meeting with the Society for the Promotion of Engineering Education.

Papers will be presented by the following-named members of the Institute: W. S. Franklin, J. G. White, E. H. Mullin, B. Gherardi, Jr., L. A. Osborne and T. J. Johnston.

FRIDAY AFTERNOON.

Technical trips to Buffalo, Buffalo General Electric Company, Buffalo Terminal House.

CHICAGO PARTY.

Mr. Junkersfeld, the local honorary secretary of the Institute in Chicago, is endeavoring to organize the Chicago members visiting the convention into a compact body to travel together. He has appointed a transportation committee consisting of Homer E. Niesz, T. P. Gaylord and V. R. Lansingh, and these gentlemen are making the arrangements. It is hoped that Chicago will be represented at the convention by a large party. Gentlemen intending to go are requested to communicate with the members of the committee.

EASTER ELECTRICAL DECORATIONS IN CHICAGO DEPARTMENT STORE.

Electric Automobiles in Massachusetts.

The purchase of electric-lighting companies in places adjacent to Boston by the Edison Electric Illuminating Company of Boston undoubtedly will result in an increase in the use of electric automobiles. Hitherto the owner of an electric carriage never knew whether he could find suitable or sufficient recharging stations on untried routes to warrant his running far from Boston, and even in the city the public recharging stations have been confined to a small area. By the end of summer the Edison company expects to arrange for the charging of electric automobiles in nearly every large garage, at the electric-light stations, and even in many livery stables in the Boston district. Most of the places will be open day and night. The company is also considering the feasibility of selling books containing coupons, each good for a certain amount of electricity. By the first of August about 40 recharging stations in Eastern Massachusetts, within a fair running distance of one another, will be available. The charge will be at the rate of 10 cents a kilowatt, the minimum being 30 cents.

The Edison Company of Boston has ordered a special equipment of heavy electric trucks and lighter vehicles, to be used instead of horses and wagons in caring for its wires and lamps in Boston and its suburbs. The heavy vehicles will have special electrical devices for hoisting poles, drawing wires through conduits, and there will be a light van for emergency repairs, with a speed capacity of 16 miles an hour, and two trimmers' wagons.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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DATES AHEAD.

New York State Independent Telephone Association, Butterfield House, Utica, N. Y., June 10th.

Canadian Electrical Association, Toronto, Ont., June 10th to 12th.

Pacific Coast Electric Transmission Association, Hotel Rafael, San Rafael, Cal., June 16th and 17th.

Independent Telephone Association of the United States of America, Chicago, June 24th and 25th.

American Society of Mechanical Engineers, Saratoga, Springs, N. Y., June 22d to 26th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

International Association of Municipal Electricians, Hotel Rudolf, Atlantic City, N. J., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

SEVERAL of the papers presented at last week's meeting of the National Electric Light Association were out of the usual run, and one of these was on "First Aids and Appliances for the Injured," by J. D. McGowan, M. D., of Chicago. It is needless to say that this subject is of great importance to all men who work about mechanical plants, whether electrical or otherwise. Dr. McGowan's suggestions and directions are set forth in a very clear, concise and practical way, so that every electrical man can understand them. We print the paper in full in this issue of the Western Electrician, and suggest that it be preserved in some convenient place for consultation when the emergency arises.

IN SELECTING Boston, rather than St. Louis, as the place of its annual meeting of next year, the National Electric Light Association has undoubtedly acted wisely. May is the month of holding the convention, and is now so fixed by custom if not by a constitutional provision. The Louisiana Purchase Exposition, St. Louis' great attraction for next year, will not be open until June. It is probable that a World's Electrical Congress will be held in St. Louis, in connection with the exposition, in the summer or early autumn, and at that time the National Electric Light Association will undoubtedly unite with the American Institute of Electrical Engineers and other electrical societies to make the congress a success. But the association can best transact the business of its own annual meeting in some place away from the turmoil of the exposition city.

OF QUITE unique interest is the contest between the esthetes and the utilitarians in relation to the power development of Niagara Falls. On the one hand it is contended that such a stupendous manifestation of the grandeur of Nature as the cataract, gorge and rapids at Niagara should not be marred by a merely industrial development, but should be left in its original state as an awe-inspiring spectacle for all the world to marvel at. The power-development advocates, in their turn, from Lord Kelvin down, insist that it were better that Niagara should run dry than that its unrivaled industrial possibilities should be neglected, to the detriment of the real progress of the race.

In this radical divergence of views the commissioners of Victoria Free Park on the Canadian side find themselves between two fires. They have awarded several franchises for the development of the energy of the Horseshoe Fall, and have been subjected to criticism in consequence, it being alleged, with some show of plausibility, that such acts were not contemplated in the acquirement of the lands for park purposes. Apparently, the commissioners feel that this criticism has gone far enough, and in their seventeenth annual report, recently issued, they take occasion to answer the fault-finders in words that allow no misunderstanding. There is much that is interesting in this report, and it should be understood that the quoted portions given in the following paragraphs are simply relevant extracts.

"The production of electrical power as a means of providing revenue has perhaps more than anything else been characterized as vandalistic in its ultimate effects on scenic conditions in the park.

"It should be borne in mind that at the time the park was established the science of producing electrical energy for motive purposes was practically in its infancy, the first electric street railway in America having been put in operation in 1887. It was only when the practicability of transmitting electrical power assumed shape that the matter was considered by the commissioners as a possible means of obtaining revenue.

"Had the property [that portion of the park lying south of Cedar Island] not been expropriated when the park was founded, viewing it now in the light of what has transpired on both sides of the river, that part of the property would doubtless have been acquired by capitalists and laid out as a manufacturing district without reference to its scenic environments, as has been done on the American side of the river north of the steel arch bridge, to the irreparable disfigurement of the river bank.

"Coming now to the charge that the commissioners have, in granting certain power privileges, committed acts of vandalism that will ultimately ruin the scenery of Niagara Falls, the commissioners have to state that, with the exception of the Ontario Power Company's power house in the gorge under the falls, all the proposed works connected with the generation of electricity are practically beyond the territory originally designed for park purposes. When the electrical power works are completed, not a single view of the falls, rapids or gorge under the falls will be obstructed in the slightest degree. On the contrary, the filling in of the shore line above the falls by excavated material from the tunnels will increase the park area very considerably and will permit of roads and walks being constructed on the margin of the river which will greatly improve the views of the upper rapids.

"Respecting the construction of the Ontario Power Company's power house in the gorge under the falls, it was shown by the Canadian commissioners that the location of the building in question would present no obstruction to the free views of the falls or river from any point on the American side, and as the building would be far below the surface level of the park, a portion of the roof and the two gable ends will be the only parts of the structure that would be seen from any point of view within the Queen Victoria Park. It was further pointed out that to make the building in any sense a conspicuous or objectionable feature of the landscape would depend solely upon the design and character given to it. Should, for instance, the building be designed upon the lines of the power house on the American side near the steel arch bridge, the public would have some grounds for complaint, but so far from the commissioners sanctioning such a structure they have made the most stringent provisions to secure the highest degree of artistic treatment in outline, color and design which it is possible to secure, and they have no hesitation in asserting that upon the completion of the power house, with its facade covered by creepers and relieved by evergreens, and a roof harmonizing in color with the high limestone cliff forming a background, it will be found that not only will the structure itself be unobtrusive and entirely unobjectionable from every point of view, but that no violence will be done to the environment of the great cataract.

"All of the works and structures connected with the electrical power projects have been designed with the object not only of doing the least possible injury to scenic conditions, but the commissioners are confident in the belief that when the several works are completed, the consensus of opinion by the vastly increased numbers of visitors that are expected to visit the park will abundantly sustain them in their contention that the park as a whole, with its wealth of electrical machinery, will then be of tenfold greater interest to the great majority visiting it; and in addition not only will the immediate locality beyond the park be built up into one of the great manufacturing centers of the world, but the quickening impulse and vivifying effects of the whole of the world's latest and most perfect form of energy—created and sent forth by the Falls of Niagara—will be felt from end to end of the province."

We have quoted at considerable length from the report because the subject, while it may seem to have a whimsical side, is really one of importance and bound to come up at all other places where waterfalls of natural beauty are sought as sources of power. In this particular case it will be observed that the commissioners defend themselves on the ground that the electrical plant will not look so very bad when completed and that anyway the Americans are just as bad, or even worse. Their case might be argued on a loftier plane—the benefit to humanity of cheap power, with its almost innumerable advantages for the uplifting of the race. Broadly considered, we believe that the utilitarians have the better of the argument; but this is a case where one's reason points in one direction and one's inclination in another. Fortunately for all lovers of Nature, Niagara is so great that the demands of the power users will be comparatively negligible, so far as the relative volume of diverted water is concerned, for many years to come. As it is now, the natural spectacle and the industrial development exist side by side. We, who are perpetually amazed at the one and greatly interested in the other, hope, and indeed expect, that it may be ever thus.

Heating from Central Stations.[1]

By John W. Glidden.

Your committee on district heating finds that there are about 100 heating plants of this character in operation in the United States at the present time. Possibly 10 of these are live-steam heating plants, operating solely for the heating business. The remainder are about two-thirds exhaust-steam-heating plants, and one-third hot-water-heating plants. A list of questions was mailed to all of these plants, to which about 50 replies were received. Twenty-two were regular blanks partly filled in; the rest were letters stating they could not give the information or did not wish to give it. Quite a few have been in the business but a few months. When this circular was gotten out, it was my intention to sift and tabulate this information in such a manner as to demonstrate the actual basic conditions under which each plant is operating. For example, a plant operating with a simple engine, under a back pressure of 10 or 15 pounds, was to be compared with the operating conditions of the same plant, supposing that the money expended in installing the heating mains had been judiciously spent in improving the engine and boiler plants. It was also intended to ascertain whether general expense items were properly distributed. The nature of the replies, and other matters that I shall treat of later show this to be impracticable at this time.

Table Showing Data.

No.	Investment in Heating Plant.	Heating Revenue	Price of Coal.	Labor and Fuel for Heating.	Total Coal.	Back Pressure.	Net Revenue Per Cent. of Investm't.	Remarks.
1	$75,000	$26,000	$1.00	$12,000	$31,536	3-15	18.7	Day load
2	4,800	2,000	2.40	.....	.....	0-0	.....	Water-power
3	12,000	3,200	1.75	.....	.....	2-5	.....	No day load
4	33,000	2,293	1.25	.....	5,838	0-3	.....	Day load
5	67,738	26,449	1.58	20,916	27,594	3-20	8.2	Day load
6	5,000	1,000	1.25	.....	.....	0-0	.....	No day load
7	40,000	Just std.	2.15	.....	.....	0-0	.....	Day load
8	15,000	6,500	1.70	3,000	8,148	0-0	23.3	Day load
9	.....	43,000	.....	14,800	.....	5-18	.....	Live St. only
10	16,000	3,712	2.00	.....	.....	0-0	.....	Day load
11	66,159	15,843	.....	13,282	7,185	...	4.0	Live St. only
12	30,000	3,170	2.25	.....	.....	0-0	.....	New plant
13	.....	.....	5.00	.....	.....	....	.....	Sore spot
14	48,000	10,000	.90	.....	.....	2-5	.....	Sore spot
15	10,000	2,642	1.35	1,414	4,950	1-3	12.3	Day load
16	6,000	1,906	2.10	.....	3,509	1-5	..	No day load

Note.—Isolated office buildings use 100 pounds good Illinois coal per square foot of radiation during seven months' heating season.

This table is put in not because of its value, but to emphasize the condition of the heating business. You can notice a lack of information in a majority of cases. This arises from two reasons: First, because they have not got it, and, second, because they are afraid of the damage to their capital stock if the actual conditions of their heating business became known. A few extracts from letters received may serve to emphasize this. One man of several years' experience writes: "We are not in a position to answer your questions in any way that would be satisfactory to you." Another in business writes: "Possibly next year we can aid you in this matter." Another: "I do not think it possible to give you the information for various reasons." Another: "I receive many blanks from the National Electric Light Association. It would require more clerical work to fill out your blank than it would to make an annual report to the state; in fact, it cannot be done, as we have not the data. I wish you would drop my name from the mailing list." Another: "I will bring this matter before the president of the company." Another: "We have learned much by experience, which is always expensive, and we do not care to contribute to the general knowledge." Another: "I feel that the matter requires more careful consideration than I have time to give it."

I believe this table and these letters show that this subject requires good, strong treatment by the association. I visited about 20 heating plants and personally interviewed the managers thereof and inspected the properties. Aside from the plants located in the cheap coal belts, where screenings can be delivered for about $1 per ton, and a few other plants where the gross receipts are at least 60 per cent. of the investment in mains, there is very little enthusiasm among heating managers. The representations which induce a great many of these men to go into the business have not proven out, and they are left with large plants which they are continuing to operate because they do not know what else to do with them.

Looking at the heating business from another standpoint, it is a question for the consideration of this association whether an investigation of the present conditions of the business and the publication of these results is broad enough in its treatment to take in all phases of the business. Personally, I became convinced from talks with heating managers and from the merchants' plants, which are being installed, that even though it were demonstrated that the present conditions of the business would not warrant central-station men in going into it, they would go into it, nevertheless, because the public has become so thoroughly convinced of the desirability and practicability of district heating, that if the central station does not occupy the territory, it will be occupied by merchants' associations. These associations will, at the same time, enter the lighting business and jeopard the investment of the older company. It seems to me beyond dispute that there exists a very lively and pressing demand for heating plants. If we grant that this demand is to be met by some one, is it not fair to state that electric central stations are the best people to meet it? First, because of some available apparatus already installed; second, because they possess the technical knowledge; third, because they possess the organization, and, fourth, for their own self-protection.

I recommend the appointment of a permanent committee to work continuously on the heating business. I think the association should decide on one or two methods of procedure: Whether this committee should continue to gather data to show what heating plants are doing, or whether it should investigate the losses in the heating business, and devote its energies to the development of the business. A few managers are working out their salvation alone. If they would combine their efforts under the leadership of the committee of this association and arouse activity among those who are drifting at the present time, their united efforts would bring an early solution of many of the present difficulties. A uniform system of accounting and keeping data, with the inauguration of thorough testing to show what becomes of the actual heat units sent out, would clarify the business and remove it from the field of haphazard experiments and make it an exact science.

Recapitulation.

First—I find no evidence that the business is generally profitable.

Second—A lack of information among heating managers.

Third—A lack of enthusiasm for the business.

Fourth—Little separate accounting.

Fifth—Genuine demand from the public for the services.

Sixth—I think a permanent committee should be put in charge of the heating business.

Seventh—I think this association should instruct this committee whether to devote its time to the investigation of the business as it stands, or devote its time to the promotion of the business by testing, and so forth.

Discussion.

C. R. Maunsell, Topeka, Kan.: I cannot indorse some of the things Mr. Glidden has said in reference to the heating business. I presume I am one of the persons who did not answer his letters satisfactorily. There is no doubt whatever, as Mr. Glidden says, that there is a manifest demand for the steam business. In our town the demand greatly exceeds the capacity of the company. We have had very nice returns from it in a financial way, not only from the heating business, but in the results of lighting and power business. I feel, too, that a permanent committee would be a very good thing to investigate this subject and get some reliable data.

President Ferguson: I think in view of what Mr. Glidden has said in his report, and also what Mr. Maunsell says, it is very apparent that this committee, or another committee, should be continued, and that the investigation be carried on so that we will really get at the milk in the cocoanut. As it stands at present, Mr. Glidden has found it difficult to get really satisfactory information. If Mr. Maunsell will put his suggestion in the form of a motion that the committee be continued, with an enlargement, possibly, of two more members, I would be glad to put that before the convention.

Mr. Maunsell: I make that as a motion. [The motion was seconded and later was carried.]

D. F. McGee, Red Oak, Ill.: I, like many others in the heating business, came to this meeting to get all the information I could. I also realize, with Mr. Glidden and Mr. Maunsell, what we may call the enormous demand, all over the country, for heating plants. I have answered no less than 600 letters of inquiry on this subject inside of four years. I also have had personal visits from managers in every state from Kentucky to Washington. They were all anxious to get into the business, and they wanted definite information; and I think if we are going to look the matter up, our investigations should be conducted in a way that will secure exact results.

Mr. Maunsell: We have been in the business for six years. We have $40,000 invested in our underground mains. Last winter we had a revenue of nearly $15,000, sufficient to pay all the coal costs of the plant for eight months, and leave nearly four per cent. interest on the money. I do not know of any better argument I can bring up than to say that, in order to keep from making too great a showing on the steam heating, we charge everything possible to it, and still find that the operating costs of the steam heating are only something like 29 or 30 per cent. of the gross revenue from heating; and I feel pretty certain that on the meter system, which is the only proper way to sell heat, we would show even better results. My experience has been very limited in the matter of the depreciation of the steam mains. We have had practically no trouble; no cost for repairs, and when we made examinations for deterioration, we found very little after six years' use.

James E. Pyle, Westchester, N. Y.: I am very much interested in this question of steam heating. About a year ago we concluded to put in a steam plant in Westchester, and we installed 4,000 feet of mains, varying from five to 12 inches in size. We operate an electric plant, which has some day load, and we took on about 50 customers or more, and did practically all our heating during the winter with exhaust steam. We used less than $200 worth of coal for live steam, and we operate the system during moderate weather with about 1¾ pounds actual pressure in the power house. During severe weather it would run up to three and 3½ pounds to supply a plant some 3,000 feet away, and the outfit was not exactly what it ought to be. It required more pressure at the power house on account of that installation than for any other customer on the line. As far the question of the system being profitable is concerned, it all depends very much on the location of the steam plant, whether it is close to the locality where you want to distribute steam or not, whether you can operate largely by exhaust steam or not; if you have no day load, it is evident it will take a great deal of live steam to supply the customers. Another thing which cuts some figure is the comparative cost of steam coal and domestic coal. With us, the price of steam coal is about one-half that of domestic coal. In some places it is different, and in those cases they have the advantage of us. As far as depreciation on these lines is concerned, we have had opportunity to look into some places that have been in operation 12 or 13 years, and it has been found the wooden log is beginning to rot to some extent, but not very much. The location has more to do with the general proposition than anything else. If you have to run a long main from the power house out to the distributing system, you will have to invest a great deal of money in the main.

G. W. Brine, Atlanta: During the last steam-heating season we had 15,000 feet of mains and 200,000 square feet of radiation connected; and while we do not think we made any money, as far as actual income is concerned, we think the steam-heating business is of great service in keeping out isolated plants. We figure that the pounds of coal increased about one-third on the steam-heating business. We operated for one-third less per pound of coal per kilowatt-hour. With the mains we had we do not think we made anything. We are now putting in about 5,000 feet of additional mains, which we think will be a benefit in giving us a better circulation and allow us to operate on a slightly increased cost. We will take on 200,000 square feet more of radiation, with a trifling increase in cost.

1. Report of committee to National Electric Light Association at Chicago on May 28, 1903. The chairman, Mr. Glidden, is superintendent of the DeKalb-Sycamore (Ill.) Electric Company.

Electrical Exports for April.

The electrical exports from the United States for the month of April, 1903, amounted to a total value of $749,540, as compared with $835,066 in April, 1902, a decrease for the month from last year's figures of $85,526. The figures for April of the present year also show a falling off from those of March, 1903, in the amount of $112,338, last month's exports having amounted to $861,878. While the exports of electrical appliances, including telegraph and telephone instruments, for April of the present year, show an increase of $85,278 over the figures for April of last year, it was not a sufficient gain to overcome the falling off in exports of electrical machinery, which amounted to $170,804. The figures are: Electrical appliances—April, 1902, $296,948; April, 1903, $382,226. Electrical machinery—April, 1902, $538,118; April, 1903, $367,314. For the 10 months ended with April, 1903, however, there has been an increase in total electrical exports amounting to $867,906, as compared with the corresponding period in 1901 and 1902. The amount for the 10 months ended with April, 1903, was $8,438,361, while that for the 10 months ended with April, 1902, was $7,570,455.

Classified according to destination, the exports of electrical machinery to some of the principal buyers during April, 1903, were as follows: United Kingdom, $117,913; British North America, $106,083; Mexico, $71,263; British Australasia, $13,696; Japan, $9,306; Germany, $6,476; Philippine Islands, $4,224; British Africa, $3,253; France, $3,113; Argentina, $2,208; Hongkong, $1,770; Brazil, $1,653; British East Indies, $1,151.

Heat from Coke Ovens for Electric Power.

The coking plant of the Nothwestern Fuel Company in Superior, Wis., may be utilized in the development of electric power. There are 120 ovens now in use, and nearly as many more are being built. From these ovens heat to the extent of 3,000 degrees is going to waste all the time. It is proposed to utilize this heat in the generation of electricity. The heat is to be insulated and conducted to one end of the coking plant where the boilers of the electric plant would be installed. Once the plant is installed, the expense of operation would be nominal.

Announcement is made in Wall Street by the Marconi Wireless Telegraph Company that Thomas A. Edison has become a member of the board of technical engineers of that company. Mr. Edison, it is said, has become a stockholder in the wireless company, turning over patents he owns controlling certain inventions by which wireless telegraphy over limited distances by electrical induction is obtained.

DEVELOPMENT OF THE TELEPHONE FIELD.

National Telephone Convention in Chicago.

As stated in the Western Electrician of May 23d, the next annual convention of the Independent Telephone Association of the United States will be held in Chicago on June 24th and 25th. The Auditorium Hotel has been selected as the meeting place.

Secretary J. B. Ware of Buffalo and J. G. Ihmsen, chairman of the Chicago committee of arrangements, announce the following programme:

WEDNESDAY AFTERNOON (JUNE 24TH).

2 p. m.—Address of welcome by Hon. Carter H. Harrison, mayor of Chicago.

Response by Hon. S. P. Sheerin of Indianapolis, Ind.

Annual address of President James M. Thomas.

Roll-call of states for 10 minute reports.

"Advantages of Association." Paper by Hon. C. E. Hull, Salem, Ill., president Interstate Telephone Association.

"The Telephone and the Technical School." Paper by J. C. Kelsey, professor of telephony in Purdue University, Lafayette, Ind.

"Modern Exchange Construction." Paper by W. H. Johnson, general superintendent Frontier Telephone Company, Buffalo, N. Y.

"Independent Telephone Development in the South." Paper by C. E. Stinson, president Memphis Telephone Company, Memphis, Tenn.

"Western Telephone Development." Paper by J. S. Bellamy, Knoxville, Iowa.

WEDNESDAY EVENING.

6 p. m.—Concert in Auditorium Hotel.

8 p. m.—Special train to San Souci Park. (Programme of entertainment at this summer garden to be given later.)

THURSDAY.

10 a. m.—"Patent Litigation." Committee report by Hon. Hugh Dougherty, Bluffton, Ind., chairman.

"Telephone Discipline." Paper by C. E. Tarte, general manager Citizens' Telephone Company, Grand Rapids, Mich.

"Eastern Telephone Development." Paper by F. A. Demarest, general manager Interstate Telephone and Telegraph Company, Trenton, N. J.

"Present and Future." Paper by Frank L. Beam of Columbus, Ohio.

General business.

Election of officers.

This is a short programme, but a good one. Especial interest, probably, will center in the report of the patent-litigation committee, which has ably looked after the interests of the association in the famous Berliner and Carty suits. Special rates will be arranged with the passenger associations, and a large attendance is anticipated.

WISCONSIN SUMMER CONVENTION ABANDONED.

The executive committee of the Independent Telephone Association of Wisconsin has decided not to hold a summer meeting during 1903. The national association meets in Chicago upon the date the Wisconsin organization had selected for its summer meeting, and President Valentine says that the latter does not want to interfere with that meeting, although it was first in selecting the date.

Bribery Charged in Evansville.

The latest sensation growing out of the telephone situation in Evansville, Ind., was the announcement last week by four councilmen that another councilman had attempted to bribe them. The four men have testified under oath that an attempt was made to buy their votes against the repeal ordinance relating to the franchise of the Cumberland Telephone Company, which was declared by the City Council to have terminated some months ago. At the time the company sought a renewal, but it was refused because the company would not agree to a reduction in rates. After the passage of the repealing act the council notified the company to remove its property from the streets under penalty of having it done at its expense. The company filed an injunction suit in the Federal Court asking that the city be prevented from cutting down the poles and wires. The four councilmen have testified in substance that their fellow councilman approached them and said that if they would vote against the repeal of the telephone franchise there would be $2,000 for them. The attorneys for the Cumberland Telephone Company expressed surprise at such a revelation and declare that no one had authority from their company to attempt to bribe the council. The councilman accused says the charges against him are false.

The Kentucky Telephone Company has secured a temporary injunction agaist the City Council of Covington to prevent it allowing F. K. Ludlow to proceed with his work of installing a fire and police-telephone system in underground conduits. The company claims its bid was the lowest submitted and yet was rejected.

Telephone News from the Northwest.

The Minnesota Independent Telephone Association has arranged to be represented at the seventh annual convention of the Independent Telephone Association, to be held in Chicago, June 24th and 25th. The association elected officers as follows: President, Dr. J. H. James of Mankato; first vice-president, J. A. Tawney of Winona; second vice-president, E. L. Bradley of Duluth; third vice-president, Dr. E. K. Robinson of Norwood; secretary, B. F. Clarke of Hector; treasurer, E. H. Moulton of Minneapolis.

The Windom Mutual Telephone Company has been incorporated with a capital of $45,000.

The case of the Northwestern Telephone Exchange Company vs. the Twin City Telephone Company, is being argued before the Supreme Court of Minnesota. The case arises from the Twin City having set its wires in such a way as to interfere with the extension of wires of the other company in Minneapolis.

The discharge of four telephone operators by the Twin City Telephone Company, in Minneapolis, led to a walkout by 14 other girls, who demanded their reinstatement. They claimed that the action of the discharged girls in working for a union was the cause of their dismissal. The company declined to take them back, and says the discharge is due to incompetency. The Minneapolis Telephone Operators' Union has been formed, and the trouble will be turned over to the Trades and Labor Union, for adjustment. Other electrical workers may become involved.

The city comptroller of Duluth has completed an investigation of the books of the Zenith Telephone Company, which seeks permission from the city to increase its rates, alleging that it is losing money on the present rates. He finds that the company netted $2,139.89 for 16 months, the total receipts being $97,242.07 and the disbursements $95,102.18. The company's profits last year were only $849.74, but this year in four months it has a margin of $1,290.15.

The Modern Telephone Company succeeds to the interests of the Modern Electric Company at Burlington, Iowa, and proposes to install a new telephone system on the automatic plan.

Stafford Bros. have sold their telephone plant at Blairsburg, Iowa, to F. C. Vaughan of Coon Rapids, Iowa.

The Independent Mutual Telephone Company of Shenandoah, Iowa, has increased its capital from $50,000 to $100,000.

The DeWitt (Iowa) Telephone Company has increased its capital to $50,000.

W. J. Van Allen of Epworth, Iowa, and Jos. A. Lattner of Worthing, Iowa, have bought the Hawarden (Iowa) telephone exchange. Lines are to be constructed through the county.

The Interstate Telegraph and Telephone Company of Austin, Minn., has awarded the entire work of constructing a local system to James B. Taylor of La Crosse, Wis., for $40,000. The system will be entirely cabled, with no exposed wires. It is expected to be completed by August 1st.

The stockholders of the Creston Mutual Telephone Company of Creston, Iowa, have increased the capital stock to $100,000, and have voted to expend $12,000 in improvements and additions within the city limits.

R.

Indiana Telephone Items.

The demand for telephone service in many portions of Indiana continues. This is evidenced by the 16 new companies organized during May, and the steps taken by established companies to increase their capital stock and the sale of bonds to procure means adequate for the making of extensions and improvements necessary for increased patronage. During the last week the Plainfield Telephone Company filed amended articles increasing the capital stock from $25,000 to $100,000. The Plainfield company and the Danville company were recently combined, with Amos Carter as president. The Connersville Telephone Company also filed papers indicating an increase of the company's capital stock to $100,000.

The combination of the telephone linemen's strike and a severe wind and hail storm last week, occasioned the telephone companies in Indianapolis considerable trouble. Both companies suffered damage to their wires, more particularly the long-distance wires. Practically all the linemen employed by the two local companies are out on a strike, insisting upon their original demand of 25 cents a day increase over the present wages of $2.50 a day. The New Telephone Company has imported no men, although it is said that a hundred telephones are out of service. W. L. Hill, manager of the Central Union, has called on the mayor for police protection for a few imported men. The strikers say they are making no threats and desire to conduct their strike in a quiet manner.

F.

Ohio Telephone Notes.

The City and Suburban Telephone Company of Cincinnati has purchased a lot at the corner of Race and Canal Streets, on which a thoroughly modern telephone exchange building will be erected. This will give the business section of the city two exchanges, and they are needed very badly, as the old one has had all it could do for some time and the suburban exchanges were not sufficient to relieve it of the burden.

The South Charleston Home Telephone Company, South Charleston, has been incorporated with a capital stock of $50,000 by S. B. Rankin, Alex Renick, Edwin R. Sharp, Frank L. Beam and Frank A. Davis. Mr. Rankin is a prominent banker of that place; Mr. Sharp is a banker at Columbus, and Mr. Beam is manager of the Citizens' Telephone Company of Columbus.

The Miami Telephone Company has secured a franchise at Yellow Springs, where it will establish an exchange.

The Pennsylvania Railroad Company has commenced work on its new telephone line from Pittsburg to Ashtabula, Ohio, and it is expected that it will be in working order within two months.

The Federal Telephone Company management has secured enough proxies to carry out the plans outlined in the Western Electrician last week. The meeting for the purpose of voting upon the matter was held at Orange, N. J., on Monday. Out of an authorized issue of $6,000,000 bonds, probably $5,000,000 will be sold. It is stated that the Federal Telephone Company will probably purchase the 2,000 shares of the Citizens' Telephone Company stock (Columbus) which were disposed of some months ago. The company sold for $45 per share and may repurchase for the same amount and the accrued interest, under an arrangement made at that time.

O. M. C.

Central Union Headquarters Going to Indianapolis.

The Central Union Telephone Company will remove its general offices from Chicago to Indianapolis within a few weeks. The company has leased two floors of the Majestic Building in the latter city and will establish therein its headquarters. The office force consists of about 200 people and nearly, if not quite all, will remove to Indianapolis. The supply department and shops may be removed also. The general officers of the company who will go to Indianapolis are: L. G. Richardson, president; Horace F. Hill, general manager; W. S. Chapman, secretary-treasurer; C. T. Hege, auditor, and J. C. Renny, purchasing agent. It is asserted that the movement is a direct step toward the improvement of the service throughout the three states in which the company operates—Ohio, Indiana and Illinois.

GENERAL TELEPHONE NEWS.

The Common Council of Corvallis, Ore., has granted to Z. H. Davis, August Fischer and E. E. Wilson the right to construct, operate and maintain an Independent telephone exchange and appurtenances in that city for 25 years.

The Levels Telephone Company of Levels, W. Va., has been incorporated, with a capital stock of $5,000, by W. H. Harmon, D. M. Dickens and others. The company will build a line from South Branch to Romney by way of Levels.

The underground system of the Southern Bell Telephone Company in Savannah, Ga., will be considerably extended if the necessary permission can be secured from the city. A petition from the company has already been presented.

MANUFACTURERS AND DEALERS.

Mr. Frank Middleton, who for the last three years has been identified with the sales and correspondence departments of the Stromberg-Carlson Telephone Manufacturing Company, has resigned to accept a position as manager of the sales department of the International Telephone Manufacturing Company. Mr. Middleton has had a broad and practical experience in the telephone field, having started when a boy with the Central Union Telephone Company at Elkhart, Ind. With the opening up of the Independent field, he took a prominent part in the movement and was one of the organizers of the Elkhart Independent Telephone Company. He was for several years connected with operating companies, and later entered the employment of the Stromberg-Carlson Telephone Manufacturing Company.

The Automatic Electric Company, Chicago, manufacturer of the Strowger automatic telephone equipment, reports an increasing demand for automatic telephone apparatus. It has recently sold to the Columbus (Ga.) Automatic Telephone Company complete equipment for a present installation of 700 lines, the switchboard to have an ultimate capacity of 3,000. Other smaller orders have been received from Mount Olive, Ill., Birmingham, Ala., Danville, Ill., Rock Island, Ill., Grand Forks, N. D., Cape Town, Africa, and Medford, Wis. The large exchange of 6,000 stations which the Automatic company is building for the Dayton Home Telephone Company of Dayton, Ohio, is rapidly nearing completion, and it will only be a few weeks before the citizens of Dayton will have automatic telephone service.

Ashtabula's New Independent Telephone Exchange.

The Ashtabula Telephone Company, having an exchange at Ashtabula, Ohio, has recently re-equipped its exchange, in respect to telephones and central-office equipment, and has now, it is asserted, one of the finest exchanges in the state of Ohio. This company was organized in 1896, after the refusal of the Bell company to give reasonable rates. It is composed of the leading business men in Ashtabula, and the growth has been so rapid that the exchange is to-day several times larger than was first considered possible. After having outgrown several switchboards, as well as the outside construction, a contract was placed with the North Electric Company, Cleveland, Ohio, for a complete new equipment for a central office. The switchboard ordered was of the lamp-signal, common-battery, multiple type, and is shown in Fig. 1.

Fig. 1. Main Switchboard.

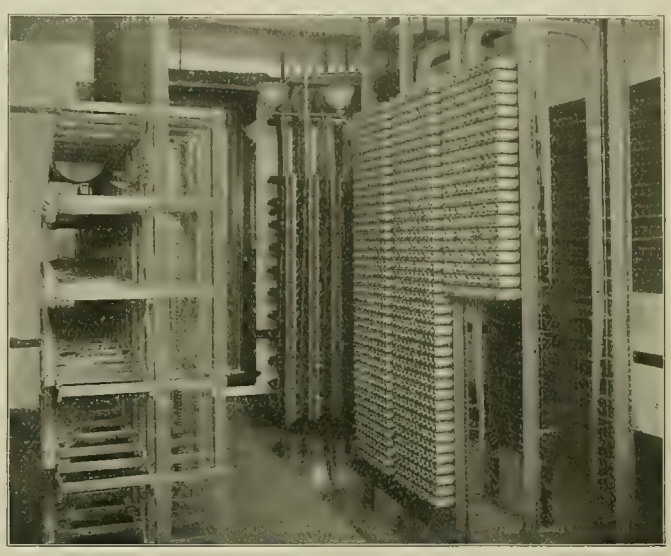


Fig. 2. Terminal Room.

ASHTABULA TELEPHONE EXCHANGE.

This switchboard is of 1,800 lines' capacity, having installed line equipment for 1,000 local common-battery lines, also a separate position on the board equipped for magneto rural lines, which class of service the Ashtabula Telephone Company has been recently covering. As will be noticed in the picture, the first or annex position, is reserved for the use of the necessary multiple jacks; the second, or magneto position, generally known as the "B" position, is equipped with 50 magneto drops, for taking care of the rural lines. The operator at this position has within her reach the multiple of every line on the entire switchboard. This position is equipped with party-line signaling apparatus, so that the operator can selectively signal any of the subscribers on her section.

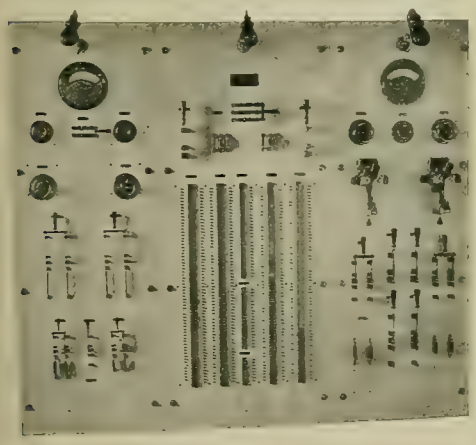


FIG. 3. ASHTABULA TELEPHONE EXCHANGE.—POWER SWITCHBOARD.

The third position on the board, known as the "switching" or second "B" position, is equipped with a duplicate of all toll drops, as well as with the necessary trunks for handling the toll traffic during the daytime. At night the toll service is switched from the separate toll board to the switching position on the main board, so that the night force can handle the entire traffic of the exchange at one point. The switching position is also equipped with busy-back signals, so that any subscriber's line, which is temporarily in use, can be easily reserved and held for any long-distance work that may be required.

The next five positions, known as "A" positions, and equipped with local lines, are arranged with 200-line equipments to the operator. This has been considered an unusual number of lines for one operator to handle, but the experience at Ashtabula has demonstrated, beyond a question, the claims of the manufacturers, that 200 lines can safely be handled by expert operators and give first-class service. While the service average per line on this exchange is above the average for its size, nevertheless a three-second service is maintained, which telephone men will readily concede is above the average results obtained. Each of the "A" positions is equipped with the necessary cord equipment, including party-line keys and supervisory signals for each cord pair, so that the operator can at all times tell automatically whether a subscriber has answered a call, whether either one has finished, and whether either one is demanding a subsequent call. In addition to this, she can selectively signal any party-line subscriber with whom she has occasion to connect. This makes this board particularly attractive for work in exchanges of the character mentioned.

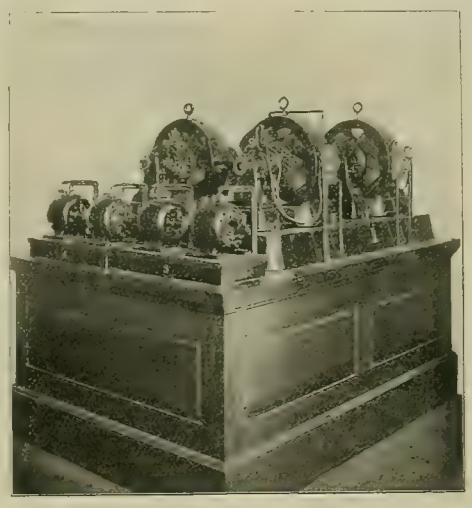


FIG. 4. ASHTABULA TELEPHONE EXCHANGE.—POWER PLANT.

The chief operator's desk, which is not shown in the illustration, is equipped with all the necessary listening taps and apparatus for the chief operator to handle the force working under her. In addition to this, her desk is equipped with observation lines, so that any lines needing special attention can be covered.

In Fig. 2 is shown what to many telephone men is the most interesting part of the exchange; that is, the terminal room. Here are located the main and intermediate distributing boards, as well as the relay racks. To the line side of the main distributing rack are brought all of the outside cables, while on the switchboard side are located the protectors. The intermediate distributing board is also of the open iron-rack construction and of the latest design. The relay racks shown on the right of the cut are strong and substantial, the relays being so mounted that all parts are accessible. In the inspection of the cut shown, it will be noticed that all relays are enclosed in individual dustproof cases.

In this room is also located the wire chief's desk, equipped with meters, switches, plugs, keys and all other paraphernalia necessary to enable the wire chief to test any of the lines in use in the exchange.

The most important part of a common-battery, central-office equipment is, perhaps, the power plant. In the Ashtabula exchange the power board consists of three panels of Tennessee marble, as shown in Fig. 3, mounted in a substantial iron rack, the panels being equipped with all fuses, switches, circuit-breakers and meters, nothing but Weston instruments being used. The work in the rear of the power board is very substantial and heavy, and would take care of the currents required, if the exchange were several times its initial size. Very heavy and substantial switches are used on this power board, the work being designed to meet the most trying requirements.

The entire power plant is in duplicate. The generators (Fig. 4) are mounted upon a pedestal which is filled with sand, taking away the noise of vibration ordinarily incident to power plants of this construction. The charging machines are of the Holtzer-Cabot make, and are designed to work off of the various power plants available at this center. The charging machines are in duplicate, so that, in the event of a breakdown of one power circuit, the other is available. The ringing machines are manufactured by the same company, one being equipped to work off of the power circuit and the other off of the batteries. Each individual machine bears its number, which corresponds to the switches and other apparatus on the marble power board.

FIG. 5. ASHTABULA TELEPHONE EXCHANGE—STORAGE BATTERY.

Fig. 5 shows the storage batteries, which are in duplicate, mounted upon angle-iron racks of sub-

stantial construction. They are of the Chloride type, and each set of ample capacity to handle the exchange for 24 hours when running to its full capacity. The wiring to the cells is such that an individual test at the power board can be made of each cell, or each set of batteries can be tested in unison. The power wiring is put in in such a way that there is no charging induction. The storage batteries are set in a separate room, in which ample provision is made for taking care of the fumes, by proper ventilation.

The toll board, which is situated in a separate room, is connected by a complete automatic trunking system in such a way that the signals between the toll board and the main board are automatic, the toll operator having complete supervision over all toll calls.

The Ashtabula company has a branch exchange located at Ashtabula Harbor, the board being for 300 lines, on which is handled a great many party lines. This board is connected to the main exchange by several incoming and outgoing trunks having automatic signals, all trunks terminating on the second "B" or "switching" position. This gives a complete supervision of all trunk connections by the switching operator.

In the installation of this equipment every precaution has been taken to give the operators and the force handling the traffic the most complete apparatus for the giving of modern service, and visitors who have inspected this exchange are loud in their praises.

The Ashtabula Telephone Company erected its own building, investigation proving this to be the most advisable course. The exchange is provided with work shop, inspectors' room, stock room, operators' retiring room, and everything necessary for the handling of the business. There are, in addition to this, the general office, directors' room, as well as the counting office.

Weston Employes' Club.

The Weston Electrical Instrument Company, Waverly Park, Newark, N. J., has turned over to its employes the fine clubrooms recently constructed for them. The occasion was commemorated by a reception and ball on the evening of May 22d, to which each employe and a friend were invited, also a large number of the friends of the directors, and all the prominent city officials of Newark, including the mayor, also the governor of the state. Over a thousand guests and members of the club were in attendance, and the affair was a success in every particular and reflected great credit on the various committees in charge.

Mr. Edward Weston, the president of the company, made a presentation address, in which he explained the roads along which employer and employe progress and outlined the directors' ideas of how the interests of both could be best served. He pointed out that, without complete understanding of each other's position, no measure of successful co-operation could be obtained, and closed by asking for the submission of ideas at any time which would tend to benefit the employes, assuring his hearers that any plan presented that was at all feasible, would have the company's earnest attention.

Mr. A. O. Benecke responded for the employes, thanking the company, and stated that the employes considered that a new era had dawned, in which their welfare was the predominant feature. In testimony of this a large loving cup was presented to Mr. Weston by the employes. Mr. Weston, in response to the gift, showed how greatly he appreciated the feeling of regard his employes extended toward him, and assured them that no business of the magnitude of the Weston company could achieve success without being able to repose confidence in every employe, and especially in the lieutenants of the business.

Supper was served in the club dining room. An idea of the size of this room can be obtained when it is stated that in round numbers, 800 people were seated at the tables at one time. Dancing, which followed, continued until an early hour the next day, which was designated a holiday by the company.

The result of this employes' club will be watched with interest by manufacturers generally, as its success seems assured. Before turning the apartments over to its employes the Weston Electrical Instrument Company carefully considered every detail. The company has placed the entire government, including the restaurant, in the employes' hands, and, moreover, given them all the furnishings and the benefit of the company's backing. If any fault is found in any department, the blame will be centered on the committee in charge, and in no manner can any trouble be construed into a company affair. A feature of the restaurant is the foremen's dining room, in which the president will dine with the heads of the various departments, and as all are seated at one large table, it is expected that any foreman will be able to discuss and obtain advice on any problem he desires. An ideal kitchen and ice manufacturing plant have also been installed, and there is a swimming tank over 130 feet long, fitted up in the most sanitary fashion.

Lost and Unaccounted-for Current.[1]

By L. G. Van Ness.

When this subject was assigned to me I hoped to be able to present a tabulation of records showing lost and unaccounted-for current from a number of stations, but I was disappointed in getting some of these records. Instead of a tabulation of results, I will only attempt to discuss the subject in detail, and try and show how the different elements may be calculated and to what use this information may be put once it is determined.

This may not be as interesting to central-station men who now know what their lost and unaccounted-for current is, but it will be of more value to those who do not know, if they will attempt to apply the methods to their own conditions.

Lost and unaccounted-for current in high-tension transmission lines will not be discussed here, as an inductive drop plays an important part, and a study of conditions of existing lines would probably reveal embarrassing errors in original design which were practically unavoidable at the time the design was made.

The study of lost and unaccounted-for current in distributing systems is not only interesting work, but it almost invariably brings to attention conditions that can easily be remedied and the efficiency improved thereby.

Lost and unaccounted-for current in alternating distributing systems may be classified under four heads: Transformer iron loss; resistance loss; meter shunt loss; unaccounted-for current.

For direct-current distributing systems, lost and unaccounted-for current may be classified under three heads: Resistance loss; meter shunt loss; unaccounted-for current.

These headings will be described briefly, and I shall endeavor to show that the losses may be accounted for, and that this accounting will, in itself, suggest means to reduce the loss.

Transformer-core loss is very easily calculated by multiplying the loss per transformer times the transformers in circuit, times the hours of operation, when the transformers are all of the same size. When various sizes are used it may be calculated for the different sizes and footed for the total. If transformers have not been tested in the testing room, the makers' guaranteed loss may be used if due allowance is made for aging of the cores. An allowance should also be made for the voltage under which the transformers are operated, if makers' tests are not at the same voltage at which transformers are operated. Within small limits core loss will increase about two per cent. for each one per cent. increase in voltage over tested voltage. A comparison of two districts, one supplied by isolated transformers and the other by individual transformers, will at once give us an idea of how much money might be spent to install a three-wire secondary system, as much less transformer capacity will take care of the same load in three-wire network than with isolated transformers. In case of very large installation near the shop, it may be advisable to make arrangements to cut out certain transformers during period of light load. In case there is practically no morning peak, a portion of the transformers may be cut out at 10 or 11 p. m. and left out until dusk of the following evening.

A comparison of the cost of generating this particular amount of current for that time with the cost of labor incurred in cutting out and cutting in transformers, would determine whether or not this would be a profitable arrangement. Remote control switches have been proposed for doing this work, but as it is necessary to cut out both primary and secondary of a transformer on a three-wire system, the switching apparatus becomes complicated, and it is doubtful if this may be done profitably.

Resistance losses may be calculated in several ways. The simplest and probably the most satisfactory way is to compare the average voltage of the lamps on a circuit with the voltage carried at the station as determined by station records. This will show a certain variable difference in voltage due to the load on the station at any particular hour. This difference in voltage represents the current resistance and reactive drop of the feeders, which, multiplied by current carried by feeders at the same time, and the power factor of the circuit, will give us watt loss in our distributing system for that particular load. This may be calculated for as many different loads as is thought advisable, and the summation taken for an average day of the period. The information necessary for all this calculation is available in almost every station, as indicating amperemeter readings are usually taken at intervals of one-half hour or hour, and every central-station man will claim that his lamps are run at very nearly their rated voltage.

There is another and more complicated way of calculating resistance losses, which may be used to check the method described previously. The loss in the feeders may be calculated by taking size and length of feeders and calculating the C^2R loss for one ampere flowing to the first point of division. From this point to the end of the circuit, if the one ampere is considered as dividing in proportion to the connected load on different branches, the C^2R loss may be calculated accurately to the end of the feeders. From this value per ampere the all-day losses may be calculated by taking the station amperemeter readings at intervals during the day and squaring them and multiplying by the loss per ampere. By taking the station output for the same period, a certain relation may be established between the C^2R loss and the output of the station. This ratio may be applied to the output of the station for the period, to determine resistance losses for the period. It must be borne in mind that the losses increase or decrease in proportion to the square of the output.

Secondary losses may be calculated in the same manner, and transformer resistance losses may be calculated by using the rated loss at the load carried by the transformer at different periods of the day. This process is somewhat tedious, and I think the first method will give the resistance losses fully as closely as the second method, and it has the advantage of being rapid and requiring very little data.

The cost of furnishing this current that is lost in the feeders will furnish an indication of the time when it will be proper to make an expenditure to reinforce the lines. If all feeders are carried on one bus-bar and feed independent districts, it may be necessary to consider also a feeder regulator to overcome excessive drop due to increase of business in one district. The figures to compare are, then, interest and depreciation on reinforcements, cost of resistance losses, and cost of regulator losses.

Meter shunt loss is calculated by determining by test the losses of each type of meter and each size and multiplying the result by the number of each type and size.

Meter shunt loss, while not considered serious, will sometimes show more than transformer iron loss. This is quite possible in a residence district fed by a carefully designed secondary network. Many small consumers may be served by small transformer capacity, but they require a meter per consumer, and unless losses are small per meter, the total loss is a serious item. The only means of reducing this loss is by installing meters with less loss per meter, or by using ampere-hour meters. It has occurred to the writer that if meter manufacturers would devote as much time to developing an ampere-hour meter as they spend trying to improve the wattmeter, they might produce a meter that would serve our purpose much better. We all claim that we give good regulation, and if this is true, we can calculate the consumption for alternating incandescent load as accurately with a correct and sensitive ampere-hour meter as it can be measured by a wattmeter. We should then eliminate a loss that amounts to from 16 to 36 kilowatt-hours per year per consumer.

The unaccounted-for current is all that we are unable to trace accurately. This includes faulty registration of meter, elimination of meters from the records, theft of current, and leakage by grounds in underground systems. There is really no good excuse for losing records. However, it sometimes happens, and the only way to check this is to go over the districts covered, counting connections and comparing with the number of consumers shown by the ledger.

The resistance losses for the direct-current system should, I think, be calculated by the first method given for alternating system. If we attempt to calculate it by the second method, the problem is almost endless, on account of interconnecting feeders and mains. The only error that can appear in calculations by the first method is error in assuming the voltage at which the lamps are operated. This should be checked by numerous tests at all hours and over the entire system. It is not sufficient to assume that lamps are run at rated voltage because the management claims that they are giving an average regulation within a certain per cent. It is possible that a test for this purpose will develop some deficiencies in regulation that are not suspected.

The following are some figures on three representative circuits:

Table I., Showing Data on Three Feeders and Losses on Same.

	1	2	3
Voltage	2,000	1 000	1,000
Connected load, kilowatts	337	461	351
Maximum demand, kilowatts	176	81	88
Number of transformers	12	15	145
Capacity of transformers, kilowatts	130	135	160
Number of meters	182	266	308
Trans. iron loss, per cent	3.6	15.4	42.7
Resistance loss, per cent	4.5	6.5	6.3
Meter shunt loss, per cent	.8	5 2	1.4
Unaccounted for, per cent	13.3	1.7	1.1
Sales, per cent	77.8	71.2	48.5
Output, per cent	100	100	100
Output, kilowatt-hours	35,386	9,135	20,100

The first is a well-designed feeder, supplying a business district on three-wire network. The second is a carefully designed feeder, supplying a residence district on three-wire network. The third is a feeder with isolated transformers, such as we often find, that has been added to from time to time and no attention paid to economy of operation. This feeder supplies a mixed residence and business section, and could be, and was, made with very little expenditure an efficient distributing system. The data are not at hand to show just what efficiency was obtained after changing, but it would probably fall between feeders 1 and 2.

It may be noted that between feeders 1 and 2 the transformer iron loss is 3.6 per cent. for No. 1 and 15.4 for No. 2. The actual watts lost in No. 2 are more than the watts lost in No. 1, but the lesser sales, due to its being a poorer district, raise its percentage of iron loss.

The meter shunt loss shows less, both in percentage and watts, for feeder No. 1 than for No. 2, for the

1. Report of a committee read before the National Electric Light Association at Chicago, May 28, 1903. Mr. Van Ness is a well-known Western central-station man.

reason that the consumers are fewer in number and the consumption greater.

The unaccounted-for current shows an abnormal amount under feeder No. 1, which indicates that there is some theft of current in that section. The natural course to pursue would be to check up all meters in that district, and if no large meters were found dead, then it would be necessary to begin a search for taps taking current without measurement.

Feeder No. 3, while it appears to a great disadvantage beside Nos. 1 and 2, is by no means unusual. There are many operating under the same conditions to-day, and few realize the cost of this operation. For instance, the iron loss in this feeder amounts to 8,600 kilowatt-hours per month. This, at the generating cost of one cent per kilowatt-hour, amounts to $86 per month, or $1,032 per year. The excess of this over normal transformer loss would pay interest on considerable investment for new transformers and secondary copper, and we should also be able to give better regulation.

TABLE II., SHOWING LEGITIMATE LOSSES ON FIVE CAREFULLY DESIGNED FEEDERS SUPPLYING ALL CLASSES OF BUSINESS.

	Voltage.	Trans. Iron Loss		Resistance Loss.		Meter Shunt Loss.		Output.
		Watt-hours.	Per Cent.	Watt-hours	Per Cent.	Watt-hours.	Per Cent.	Watt-hours.
1....	1,000	28,488	6.76	23,923	5.68	14,916	3.54	421,000
2...	1,000	19,752	3.78	25,086	1 98	19,092	3 65	522,400
3....	1,000	28,680	9.56	17,026	5.60	23,316	7.77	300,000
4....	2,000	20,712	5.01	29,691	7.28	24 504	5.93	413,000
5....	2,000	42,576	8 55	28,867	5.79	18,720	3.76	477,600

Table No. 2 shows output and losses for an average winter day for five feeders, which have received considerable attention in the way of design. There is but one peculiarity in these figures, and that is that in feeder No. 4 the meter shunt loss amounts to more than the transformer loss. This is due to the fact that the feeder supplies a residence section by a carefully designed three-wire network. The conditions here were such that the transformer capacity could be so installed that very little more than the demand of the feeder was necessary in order to give proper regulation. On account of the large number of consumers, it was impossible to keep the meter shunt loss down without using ampere-hour meters.

TABLE III., SHOWING LOST AND UNACCOUNTED-FOR CURRENT FOR A STATION FOR THE FIRST THREE MONTHS OF ANALYSIS.

	Transformer Iron Loss.		Resistance Loss.		Shunt Loss.		Unaccounted For.	
	Kw. Hrs.	Per Ct.	Kw. Hrs.	Per Ct.	Kw. Hrs.	Per Ct.	Kw. Hrs.	Per Ct.
January	29.296	14.3	7,849	3.76	7,486	3 58	43,205	20.6
February.....	26,163	14.5	6,588	3.66	6,625	3.68	36,096	20.1
March	28.153	16.0	4.377	2.62	7.121	1.28	23.958	14.4

Table No. 3 will give an idea of some of the things that we may learn by an analysis of lost and unaccounted-for current for an ordinary station. This shows analysis for the first three months. It will be noted that transformer iron loss remains practically the same. The person making this analysis states that it will be cut something like 10,000 kilowatt-hours per month in a very short time. This is not entirely due to the analysis of the lost and unaccounted-for current, as the requirements of the service demand an improvement in this line.

The resistance loss has been decreased by very little expenditure, simply because they found where the resistance loss took place.

They do not expect to reduce the meter shunt loss, but the unaccounted-for current has been reduced about 45 per cent. in three months. This was accomplished by looking up lost records, defective meters and thefts of current.

The person making this analysis, in reporting, says: "The work necessary to make this analysis easily pays for itself many times over, as it is very probable that we should not have discovered the theft of current or loss of records had it not been brought to our attention in this forcible manner."

These figures are not cited as representing average conditions. However, there are many sections to-day with alternating distributing systems in no better condition than this one was in January. While an analysis is not always necessary to get a station in good condition, I maintain that the information brought out in analysis of this kind will assist us greatly in tracing out inefficiencies that can easily be remedied.

Some Notes on Modern Horizontal Water-turbine Development.

By Mark A. Replogle.

The term horizontal turbine waterwheel, as generally used by engineers in designing or handling turbines, is understood to refer to a turbine mounted on a horizontal shaft when in operation or developing power. A horizontal turbine differs little in its essentials from a vertical turbine other than the relative position of its axis. A turbine revolving in a horizontal plane about a vertical axis is called a vertical turbine, and, as above stated, a turbine revolving in a vertical plane about a horizontal axis is called a horizontal turbine.

Not a few make claim to being inventors of the horizontal turbine. Some claim priority patents, but observation will lead to the belief that the idea of setting a turbine shaft in a horizontal position does not involve novelty, especially when all early devices, such as overshot, undershot and breast waterwheels, were so mounted. There is, however, a broad field for experimentation in the design of wheel cases and the suction or draft tubes that are used in connection with horizontal turbines.

The great advantage of the horizontal turbine over the vertically arranged waterwheel is simplicity. It may be keyed to a common shaft with the driven machine, dispensing with gearing and belting, with their accompanying harness and supports. It can be placed above the tail water, where it can be cared for with comparative ease. It is even better adapted to drive generators than the steam engine, on account of its constant torque. All crank engines have a variable torque that affects the voltage, unless heavily loaded with balance wheels.

If a mechanical transmission is desirable, the turbine shaft can be extended to the work, or pulleys can be used in transmitting the power, or for changing it to higher or lower speeds.

The horizontal turbine has some disadvantages. Its quiet nature causes it to be neglected. It may wear its bearings away after months of steady service. It may grind its rim down or cut its shaft half off, and then may not have attracted the attention of the attendant, who waits for something to happen before acting. Its draft tubes may admit air through a neglected stuffing box, or an imperfect joint, causing a heavy loss in power. It must be noted that a portion of the effective head is below the turbine, hence, any air that enters the draft tube will expand on account of the tendency to a vacuum, and destroy its effectiveness.

The horizontal turbine may be designed for high heads, medium heads and low heads. These terms are only relative, and lack specific meaning. Their interpretation may be different with each observer. Keeping in mind the turbine as developed in America, high head may be applied to any head above 50 feet. Low head may be applied to any head below 16 feet. Medium head will then apply to all heads between 16 feet and 50 feet. Examples of high-head horizontal development may be found in nearly every enlightened community that is favored with waterfalls.

Horizontal turbines in iron cases with feed pipes and draft tubes are more common than any other. In fact, this type may be considered standard for heads ranging from 16 feet to 50 feet. The horizontal turbine for low heads is not so well developed; at least practical demonstrations are not so plentiful. There are several reasons for this. First, low heads generally are last to be developed, on account of increased cost per horsepower; second, they suffer greater relative variations in head, due to floods. Also greater fluctuations in the water supply. The latter conditions make it necessary for additional caution in power-house construction to protect the driven machinery from being flooded by the tail water. This can easily be provided for by using watertight compartments for the driving pulleys, dynamos or other power-using devices. By the use of a watertight room, with a small pump to take care of the seepage, any head below 16 feet that is worthy of improvement may supply power efficiently by the use of horizontal turbines, the power depending entirely upon the difference between the levels of head and tail water and the quantity passing through the turbine.

The horizontal turbine is especially fitted to develop power for electrical generators on account of its flexibility. The best American turbine systems have a full line of tested patterns that will admit of little change in speed and power under given conditions. But, when a generator speed has been decided upon, the proper turbine for this speed under the given head can be selected. It is only necessary then to mount a sufficient number of turbines on one shaft to raise the unit to the required capacity.

One query that naturally presents itself is, How will the efficiency of horizontal turbines compare with the vertical test records? At first thought, it would seem that the power and efficiency should approximate the same. Past experience shows, however, that the power had fallen off as much as 10 to 20 per cent. in some carefully designed power houses where horizontal installations were made. Such deficiencies have beneficial effects in leading to greater care and thought in future installations. They also suggest that tests be made of turbines under their working conditions. The most exhaustive tests of this kind on record are those made of turbines for the power house at Sault Ste. Marie, Mich. The turbines had been raised above standard to the required power and efficiency in vertical step tests. These same turbines were mounted on horizontal shafts after the best-known designs and tested again. They fell short five horsepower for each turbine. The testing and experimenting that followed extended over more than a year, with a final result that each turbine tested nearly five horsepower more than the original vertical-step test, but the wheel case and draft-tube design were radically changed from the original horizontal setting. It has been demonstrated that a horizontal turbine may generally develop power with an efficiency equal to the vertical-step tests (except a possible minor loss, due to friction in the longer feed pipes and draft tubes).

Present American practice shows great liberality in arrangement of horizontal turbines. The following are some of the combinations:

1. A single turbine in open penstock.
2. A single turbine in iron wheel case.
3. Double turbine, discharging into one common draft tube.
4. Double turbine, discharging into individual draft tubes.

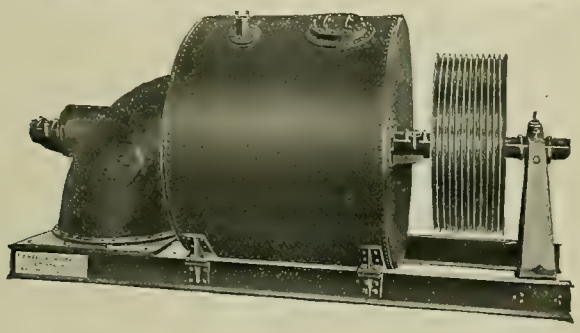


Fig. 1.

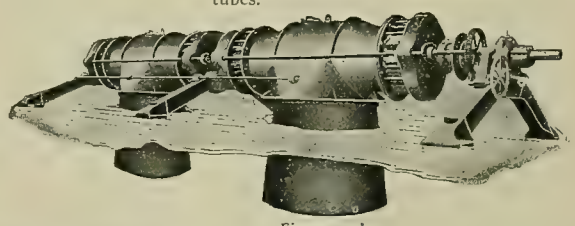


Fig. 2.

MODERN HORIZONTAL TURBINE WATERWHEELS.

It can readily be seen that any combination or number of turbines may be arranged from the above. (Combinations 3 and 4 may be set in open or closed penstocks.)

Fig. 1 shows the No. 2 combination, with the draft tube absent. Fig. 2 shows the No. 3 combination, with the supporting beams and side walls absent. This unit consists of two pairs of turbines mounted on one shaft in open penstock, each pair discharging into one common draft tube. Examples of all the above may be found in modern waterpower plants.

In conclusion, it may be said that the past has furnished experience; the present is furnishing reliable data, and the future will be devoted to perfecting the construction from a hydraulic, as well as an economical, point of view. Last, but not least, the horizontal-turbine waterwheel plant will be designed to make valuable many low-head waterpowers that are now lying idle or are poorly developed.

[Mr. Replogle, the writer of this article, is the hydraulic engineer for the Wellman-Seaver-Morgan Company at Akron, Ohio.]

Static Electricity on Automobile.

The state highway commissioners of Massachusetts recently made an inspection trip in a steam wagonette, but were greatly delayed by the machine's inability to make steam fast enough to carry it over heavy grades. At one time when the wagonette was standing still the air pump was started. A moment later one of the party touched the metal bar supporting the canopy, and received an electric shock. It was noticed that the metal parts of the vehicle were electrically charged whenever the air pump was running, and it is supposed that the pump generated the current by friction, the rubber tires preventing its escape to the ground.

The Toronto Railway Company has started to build 40 new cars, of which 30 will be very large closed cars and 10 will be the medium-sized open cars capable of seating 60 people. The experiment tried a short time ago of making two old cars into one has proved such a success that the company is going to make further experiments. By joining two of these cars together the company saves two men on each double car, as well as increasing the carrying capacity 30 per cent. beyond any of the present cars.

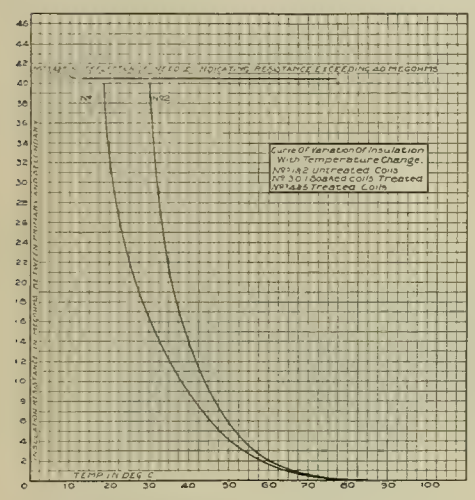
Transformer Insulation.

By Edward A. Wagner.

The subject of transformer insulation has not, until the last few years, been given the same special attention that many other electrical problems have received, although the development of the transformer from its original form, consisting of an iron core enclosed by coils of wire, to its present degree of refinement and economy of material, has been comparatively rapid.

The importance of uninterrupted service to customers and the vexatious and costly failures of the earlier types of transformers in which air and fabric-insulating materials were exclusively used, caused the introduction of oil in transformer operation. Because of the relatively high insulating properties of the mineral oils used for this purpose, it was at first considered that simply immersing the coils of the old dry type construction in a bath of oil would so greatly enhance their insulation that no further trouble from burn-outs or break-down of insulation would occur. Tests of such transformers when new showed that the insulating strength was much greater after the coils had been soaked in oil than before.

But, although they withstood very rigid tests at first, they would almost invariably fail after several months' use. This failure was traced to deterioration of the cotton insulation caused by the chemical action of acids formed by the combination of oil with varnishes or shellac, not thoroughly dry, in contact with copper. In the old dry type, varnish and shellac were applied freely to the windings in an effort to increase the insulating properties of the cotton



CURVES SHOWING STRENGTH OF TREATED AND UNTREATED TRANSFORMER COILS.

covering of the wire, and as this practice was continued after oil was included as an insulation, the transformer so constructed continued to cause trouble as soon as the deterioration of insulation was sufficient to allow short-circuits.

To remedy this defect the use of shellac or varnish was usually discontinued in transformers immersed in oil. Although this had some effect in increasing the life of the insulation, failures were usually to be expected after a somewhat longer period of use than before the omission of the insulating paints. It was found that the constant vibration, to which the numerous closely packed turns of wire was subjected, was quite liable to chafe the cotton covering of the wire and gradually wear it away in certain parts of the winding, causing short-circuits and burn-outs. The absence of the insulating paints contributed to this condition since their binding or cementing properties would prevent vibration of the conductors.

It was also noticed that unless the coils were in a thoroughly dry state when immersed in the oil, the insulation strength would vary with changes in temperature, a rapid decrease taking place as the temperature of the transformer increased in operation. This was due to the moisture contained in the fibrous materials of which the insulation of the coils was composed.

It is a well-known fact that the greater the rarefaction of the atmosphere, the lower will be the temperature required for evaporating water. Since the commonly available transformer-insulating materials such as cotton, paper, linen, etc., show a decided loss of mechanical strength when subjected to temperatures above 85 degrees C., and since water in the low altitudes must be raised in temperature to 100 degrees C. before it will evaporate, it necessarily follows that transformers must be subjected to a temperature greater than 212 degrees F. when under atmospheric pressure in order to thoroughly dry the coils. When certain varnishes are used inside the coils even this high temperature is not sufficient thoroughly to dry out the varnish inside the coil unless extra means are employed to supply a sufficient amount of oxygen to the interior of the coil to thoroughly oxidize the oil in the varnish.

Careful study of these conditions and others indirectly associated therewith led to the development of a "vacuum drying and substitution process" whereby the difficulties due to the deterioration of insulation were overcome. This process consists of drying the coils thoroughly in a vacuum at a comparatively low temperature, and then, before allowing access to the atmosphere, with the possible absorption of moisture, filling them with a waterproof compound which penetrates every interstice in the coil and insulation.

From an analysis of the various deficiencies of previous methods of insulating transformer coils it may be seen that certain requirements must be fulfilled if a perfect insulation is obtained. The compound with which the coils are impregnated must have the following qualities:

First—It must be non-hygroscopic or waterproof, so as not to absorb moisture from the atmosphere or oil.

Second—It must be cohesive, so as to hold the conductors firmly in place and prevent vibrations.

Third—It must be insoluble in mineral oils used in transformers.

Fourth—It must be a good heat conductor, so as to conduct readily heat from the interior of the coils to the oil, and thus equalize temperatures throughout the transformer.

Fifth—It must possess a constant insulation strength through a wide variation in temperature.

Sixth—It must be plastic, so as to readily heal any punctures caused by lightning or other high-tension static discharges.

A compound possessing these properties has been in use for several years by certain manufacturers of transformers and has proved very satisfactory in maintaining steady, uninterrupted service of lighting transformers, especially those of small or medium capacity which are most liable to be subjected to abnormal strains. Results obtained by the writer in comparative tests of transformers constructed with this compound applied by the vacuum process and with others not so treated indicate that the insulation of the treated coils is practically perfect, no deflection being produced on a voltmeter connected so as to indicate a minumum of 40 megohms resistance. (See accompanying curves.) The insulation strength of untreated coils rapidly decreased with increasing temperatures as shown by the curves. The coils of transformers Nos. 1 and 2 were wound with cotton-covered wire shellacked and immersed in oil. No. 3 was a transformer similar to Nos. 1 and 2, but had been treated after being in use in oil about one year without treatment. Nos. 4 and 5 were treated before immersion in oil.

Careful tests have shown that coils insulated by varnish and immersed in oil will readily withstand a break-down test of 10,000 volts applied for 30 seconds between coils and core when cold, but when the temperature of these coils is increased 50 to 60 degrees Centigrade a potential of 8,000 volts applied for 30 seconds almost invariably causes a break-down of the insulation.

The development of the vacuum-drying and substitution process of treating transformer coils is a marked indication of the specialization that is becoming more and more necessary in the various contributary arts lending aid to the electrical and mechanical engineer.

[Mr. E. A. Wagner, the writer of this article, is an engineer in the transformer department of the Fort Wayne Electric Works.]

Space Telegraphy Established Between Milwaukee and Chicago.

Official tests of the space-telegraph stations erected at Milwaukee and Chicago by the Marconi Wireless Telegraph Company were made on June 1st and proved satisfactory, messages being exchanged between the two cities, 83 miles apart. These stations are the only ones of the Marconi company west of New York. The Chicago station, an account of which was given in the Western Electrician of May 23d, but which was erroneously credited to the De-Forest company, is only for temporary use and consists of a small building, housing the instruments, and a tall mast, sustaining the antennæ.

The first messages sent consisted of an exchange of greetings between the mayors of the two cities. Besides several officials of the company and the chief engineer, a number of prominent electrical men were present at the test and witnessed the sending of messages, which, in the Marconi system, is done by means of a telegraph key, like the ordinary key, except that it is several times larger. The Morse alphabet is used. Messages are received by means of a tape machine on which the dots and dashes are printed. The Chicago-Milwaukee instruments will receive from 15 to 25 words a minute. Improvements are under way which it is expected will greatly increase the receiving capacity. It is expected that later a general business will be transacted on the Great Lakes.

Third-rail Plans for Boston and Albany Railroad.

The New York Central and Hudson River Railroad Company is making plans for a third-rail electric system for its Boston suburban service on the Boston and Albany Railroad, but it does not intend to install the system at present. The preliminary work is for the purpose of determining the cost.

Chicago Street-railway Situation.

Negotiations between the local-transportation committee of the City Council and officials of the Chicago City Railway Company looking to the extension of franchises continue, and it is stated that a better understanding has been reached. The fact that the negotiations have been carried on chiefly between the council committee and the Chicago City company has given rise to a report that an understanding exists between the Chicago City and Union Traction companies whereby the former is to pave the way for the latter in the matter of securing franchises. This report is denied by officials of both companies, and Receiver Sampsell of the Union Traction Company declares that his company has not been asked to join in the negotiations.

What shall be done with the claims under the 99-year act has taken up most of the time of all the conferences held so far. The company has signified its willingness to waive these claims if it is given something in return.

The matter of improving the service of the Union Traction Company will come up in the form of a request for more explicit instructions from Judge Grosscup. President Roach of the company has been at work for some time on a set of alternative plans for this improvement, running all the way from an almost complete renewal of the system down to a simple substitution of electricity for horse cars in the downtown district

The matter of subways was discussed by the transportation committee at a meeting called to consider an amended ordinance whereby the Illinois Telephone and Telegraph Company seeks permission to enlarge certain portions of its tunnels. A doubt was expressed whether a double-deck system of subways, which would allow the best terminal facilities for street-railway lines, can ever be constructed in Chicago, owing to the sandy nature of the ground which forms the downtown foundations of the city. An attempt to go deep enough to build a double-deck subway would result in widespread destruction to downtown buildings, it is feared, as the digging of caissons for the foundation of the west wing of the new First National Bank building is said to have caused the present bank building to the east to sink four inches.

Employes of the Chicago City Railway Company have demanded an increase in wages of General Manager Robert McCulloch. The men employed on the electric lines want four cents more an hour. The present rate is 24 cents. The increase would give them the same pay as the cable men on the State Street line and two cents an hour less than the scale on Cottage Grove Avenue. The shop employes want a nine-hour day and no reduction in wages. The executive committee also will ask Mr. McCulloch to unionize the entire system.

Large Power Plants Near Seattle.

Plans have been completed and work begun on the construction of two of the largest electric power plants ever erected on the Pacific Coast. The Tacoma Industrial Company is the name given to one of the companies which has been organized for the purpose of developing the waters of White River, and the Pierce County Improvement Company is organized for the same purpose to erect a plant on the Puyallup River.

The first plant will be located 25 miles from Seattle, and the latter 40 miles. The uses to which the power will be put will be to operate the street railways of Seattle and Tacoma, the Interurban line, and to furnish power to the manufacturing plants in the two cities and along the line of the electric road between Seattle and Tacoma.

Both companies are being financed by Stone & Webster of Boston, who represent the stockholders in the Seattle, Tacoma, Whatcom and Interurban railway lines. Ground has already been broken on both sides, and the plants, when completed, will represent an expenditure of several millions of dollars. The White River plant will be in operation by the end of the year, and the Puyallup River plant some time early in the spring of 1904. All work will be under the supervision of S. Z. Mitchell of Seattle, who has been named as general manager of the Stone & Webster power enterprises in the Northwest. The two plants will be capable of generating upwards of 30,000 horsepower, which is sufficient to supply the 20,000 horsepower now needed to operate the Interurban road and the Stone & Webster properties in Seattle and Tacoma, and also provide for a large increase in the growth of the manufacturing business of the Puget Sound cities and for the extension of electric systems.

It is by far the largest enterprise of this character that has ever been undertaken in the Puget Sound country, and will be the means of stimulating manufacturing plants along the line of the Interurban line and in the two cities, thus increasing the value of the present holdings of those represented by the Boston company. The Tacoma Industrial Company has purchased outright all the water and land rights on both sides of the White River for a distance of over six miles, and these will be ample for the purpose to which the waters will be put. The Puyallup River rights have also been purchased.

The two companies have already placed orders with the General Electric Company for six 5,000-horsepower generators which will be installed in the two plants.

First Aids and Appliances for the Injured.[1]

By J. D. McGowan, M. D.

I believe this is the first time in the history of this association that any paper pertaining to relief of the injured has been read at its meetings; and it is one of the gratifying signs of the times that the interests of others than the members of the medical profession are being awakened, not only to measures for the prevention of disease, but also for preventing, so far as it is possible to do so, some of the unfortunate results of either improper treatment or no treatment at all in cases of accident, whether of a serious or an apparently trifling character.

Owing to the prompt application of first dressings in the late war between the United States and Spain, the records of the surgical department of the army and navy show a smaller percentage of loss of life or limb than in any previous campaign.

As all, or nearly all, of your shops are in large cities and towns, where the services of a surgeon can be readily obtained, and no great amount of time need elapse from the moment of accident to the obtaining of skilled surgical aid. I will not go into an elaborate detail of all that should be done, as it is far better to do too little than too much.

If your shop is in Pennsylvania, you may have in your employ a young man who has a brother practicing medicine in Iowa, and such relationship is apt to make him believe he has the medical instinct which gives him a knowledge superior to his fellows. If you have such a man about, and an accident happens, send him for a doctor.

It is well to have on hand at all shops or factories a box containing the necessary aticles for the application of first aid, and have a few of your intelligent foremen instructed in their use.

When an accident happens:

Do not get excited.

Send for a surgeon; tell him briefly the nature of the injury.

Remove the injured man to a quiet, well-ventilated place, neither hot nor cold, away from the noise of the engine room and machinery, and place him in as comfortable a position as possible; lay him upon his back, with his head on a level with his body, and his limbs in a natural position.

Allow nobody near except those who are needed to care for him.

Do not let him know that his condition is serious; encourage him all you can.

If the head has been injured, it should be raised somewhat higher than the rest of the body.

Loosen his clothing at neck and waist; if patient faints, lower his head and raise his feet.

If arm or leg is injured, it may be slightly raised and laid on a cushion; a cushion may be made with old clothing or any soft material.

If he vomits, or tries to do so, turn his body on one side, with the chin low, so that the contents of the stomach may flow from the mouth.

If the wound is found covered by clothing, cut the clothing in the seam, and remove only enough to show the wound. In case of burns, pour lukewarm water over the clothing before attempting to remove it; otherwise you are liable to pull off the charred skin, and leave a large, raw surface open for infection. Cover all wounds and burns as quickly as possible.

In examining a wound, wrap some antiseptic gauze around the fingers before touching it. Do not attempt to cleanse a wound; expose it and apply some antiseptic gauze, or the contents of this little package, called "first help for wounds," and wait for the surgeon to cleanse the parts.

Bleeding.

From the arteries, blood is bright red and comes in spurts or jets, as from a small hose. This should be immediately stopped, if possible, and the best method is to apply pressure over the artery at some point nearer the heart than the point of bleeding, selecting a place where the artery is near the surface of the body. First, apply several thicknesses of gauze over the wound (having fingers wrapped in a separate piece of gauze before handling), and bind tightly with roller bandage; then over the point selected between the wound and the heart, apply pressure, using anything at hand for the purpose—a piece of rubber tubing, such as is used for gas piping, is best, a pair of suspenders, a rope or a bandage; bind the parts tightly and leave them until the aid of a surgeon can be obtained.

From the veins, blood is of a dark-red color and flows out or wells up freely from the wound. Apply pressure directly over wound, using wad of gauze and bandage.

When the blood oozes from the wound, apply gauze and bandage.

In case of bleeding, keep the patient in a horizontal position; if bleeding from a limb, elevate the limb; keep the patient warm. When bleeding has ceased, hot drinks may be given.

Do not leave tight bandage on a limb too long; the bandage may be loosened after 15 minutes, and reapplied with diminished pressure. In rupture of varicose veins, elevate the limb, loosen clothing, and bandage firmly below the wound, and apply a compress over the bleeding vein.

When a man faints from loss of blood, lower the head and raise the limbs; be ready to apply compress, if bleeding starts up again.

Do not cover a wound with any dressing that is not sterilized.

Do not forget to elevate the limb.

Do not put on cobwebs, tobacco or shellac, or salve

Do not disturb blood clots.

Do not give whisky or brandy.

Do not leave a wound uncovered after the bleeding has stopped.

For internal bleeding, apply ice-cold cloths to abdomen; lower the head slightly.

Wounds.

In injuries to the head, place the patient on his back, with head resting upon a cushion covered with a clean towel.

The arm, when injured, should be brought across in front of the chest and supported by a sling.

The lower limb should be supported on a cushion or blanket.

In chest wounds, the head and shoulders should be raised by one or more pillows, until patient can breathe comfortably.

In wounds of abdomen, patient should lie down, with knees drawn up and turned toward injured side; if wound be in front, place him on his back.

After covering a wound of any kind, do not uncover it; put on more bandages if it bleeds.

In bruises or sprains, apply hot water, as hot as can be borne; if an ankle is sprained, or foot crushed, place it in a bucket of hot water, keeping the water hot by adding more hot water as required.

Fractures.

These may be simple or compound. A compound fracture is where there is an external wound communicating with the fracture. This may be caused by one end of the fractured bone penetrating through the skin, or by a spike or rifle ball or some other missile piercing the skin and tissues to the seat of fracture.

Place the patient in a comfortable position, supporting the injured member upon a cushion of some kind, which may be made with any soft material at hand. If possible to remove the clothing without causing much pain, it is best to do so. In simple fractures this is not absolutely necessary, as a splint can be applied over the clothing, using the latter for a pad.

In compound fractures, dress the wound with the contents of the first-aid packets, or with antiseptic gauze, before applying splint.

Do not attempt to set the bone; merely try to put the injured part in a position where it can be held securely, so as to prevent the fractured ends of the bone from rubbing together and causing pain.

Splints.

The chest can be used as a splint for the arm by binding the arm to the side with a roller bandage.

The uninjured leg may be used as a splint for the injured one.

A splint must be long enough to keep the joints above and below the injury at rest.

The splint should be a little wider than the thickness of the limb.

The splints should be padded with some soft material, such as sheet wadding, cotton, etc.

If two splints, one on each side of the limb, can be applied, all the better.

Material for splints is usually easy to obtain; cigar boxes, pasteboard, laths, shingles, barrel staves, broom handles, canes, shovels, umbrellas, desk rulers, fruit baskets etc. Any of these may be used.

Place the splint on either side of the injured limb, handling the broken member as delicately as you would a valuable piece of china or cut glass; have the splints well padded and secure them to the limb with a roller bandage, or a handkerchief; towels, suspenders, cord or straps may be used if the bandages are not at hand.

Someone should support the limb by slipping the hands gently under it, above and below the injury, while the others are applying the splints.

In fractures of the skull, place patient on his back with head and shoulders slightly raised, and keep quiet until surgeon arrives. If there is a scalp wound, place some antiseptic gauze over the wound.

In fractures of spine, keep patient flat on his back.

In fractures of collar bone, place pad under armpit, and bandage arm to side. Patient is best on his back.

In fracture of ribs, patient should be moved as little as possible. Keep head and chest elevated; let him lie on his back or on the uninjured side.

In fracture of thigh, apply a long splint made of board, to extend from below the foot to above the hip, first drawing the limb out to its full length, and bandaging the splint to the leg at the ankle, the knee, and about the waist.

In fracture of knee-pan, place a pad in the hollow under the knee and apply a splint to the back of the leg, keeping the leg straight.

In fracture of leg below the knee, place the leg gently in a pillow and bind the pillow to the leg. If no pillow is at hand, apply a board splint (taken from a fruit basket) to either side of leg and bandage, being careful not to bandage too tightly.

If a patient is to be carried some distance, bind the injured leg to the other limb, after applying splints.

In fracture of upper arm, place a pad in the armpit and draw the elbow to the side; bind the upper arm to the side of the chest and put the forearm in a sling.

In fracture of forearm, make a splint from a cigar box, or a piece of wood long enough to extend from the fingers to near the elbow; place this on inner side of arm and another piece over the back of arm, and bandage.

In fracture of fingers, bind one finger to the other, after placing cardboard splint under the fractured member.

Burns.

Burns are of three degrees:

First—Simple reddening of the skin.

Second—When blisters form.

Third—Charring of skin and ulceration.

Remove clothing carefully; cover burned surface quickly to exclude air; pour on oil. A mixture of equal parts of linseed oil and lime water forms the best and most convenient dressing for first aid, and should be kept on hand, in well-corked bottles, in every shop where a workman is liable to be burned. Pour this freely on the surface, apply sterilized gauze and saturate that, then a layer of absorbent cotton, and soak that with the oil. When the burn covers a large surface, expose and dress a small area at a time. When a man's clothing is on fire, throw him down and roll him over to extinguish the flame, or wrap him in a blanket, so some woolen material, and press the burning points from the outside.

If no oil is at hand, use a warm solution of baking soda in water; or use white of egg, or powdered starch, or toilet powder.

When a burn is very extensive, and patient is in a state of shock and grave danger, if there is a bathtub available, wrap him in a sheet, clothes and all, and lower him into the bathtub, which should be filled with tepid water. He may be kept there many hours with his head above the water. This is the best method to relieve pain and to prevent the danger from shock.

Burns from Ammonia, lye, etc., should be bathed freely with water, then with vinegar, and then with oil.

Burns from vitriol or other acids should be washed with water, then a solution of soda or lime water, mortar or chalk may be used; afterward apply the oil.

A fragment of lime in the eye should be washed out with water, and the eye bathed with a weak solution of vinegar or lemon juice.

Transportation of Wounded.

The four-handed seat is made by two persons clasping each other's wrists. Doubtless many of you have done this in your boyhood days at school.

After the hands are clasped together, the bearers stoop down behind the patient, who sits on the hands, and places one arm around the neck of each bearer.

The two-handed seat is made by two bearers clasping their hands and placing their free hands on each other's shoulders. A bearer stands on each side of the patient and passes one arm under his knees and clasps the hand of the other bearer; the bearers then pass their arms around the back of the patient and grasp each other's shoulders.

The "pick-a-back" method may also be sometimes used. A temporarv stretcher may be made by turning the sleeves of a coat inside out; two stout poles are then passed through them, and the coat is buttoned. The patient sits on this and rests against the back of the first bearer. To make a longer stretcher, treat two coats in the same way.

Two sacks may be taken; a hole is made in each corner of the bottom, and two poles are passed through the sack and out of the holes.

A broad board or shutter may be used as a stretcher; if used, some hay, straw or clothing should be placed on it, and then a piece of stout cloth or sacking; the sacking is useful in taking the patient off the stretcher. Always test the stretcher before using.

Never allow stretchers to be carried on the bearers' shoulders.

Always carry patient's feet foremost, except when going up hill.

The "first-aid package" or "accident case" contains many things that are invaluable to the layman in applying relief to the injured; there are also some articles contained therein which none but a surgeon should be permitted to touch, such as needles, sutures, etc.

If, however, the surgeon, hastily summoned, should have omitted to bring with him all the requisites for cleansing, suturing, and dressing a wound, it would be very gratifying to him to find everything ready for him in such a convenient, compact form.

I wish to show you also the Chicago Edison emergency box, the product of Mr. W. L. Abbott's ingenious brain. One of these boxes is carried on each wagon. It contains a box of Edison ointment, of whose healing properties we are justly proud, a gauze bandage, a first-aid package, a hypodermic syringe, and a solution containing one-twentieth of a grain of strychnine to each barrel of syringe. The strychnine is to be used to inject under the skin of a man who receives a shock from the high-tension wires. If a doctor is near by, it is well to have solution ready for him; in the absence of a doctor the foreman is instructed how to use the syringe.

Shock.

Shock is common after serious accident, injury, burn, or from the electric current.

1. Paper read before the National Electric Light Association at Chicago, May 28, 1903. Dr. McGowan is a surgeon connected with the Chicago Edison Company.

The symptoms or signs of shock are cool, clammy skin, vomiting and retching, weak, rapid pulse, sighing or irregular breathing, half-opened eyelids, dilated pupils, dullness of intellect and sometimes insensibility.

Place the patent in a warm, quiet place; after dressing wounds, wrap him in warm material and apply heat to the whole body, using hot-water bottles, water-bags, hot bricks, blankets, flannels wrung out of hot water (no heat to head), hot drinks (coffee best), spirits of ammonia, diluted with water, or small amount of whisky.

Electric Shocks.—Susceptibility to shock depends upon the individual, women and children being less resistant than men. Diseases of heart and kidneys predispose to accident from electric shock. Do not lower the head of a person who has received electric shock. Artificial respiration should be kept up for hours. Massage of abdomen and left side over the heart. Heat to body as above.

Compound or Shunt-wound Dynamos for Waterpower.

[From the Question Box of the National Electric Light Association.]

In answer to the question, "Have compound dynamos any advantages over shunt machines when run by waterpower without governors?" these were the answers:

W. S. Barstow, New York: No; as variable speed will prevent compound dynamos from compounding properly.

George B. Lander, Concord, N. H.: Our experience with any machine running from an ungoverned waterwheel would lead us to say without hesitation that a shunt-wound machine would give about as good regulation—probably quite as good—as a compound-wound. Any increase or decrease of load tends to slow up or speed wheel, and a compound winding would aggravate this trouble.

Edison Electric Illuminating Company of Boston: An over-compounded dynamo should have a distinct advantage over a shunt machine when run on waterpower with poor regulation, as any increase in load causing the speed to drop could be compensated for by properly over-compounding. This arrangement with several machines in parallel, if the various wheels driving them will not regulate together, might get you into rather serious difficulties; but if the waterwheels were all tied together mechanically they would probably be all right.

BOOK TABLE.

Les Applications Pratiques des Ondes Electriques. (Practical Applications of Electrical Waves.) By Albert Turpain, D. Sc. Paris: C. Naud. 1902. Paper; pp. (5½ by nine inches) 412, with 271 illustrations. Price, 12 francs.

This is a thorough and practical exposition of the art of space telegraphy and goes back as far as the work of Hertz, while the recent advances recorded include the experiments of Lodge, Marconi, Slaby, Arco, Tesla, Oerling, Branly, Popoff and others. The author describes practically and historically the various types of instruments involved in the operation of the different systems, including in such mention exciters, coherers, anti-coherers, induction coils and interrupters. The principal part of the work is devoted to space telegraphy, the other topics considered being wire wave telegraphy, Tesla currents and the application of high-frequency currents to electric lighting. A list of French, British, German and American patents is a valuable feature of the book. The illustrations are good and, especially in the case of the Hertz experiments, of much historical value.

The Induction Motor; Its Theory and Design, Set Forth by a Practical Method of Calculation. By Henry Boy de la Tour. Translated by C. O. Mailloux. New York: McGraw Publishing Company. 1903. Pp. (six by nine inches) 200, with 75 diagrams. Price, $2.50.

The author of this valuable treatise is chief electrician and designer in the electrical department of the Compagnie Fives-Lille, Givors, France. He has handled the subject in a masterly manner; his object has been to explain the theory of the induction motor, treating all of its peculiarities and giving a practical method of calculation without going beyond the bounds of elementary mathematics. This book is, therefore, well adapted to the needs of the non-theoretical designer as well as the student. The value of the work has been enhanced by the translator by his careful translation and by the addition of an introduction explaining the nomenclature used in the text. The nine chapters take up in succession the revolving field and the electromotive forces which it induces, the electromagnetic couple, magnetizing action of windings, computation of the resistances of short-circuiting rings in connection with squirrel-cage windings, recapitulation of preceding chapters, performance diagrams of induction motors, practical applications, and the Heyland motor, the last chapter being added by the translator. The book may be recommended on account of the clear and original treatment, the derivation of formulas and constants and the general and excellent use of physical and mathematical qualities.

CORRESPONDENCE.

London Letter.

London, May 20.—The Royal Commission on London traffic still continues its weekly sittings. Up to the present all the evidence has been in favor of the appointment of a special tribunal to deal solely with matters of locomotion, but the task of the commission is not made the easier by the proposal of the London County Council that all matters concerning tramways should be dealt with by that body, and all matters concerning railways by a special tribunal. How matters would be expedited in this manner one fails to see. One thing seems pretty clear. At present all the borough authorities in London—and they are 27—have the right of preventing any tramway proposal being considered on its merits, by refusing to give its consent, which is required by Parliament. This will assuredly be abolished. All of the county councils around London are in favor of this.

A good deal of talk has been going on recently as to the inability of British manufacturers to supply large three-phase machinery. It commenced with some evidence given before a departmental committee of the Home Office, which is inquiring into the use of electricity in mines, which was to the effect that it was absolutely impossible to obtain such machinery at home, and that one had to go to America or the Continent. Since then a number of repudiations of this statement have been published. One of them was by a manufacturer and was to the effect that at the time the order mentioned in evidence, was put out, the English firms were too busy to take the matter up. The latest explanation of the difficulties hitherto experienced comes from Alexander Siemens of Siemens, Bros. & Co., who says it is due to the fact that Tesla's patent rights in the matter did not expire until last year, and that there are no provisions in the patent laws of this country for taking out licenses for working foreign patents until those patents have expired. The general trend of the evidence before this committee is greatly in favor of polyphase working, and inasmuch as there is very little yet done in this respect, there is every prospect of a great future in this country for such installations.

The London County Council tramways were opened a few days ago by the Prince of Wales. In connection with the speeches which were made, it was interesting to note the frankness with which everyone admitted that London was greatly behind all the other large cities of the world, in matters of tramway traction. As was only to be expected—it nearly always happens with new undertakings—a slight accident occurred on the first day of public running One of the men working the track switch at a very congested spot was knocked over by a van and only half changed the point, with the result that the plow of one of the cars jammed, and inasmuch as at these points the continuity of the electrical conductor is broken for a few inches, the car was in darkness. But things have been running very smoothly since then.

The International Telegraph Conference which will commence in London this week, will be quite private, and nothing of the proceedings will be known until the official report is published. A dinner is included in the programme.

The South Wales Electrical Power Distribution Company is now ready to supply electrical energy in bulk, and a number of local authorities, who have their own electric-lighting powers, and have been waiting for this supply, have been informed to this effect.

A proposal has been made for the formation of a company to supply electrical power in Scotland, with the title of the Scottish Central Electric Power Company, with a capital of $3,000,000.

A large increase in the receipts of the Mersey Railway Company has been noticed for the first week of electrical working, and over $1,250 extra was taken in receipts.

The Swansea Corporation, which recently decided to adopt the Wolter surface-contact system of traction, has now decided to use the overhead-trolley system. W.

New York Notes

New York, May 30.—Barney Oldfield of Toledo, Ohio, broke the world's automobile record for one mile at the automobile races at Empire Track, this city, to-day. In a five-mile race with Charles G. Wridgway, Mr. Oldfield covered one of his miles in one minute 1 3-5 seconds, thereby lowering the record 3 1-5 seconds. Oldfield drove a Cooper car and Wridgway a Peerless. The race, which was of five miles, best two out of three, was won by Oldfield and was for a silver trophy emblematic of the track championship of America. It was the only really stirring event of the series of contests and drew forth a deafening demonstration from the excited spectators.

At the request of several stockholders in the Metropolitan Street Railway Company, Eugene A. Philbin has made a formal request for the books and records of the company, that his clients may be satisfied whether there have been discrepancies in the accounts of the company, as has been alleged by W. N. Amory. In the event of the company refusing to comply with Mr. Philbin's request, application will be made to the courts for a peremptory order.

After a long and exciting struggle the residents of the Bushwick and Eastern Districts of Brooklyn have won their fight for extensive transfer privileges from the Brooklyn Rapid Transit Company. The company has agreed to make all the changes asked for, and the business men of upper Broadway are particularly jubilant over the outcome of the struggle.

The eighth annual dinner of the Morse Club, composed of telegraphers, was held at Marlborough Hotel this week. It was given principally in honor of William I. Quinn, who has just resigned the post of secretary of the Telegraphers' Aid Society, after 13 years service. E. E. Brannin, president of the society, presented a set of resolutions to Mr. Quinn, after which Gardner Irving, president of the Morse Club, presented a certified check for $500. A speech in Mr. Quinn's honor was made by State Senator Walter C. Burton of Brooklyn, and Marion H. Kenner spoke of Professor Morse and the sixtieth anniversary of his invention. Michael J. O'Leary, secretary of the Telegraphers' Mutual Benefit Association, paid a tribute to Superintendent William J. Dealy of the Western Union Telegraph Company, and Mr. Dealy himself spoke briefly. At the conclusion of the dinner, Gardner Irving was re-elected president.

Engines and trucks of the Fire Department had an exciting chase in Third Avenue yesterday afternoon after a burning electric car. They wished to put out the flames, but the motorman, evidently acting on instructions issued by the company to hurry any burning car to the nearest barn, refused to stop. A defective fuse started the fire. The car was filled with men and women, and they were badly frightened by the sight of smoke and fire shooting out from underneath the car, and being unable to get off. The fire was extinguished by the company's department when the car reached the barn.

An injunction has been granted in the Supreme Court against the Dry Dock, East Broadway and Battery Street Car Line, restraining the company from allowing the Railway Advertising Company to use the backs of the street-car transfers issued by the line for advertising purposes. The injunction was issued at the request of John J. Gilroy, who contends that ,by his contract with the line, he is entitled to all the advertising privileges of the line. He declares that the advertising privileges on the backs of the transfers are worth upward of $60,000 a year.

New England News.

Boston, Mass., May 30.—The Massachusetts Legislature has passed the bill authorizing the consolidation of the Amesbury and Hampton, the Haverhill and Plaistow, the Haverhill and Southern New Hampshire, the Lawrence and Methuen, and the Lowell and Pelham Street Railway Companies as the Northern Massachusetts Street Railway Company. The bill provides that the Northern Massachusetts Company may lease its property to the Exeter, Hampton and Amesbury Street Railway Company for a period of 99 years.

S. D. White, J. D. Emery, Corydon Powers, Eugene A. Holmes, and Herbert A. P. Edwards have formed a company with a capital of $210,000, to build an electric railway between Caribou and Perham, Aroostook County, Maine, a distance of 15 miles. This will be the most northerly electric railway in New England.

The Connecticut Legislature has passed bills incorporating the Scotland Electric Power Company and the Eastern Connecticut Electric Power Company. The first-named company has a capital of $100,000 and proposes to develop a large water power at Scotland on the Shetucket River, and to supply electricity for heat, light and power in Windham and New London Counties.

George E. Emmons of the General Electric Company of Schenectady, N. Y., has sold his Swampscott (Mass.) colonial house and 21,000 square feet of land to Captain William E. Pearson, treasurer of the Equitable Auto-Truck, Power and Burner Company.

The Edison Electric Illuminating Company of Boston has let contracts for connecting its South Boston plant with the plants of the Dedham (Mass.) Electric Company, the Blue Hill Electric Company, the Milton (Mass.) Light and Power Company, the Natick (Mass.) Gas and Electric Company, the Framingham (Mass.) Electric Company, the Greendale Chemical Electric and Lighting Company of Needham, Mass., and the Newton and Watertown Gas Companies. When the plants are connected the current will be supplied from South Boston. The Framingham plant is some 20 miles from Boston. The Edison company has acquired the plants of the Chelsea (Mass.) Gas Company, the Woburn (Mass.) Light, Heat and Power Company, and the Somerville (Mass.) Electric Company. It also recently purchased the electric-light and power plant conducted by A. W. Perry under the name of the Church Green Electric Company, which supplies light and power in the shoe and leather district of Boston.

A fire occurred in the building 404-406 Atlantic Avenue, Boston, partially occupied by the Chase-Shawmut Company, dealer in electrical supplies, on May 25th. The fire by which the same firm sustained a loss last week was in the adjoining building. The company's loss in the last fire has not been estimated.

The latest report from Bridgeport, Conn., states that the Connecticut Railway and Lighting Company has resumed the running of practically all its lines, the traffic on which was interrupted by last week's strike of conductors and motormen.

The Navy Department will establish a small wireless-telegraph station at the Charlestown, Mass., Navy Yard. It has advertised for bids for installing the plant. The pole will be 180 feet high.

The Laconia Electric Lighting Company's plant at Lakeport, N. H., was burned in a large fire in that place on Tuesday. Loss about $30,000; insurance, $10,000. B.

From the Buckeye State.

Cleveland, Ohio, May 30.—The Cleveland and Sharon Traction Company has filed a mortgage in Trumbull County for $2,000,000. The company will build an electric road from Middlefield, Geauga County, to Sharon, Pa., passing through several thriving towns, with a branch from Kinsman to Meadville, Pa., the two lines aggregating 80 miles of single track. The Eastern Construction Company has the contract for building the road and the work is to commence at once.

The directors of the Cleveland Electric Railway Company and the Cleveland City Railway Company met on Friday, and it is said that the contract of consolidation was signed. The stockholders of the companies had met previously and ratified the action taken some time ago by their directors. It has about been decided to put the matter in the form of a purchase of one road by the other and the Cleveland Electric Railway Company is the one which will be continued in existence to take over the property of the other, as was indicated in the Western Electrician last week.

The Akron-Alliance Connecting Railway Company of Canton has filed a $2,000,000 mortgage in Starke County to secure bonds which will be taken by the Eastern Trust Company of New York. The company will build a line from Alliance to Akron, 30 miles, and is also planning to build from Alliance to East Liverpool on the Ohio River, a distance of 43 miles.

The Appleyard syndicate is having a sleeping car built in the East which shall be put on their roads between Columbus and Cincinnati when it is completed, about July 1st, it is thought. The car has 20 berths and will be finished in nice style and fitted with all modern conveniences. It is said it will be operated from Dayton to Cincinnati on the Cincinnati, Dayton and Toledo line until the Appleyard road is in condition to use it.

The county auditors of this state are making a general increase of the valuation of electric-road property, as the following statements will show: Canton-Akron Electric, increased from $2,000 to $4,000 a mile, with a corresponding increase in other property belonging to the company; Cincinnati, Dayton and Toledo, increased $500 a mile; portions of the Northern Ohio Traction and Light Company, increase in track of $500 a mile, with a general lump increase of some of the other property; Cleveland and Southwestern Traction Company, lump increase of $151,316; Cleveland, Painesville and Eastern, increase of about $15,000. The valuation of the Cleveland and Chagrin Falls and the Cleveland and Eastern divisions of the Eastern Ohio Traction Company, were decreased about $11,880.

The Cleveland, Ravenna and Southern Railway Company, incorporated a few days ago, proposes to build a line from Cleveland to New Baltimore by way of Ravenna. The promoters have planned to come into Cleveland over the Doan Street line. Judge Frank E. Dellenbaugh is interested in the company.

The Cleveland street-railway people have under consideration the adoption of an observation car which will make regular trips around the city for the purpose of accommodating sight-seers. Cleveland has grown to such proportions that such a car would probably prove profitable. O. M. C.

Michigan.

Detroit, May 29.—Field & Hinchman, mechanical engineers of Detroit, have the plans prepared for enlarging the electric-lighting plant of the Pontiac Light Company and for the addition of new machinery. The light company was not able to handle all the business offered last year on account of insufficient equipment.

Right-of-way for the Grand Rapids electric road has been secured through the townships of Fremont, Deerfield and a part of Rowland in Isabelle County toward Mt. Pleasant. The road is to extend, when completed, from South Bend, Ind., to Lake Huron, passing through Grand Rapids, Greenville, Edmore, Dushville, Mt. Pleasant and Gladwin. The Grand Rapids Electric Railway Company has been incorporated with a capital of $2,000,000.

The Heawath Electric Company of Detroit has filed articles of incorporation, with capital of $60,000. The principal incorporators are Hoyt Post, S. C. Mumford, Lucien S. Moore and W. S. Reynolds. The company will make incandescent lamps and handle other electrical specialties.

The Huron and Michigan Railway Company of Grand Rapids has filed articles of association, with capital stock of $2,300,000. Arthur D. Prosser of Detroit, formerly of Lansing, owns almost all of the stock of the company, which proposes to build an electric line from Grand Rapids to Saginaw.

A meeting between the Saginaw Board of Trade and several representative citizens of Flint interested in an electric line between these cities, has resulted in prospects favorable to the immediate organization of a Saginaw company for the construction of the road. The first portion is to be built from Saginaw to the village of Tuscola.

The Grand Rapids, Muskegon and Manistee electric line has a party of surveyors in the vicinity of Shelby working north. It is expected that the line from Muskegon to Manistee will be in operation within one year. The fruit prospects of this vicinity were never better, and peaches are shipped in special train lots by the steam roads. C. G. W.

Information from Indiana.

Indianapolis, Ind., June 1.—The secretary of state's office has been a busy place the last week. The high-water mark in corporation affairs was reached. Interurban traction companies, with capital stock aggregating $17,255,000, were incorporated during the week. The consolidation of the Union Traction Company of Indiana and the Indianapolis Northern Traction Company accounts for $8,500,000 of the incorporated capital stock. Henceforth these two companies will be one, known as the Union Traction Company of Indiana.

The Greenville-Union City Traction Company of Ohio, and the Union City, Winchester and Muncie Traction Company of Indiana have filed articles of incorporation. The lines of these two companies meet in Pearl Street, Union City, which intersects the state line. The Ohio company's line is from Dayton and the Indiana road from Muncie. The organization will be known as the Dayton and Muncie Traction Company. The capital stock is $800,000. The directors are Joseph E. Lowes, John E. Freight of Dayton; C. M. Anderson of Greenville, Ohio; Theodore Shockney of Union City, and E. P. Mathews of Winchester.

The Fort Wayne, Logansport, Lafayette and Lima Traction Company filed articles of incorporation, with a capital stock of $7,500,000. The company represents the absorption of a number of small roads with an increase of stock amounting to 75,000 shares, of which 60,000 are common and 15,000 preferred stock. The lines of the company will be in Tippecanoe, White, Carroll, Cass, Miami, Wabash, Huntington, Allen, DeKalb, Noble, Lagrange, Steuben, Grant, Adams and Wells Counties. The board of directors is composed of James Murdock, Henry C. Payne, S. B. Flemming, J. Levering Jones, Randall Morgan, George F. McCulloch, Bayan Henry, Hugh J. McGowan and Charles Murdock. The company's office will be at Fort Wayne. The new corporation owns no interurban lines at present, but it controls the city street-car systems in Lafayette, Logansport, Fort Wayne and other cities, and it is the plan to merge a number of interurban lines connecting these cities and make a continuous line from Lima, Ohio, to Lafayette.

The Indiana Western Construction Company of South Bend has filed articles of incorporation, with $100,000 capital stock. The company proposes to promote, construct, rent, and operate street and interurban lines, build bridges, improve waterways, build and own electric lighting, telephone and telegraph plants, etc. The directors are: W. W. Babcock, E. F. Gaffney, Clarence Sandage, H. C. Smith and Harry Long.

A 50-year franchise has been granted by the Sullivan Council to the Western Indiana Traction Company and the Coal Belt Traction Company, both of Sullivan.

The commissioners of Clay County have given to the Brazil Electric Company a franchise to construct an interurban line on the road between Brazil and Diamond.

The Anderson City Council has contracted with the Westinghouse Company of Pittsburg for a turbine engine, at a cost of $19,500, to supply more power for the city electric plant. The new engine is to have a capacity of 400 kilowatts. The General Electric Company of Schenectady charges the council with being unfair, its bid being $18,000.

Robert D. Peters of Knox, Ind., is the inventor of a device operated by electricity to prevent trains from colliding. The signal is discernible two miles ahead or two miles in the rear of a train. Mr. Peters has organized a company to manufacture the device. The factory will be established at North Judson. The device is attracting the attention of prominent railroad managers.

The Evansville and Henderson Traction Company has been granted a franchise for a private right-of-way over certain streets and avenues of Evansville, and a franchise has also been granted to the Evansville, Boonville and Rockport Company to enter the city over the tracks of the local company. F.

West Virginia and Kentucky.

Lexington, Ky., May 30.—The Maysville and Mt. Olivet Traction Company of Mt. Olivet, Ky., has been organized. It is the intention of the promoters of the company to build an electric road between the two towns named in the title of the company.

John H. Garrison, George I. Garrison and P. Zane, all of Wheeling, W. Va., and Charles E. Hasford of Butler, Pa., who are planning an electric line from Wellsburg to Bethany, W. Va., have been in New York securing figures on contracts for the construction work on their road, as well as equipment and other material needed.

The Burnsville Progressive Company of Burnsville, W. Va., has been incorporated with a capital stock of $25,000 by Hugh Amos and others. Among other things, the company proposes to build and operate electric railroads.

The Blue Grass Traction Company and the county authorities are having an interesting time at Lexington. The company has had a force of men ready to begin work for some time, but the authorities are patrolling the public highways to prevent them from working. The claim is made that the company does not intend to build a road, but is merely holding the franchises in order to sell them.

There seems to be some trouble between the holders of common stock and the preferred stockholders of the Louisville Railway, Louisville, Ky. In order to make some extensions and improvements it was the intention to issue more stock, but this the common stockholders opposed. It is said that the matter will likely be settled by the issue of $5,000,000 of bonds and the distribution of the surplus as a dividend on the common stock. Major A. H. Davis of London, the largest stockholder, is now in Louisville.

The Monongalia County (W. Va.) authorities have granted a franchise to the Fairmont, Morgantown and Cheat River Trolley Company, and a franchise has also been secured in Marion County. The survey will begin at once. C.

Texas and Mexico.

Austin, Texas, June 1.—It is reported that the property of the San Antonio Traction Company, which embraces one of the best-equipped electric-railway systems in the state, has been sold by the McMillan syndicate to the United Gas Chemical Company of Philadelphia. It is further stated that the new owners will make improvements and extensions of the lines. The same company is said to be negotiating for the purchase of other street-railway systems in Texas.

The official publication by the Mexican government of the valuable concession which it has granted the Mexican Light and Power Company for the construction of a great electric generating plant and the furnishing of lights and power for the City of Mexico has just been made. Satisfactory progress is being made in the construction of the company's plant at Necaxa.

A company composed of Alamagordo and Tecumcari men is arranging to install an electric-light plant at Tecumcari, New Mexico.

The electric-light plant of the Georgetown Water and Electric Company at Georgetown, Texas, is to be enlarged and otherwise improved. M. S. Sweet is manager of this company.

B. F. Hammett and Felix Martinez of El Paso, Texas, are interested, with other American capitalists, in a project to build an electric interurban railway between the city of Guadalajara, Mexico, and Lake Chapala. The latter is a noted pleasure resort and is at present badly lacking in transportation facilities.

An American syndicate is arranging to establish an electric street-railway system in the city of Chihuahua, Mexico. The power for the operation of the lines will probably be furnished by the Compania Industrial Mexicana.

The Penoles Mining Company of Mapimi, Mexico, has just completed what is said to be the largest electric power generating and transmission plant in Mexico. The electrical energy thus obtained is used to operate the machinery and pumps of the company's mine. H.

Among the Rockies.

Salt Lake City, Utah, May 28.—Salt Lake was in darkness for several hours on the night of May 27th, and all the electric railway cars were at a standstill, as a result of a strike of the linemen, stationmen and motormen of the Utah Light and Power Company. The demand of the electrical workers was for a higher scale of wages and for a recognition of the union. Such a recognition Manager R. S. Campbell of the electric-light company refused to give. Only 40 workers were numbered among the original strikers, but it is expected that the remainder of the employes will strike in sympathy at any time.

An important electrical transfer was effected at Bozeman, Mont., when the entire holdings of the Gallatin Light, Power and Railway Company and the Bozeman Street Railway Company were purchased by the Bozeman Light and Traction Company, an incorporation of New York capitalists, with a capital stock of $500,000. The new company proposes to institute some radical changes in the present system, and new machinery and equipment will be ordered at once. The street-railway system will also be improved and enlarged, and additional power will be secured from power plants in that vicinity.

A project is being pushed at Kooskia, Idaho, for the construction of an electric road from that point to Buffalo Hump, a distance of 80 miles. Eastern capitalists have been interested in the enterprise, which is deemed a good one in view of the fact that the system would reach several rich mines between the two points.

A large electrical power plant will be installed shortly at Beaver, Utah, where there is a network of mines. The power will be secured from the Beaver River and will be used both for lighting and for operating air compressors and hoists. Wealthy mine owners are backing the enterprise.

Senator Flannigan of Nevada has secured entire control of the Nevada Power, Light and Water Company by purchasing 6,265 shares of the stock. The plant is located at Reno, and the senator states that the transaction represents an expenditure of $200,000 Extensive improvements in the plant are promised. G.

On the Pacific Slope.

San Francisco, Cal., May 23.—The stockholders of the Standard Electrical Construction Company have voted to increase the capital stock of the company to 100,000 shares, of which 30,000 will be issued at once. The money will be used to increase the company's facilities for carrying on business. The officers of the company are: President, R. J. Davis; manager, A. M. Funk; secretary, Harrison Dibblee.

G. G. Johnson has purchased the electric-road franchise from the council of Los Angeles, and will construct an electric road along Sixth Street, from Figueroa to the western city limits.

The Great Eastern Light and Power Company of Sumpter, Ore., will erect an electric plant on the John Day River capable of developing 6,000 horsepower. Randall H. Komp is local manager of the concern.

The beach interests of the West Coast Land and Water Company in Pacific City, Orange County, have been transferred to H. E. Huntington. The interests involve the construction of an electric road from Los Angeles to the beach, by way of Santa Ana.

The Washington Water Power Company of Spokane, Wash., will construct an electric line to Glendale at an estimated cost of $16,000.

Robert N. Frick has filed a petition with the supervisors of Martinez, Cal., for an electric-railroad franchise to the top of Mount Diablo. The proposed line will run through various towns between Martinez and Mount Diablo.

The Department of Electricity will install a complete electric fire-alarm system in all of the schoolhouses of the school department in San Francisco.

The American River Electric Company is making arrangements for the extension of its lines through San Andreas to Stockton. The company contemplates the erection of an electric plant at Placerville.

The Pine Creek Power Company of Atlin, B. C., will spend $50,000 in the erection and equipment of a new power plant. L. M. Griffith is general manager for the company. A.

Seattle, Wash., May 28.—Manager Fred G. Simpson states that the Ballard Electric Company of Ballard, Wash., will increase the capacity of the present lighting plant. The plant now has a capacity of 2,500 lights and will be increased to 17,500 lights. A power plant capable of furnishing 800 horsepower for manufacturing purposes will be put in.

The City Council of Spokane, Wash., has granted a franchise to J. P. Graves, manager of the Spokane Traction Company; the franchise runs for 25 years.

Hermann Rossi, a local real-estate man of Wallace, Idaho, has obtained a franchise to construct and operate a railway system in that city. Forty miles of track will be laid this summer and the system will eventually penetrate the whole Cœur d'Alene district.

The old plant of the Skagway Light and Water Company has been purchased by Dr. Scharschmidt, representing the British Columbia Power and Manufacturing Company. It is the purpose of the new company to take the plant to Atlin, where it will be installed. The consideration was $1,500.

Work has commenced in earnest on the Spokane Cœur d'Alene electric railway. The contract for the grading of the road has been awarded to M. D. Wright and S. A. Eslick of Spokane. The company will lay its own steel, erect poles, string wires, build its own depot, wharf and approaches. The overhead-trolley system will be used.

The Oregon Electric Company, which will soon have its lines completed to the city of Union, is having surveys made through eastern Oregon. The plant at Eagle Falls will cost over $200,000, and will generate from 6,000 to 10,000 horsepower for transmission to the various towns and mines in eastern Oregon.

The Union Light and Power Company of Salem, Ore., has withdrawn its petition for a franchise and has entered into a contract with the Salem Light and Power Company to furnish power for 20 years. The Union company has already placed its order for Westinghouse machinery for its generating plant at Silverton. A line will be built from the power and generating plant to Salem, and will have three wires. The Silverton plant will furnish 1,000 horsepower and the Salem system about 500.

The Angeles Water and Power Company has been incorporated in Washington with a capital stock of $50,000. The object of the new company is to furnish the city of Port Townsend with water, gas and electricity. Ira Brownell and L. I. Rackard are the incorporators.

The Meyers Falls (Wash.) Electric Light and Power Company has been granted a 30-year franchise for furnishing electric light and power in North Port.

The Citizens' Light and Power Company of Seattle, Wash., has been incorporated with a capital of $50,000. J. H. Kane and James Cafferty are the incorporators. P.

PERSONAL.

Edward Hurst, superintendent of the electric-light plant at Wilmington, Ohio, was killed a few days ago while trimming an arc light. He in some way came in contact with the wires.

Mr. C. F. Annett, assistant superintendent of telegraphs for the Illinois Central Railroad Company, has retired. He is succeeded by Mr. Parsons, who was in charge of the operating room.

Walter W. Wheatley, formerly superintendent of the surface lines of the Brooklyn Rapid Transit lines, has been selected to succeed David Young as superintendent of the trolley system in Newark, N. J., and elsewhere operated by the new Public Service Corporation. Mr. Wheatley resigned from the Brooklyn Rapid Transit last November, and has since been engaged by the New York Central.

It is announced that Warren Bicknell, secretary of the Aurora, Elgin and Chicago Railway Company has been chosen president and general manager of the Lake Shore Electric Railway Company of Cleveland, and that he has accepted the position. He will assume his duties on August 1st, and it has been said at the offices of the Mandelbaum syndicate in Cleveland that he has resigned his position with the Chicago road.

Fitzhugh Taylor, formerly a member of the editorial staff of the Western Electrician, and later connected as an engineer with the Underwriters' Laboratories in Chicago, has accepted the direction of a new course in fire-protection engineering, leading to the degree of bachelor of science, in Armour Institute of Technology This is a new departure in educational work, and will be established at the beginning of the college year next fall. Professor Taylor is a graduate of Armour, a student, and a young man of excellent capacity and application. With his qualifications and practical experience, the new course should be a valuable one.

Dr. Selim Hobart Peabody, educator and author, who for the last year has been connected with the St. Louis Exposition, as assistant to the director of exhibits, died on May 26th. Dr. Peabody's reputation as an educator and exposition expert was international. He was in his seventy-fourth year. He served successively as principal of the Burlington (Vt.) high school in 1852; professor of mathematics at Fairfax, Vt., in 1853; professor of mathematics and civil engineering at the Polytechnic College of Pennsylvania in 1854; principal of the high school at Fond du Lac, Wis., in 1859; superintendent of schools at Racine, Wis., in 1862; professor of physics at the Chicago high school in 1865; professor of mathematics and civil engineering in the Massachusetts Agricultural College in 1871, and professor of mechanical engineering in the Illinois Industrial University in 1878. In 1880 he was elected president of the University of Illinois, which position he held until 1891, when he resigned to join the staff of the World's Columbian Exposition, as chief of the Department of Liberal Arts. Professor Cecil Peabody of the Massachusetts Institute of Technology is a son of the deceased.

POWER TRANSMISSION.

The Catawba Power Company of Rock Hill, S. C., has increased its capital stock from $650,000 to $750,000. Dr. W. G. Wylie of New York is interested. The company is erecting one of the largest power plants for electrical purposes in the state.

SOCIETIES AND SCHOOLS.

The thirty-third annual commencement of the Worcester Polytechnic Institute will take place at Worcester, Mass., on June 7th to 11th. The annual commencement lecture before the Washburn Engineering Society will be delivered by Harold B. Smith, professor of electrical engineering at the Institute, on the subject, "The Relation of the Electrical Engineer to Modern Social and Industrial Progress."

Entrance examinations to the Massachusetts Institute of Technology will be held at Boston on June 25th to 27th The Institute offers summer instruction during the months of June and July, the courses of which are open to persons not students in the Institute, if they possess the necessary qualifications. The continuity of effort and freedom from interruption made possible by summer work are of particular value in many of the laboratory courses.

PUBLICATIONS.

A Chicago hardware firm issues a catalogue of 2,460 pages that weighs 16½ pounds. It has a loose-leaf binding mechanism by which new leaves can be substituted for old ones.

TRADE NEWS.

Sealed proposals will be received until June 17th for the installation of conduit, electric wiring and gas-piping systems for the National Bureau of Standards, Washington, D. C., in accordance with the drawings and specification, copies of which may be obtained at the office of the superintendent of construction, or by addressing James Knox Taylor, supervising architect, Treasury Department, Washington, D. C.

The large increase in sales of integrating wattmeters and other electrical recording instruments by the Westinghouse Electric and Manufacturing Company has made necessary an extensive addition to the Newark works of this company. It is asserted that this factory is the finest and best equipped of its kind in the world, and the extension now being made will practically double its size and productive powers. The company manufactures its own meter tools, jewels and special appliances, so that the quality for which "Westinghouse" is a synonym prevails throughout. While the mechanical features are the best of their kind, equal attention has been given to the question of the comfort and convenience of the 3,000 employes.

BUSINESS.

The Central Electric Company of Chicago is handling direct and alternating-current desk brackets, ceiling and battery fan motors and ventilating fans of every description. Catalogues describing this apparatus will be sent upon request.

The Bryan-Marsh Company, 136 Liberty Street, New York city, reports business in a most prosperous condition. The month of May was the banner month in the company's existence. The company makes everything in incandescent lamps, and its product is meeting with general satisfaction.

T. H. Howard of the Pittsburg office of the Phœnix Glass Company, who attended the recent National electric-light convention in company with A. H. Patterson of the New York office, states that the demand for Phœnix inner and outer globes was never as brisk as it is at present. As is well known the Phœnix company is one of the oldest manufacturers of globes and other electrical glassware. The excellence of its product is well known.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) May 26, 1903.

728,823. Electric Canal System. Frank Adams, North Adams, Mass. Application filed July 29, 1902.

Power is conveyed to the boat motor from a trolley wire running along the canal. The trolley wire is supported on brackets, and guards are arranged adjacent to the brackets to guide the trolley over the brackets. On the boat means are provided for taking up the slack of the flexible conductor wire leading from the trolley wire to the boat motor.

728,833. Signal Device for Telephone Systems. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed April 14, 1902.

In this device there is a flexible body having a part securely held, and having a yielding part adapted to be vibrated. Means are provided for vibrating the flexible body, and an abutment is positioned to be engaged by the flexible body, which is extended beyond the abutment to form a part free to vibrate.

728,851. Vulcanized Kerite Compound. William R. Brixey, Seymour, Conn. Application filed March 20, 1903.

A crude kerite compound formed by mixing coal tar, asphalt, linseed oil and sulphur and vulcanizing the mixture is patented.

728,882. Electrical Ignition Apparatus for Gas Engines. Willard E. Dow, Braintree, Mass. Application filed August 2, 1902.

In an apparatus for operating a gas engine are a source of energy, an induction coil, a sparking device operated thereby for driving the engine, a condenser, a mechanical interrupter and a vibrator. The interrupter and vibrator are in series with each other in a shunt circuit around the condenser.

728,883. Electrothermic Instrument. Andrew J. Downes, Philadelphia, Pa. Application filed July 29, 1902.

An electrothermic instrument for surgical use is described, the combination of the jaw having an electrical resistance contained in a recess therein, an external terminal post, a tunnel formed in the metal of the instrument, and a conductor contained in the tunnel and connecting the external terminal post with the resistance in the jaw.

728,891. Starting Means for Vapor Electric Lamps. Stanwood E. Flichtner, Englewood, N. J., and Charles W. Denny, New York, N. Y., assignors to George Westinghouse, Pittsburg, Pa. Application filed August 23, 1902.

In this device two or more lamps are arranged in series; a starting band for each lamp is arranged in proximity to the negative electrode thereof, and conductors connecting all the starting bands to the positive main are attached at a point in advance of where it enters the first lamp of the series. (See cut, next page.)

728,901. Means for Operating Reversing Switches on Electric Cars. Edwin R. Gill, New York, N. Y., assignor to the Invention Developing Company. Application filed October 6, 1900.

A mechanical circuit-reverser for electric cars contains an electric motor having two oppositely wound field-magnet coils, operating means driven by the motor, and a switch moving with the operating means acting first to close a break in the circuit of the inactive field-magnet coil and then to open the active circuit of the motor.

728,902. Electric Arc Lamp. John O. Girdlestone and Carl F. G. Thorkelin, London, England. Application filed June 23, 1902.

In the lamp are a combination of carbon holders, converging guides for the holders, a spring-controlled drum for each holder, a flexible connection between each holder and its drum, a brake, electromagnets controlling the brake, and an operative connection between the spring-controlled drum. The brake and the electromagnets are so disposed that each drum can turn in one direction

under the action of its spring independently of the other drum and of the brake while the movement of the brake causes or allows the simultaneous movement of both the drums for striking or feeding the arc. Means for limiting the amount of rotation of the drums and an electromagnet for directing the arc are provided.

728,942. Electrical Cut-out and Regulator. Henry Leitner, Woking, and Richard N. Lucas, Byfleet, England. Application filed December 22, 1902.

Combined with a battery charged by a dynamo are a magnetic cut-out, comprising a fluid magnet and an armature; one of the parts has a double winding, a main circuit through the dynamo battery and one of the windings, and a branch circuit through the dynamo, battery and other of the windings, a switch in the main dynamo circuit and a connection between the switch and the armature. The connections are such that when the voltage of the dynamo falls below that of the battery, the battery current will pass in reverse direction to the dynamo current through both windings of the cut-out and cause the switch to break the main dynamo circuit.

728,944. Interchangeable Electric Display Apparatus. Deronda Levy, New York, N. Y., assignor to the Mason Monogram Company, New York, N. Y. Application filed February 10, 1903.

In the apparatus are a series of electric switches combined with a rotary commutator for acting on the switches. The commutator comprises the frame having a series of radial slots and a series of longitudinal commutator bars seated in the slots and provided with projecting fingers in predetermined arrangement for co-operation with the switches.

728,950. Sparking Igniter for Explosive Engines. Alonzo C. Mather, Chicago, Ill. Application filed September 26, 1900.

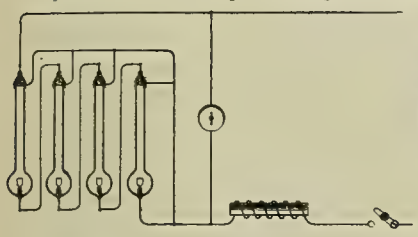
This is an electric igniter. A pair of electrodes, one movable is placed in the explosion chamber.

728,964. Telephone-toll Slot Machine. William S. Paca, Erie, Pa. Application filed August 26, 1902.

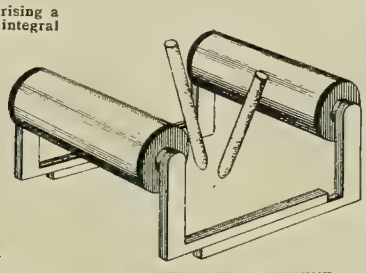
The combination consists of a box with a stationary top plate thereon having openings for different-sized coins, and having recesses in its under surface. Another stationary plate below the top plate has corresponding discharge openings for different-sized coins, and other narrower openings for discharging undersized coins.

728,968. Battery Chute. Frederick E. Paradis, Chicago, Ill. Application filed July 23, 1902.

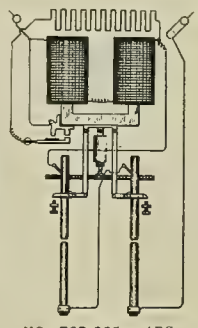
A receptacle for batteries is described comprising a cylindric cast-metal receptacle having a closed integral



NO. 728,891.—STARTING MEANS FOR VAPOR-ELECTRIC LAMPS.



NO. 729,114.—ALTERNATING-CURRENT ARC LAMP.



NO. 729,315.—ARC LIGHT.

lower end and a laterally extending peripheral interrupted flange at its upper end. A cover is provided with a peripheral depending flange constructed to telescope and fit upon the upper end of the receptacle and provided with inturned interrupted flange extensions.

728,970. Method of Varying the Output of Transformers. John S. Peck, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed August 4, 1902.

The method consists in dividing each winding into a number of substantially equal sections and connecting the sections of each winding in series for a relatively low rate of alternations and output and connecting them in parallel for a relatively high rate of alternations and output.

728,973. Electric Heater. Edwin F. Porter, Boston, Mass., assignor to the Bay State Electric Heat and Light Company, Jersey City, N. J. Application filed February 6, 1900.

One or more heat-developing electric conductors form the heater. A fan for displacing or removing the heat is operated by a motor.

728,975. System of Motor Control. William H. Powell, Erie, Pa., assignor to the Keystone Electric Company, Erie, Pa. Application filed February 27, 1902.

The method of accelerating a motor consists in passing a current through the armature, generating an initial field of excessive strength, gradually reducing the strength of the field by reducing the resistance in shunt to a field winding and gradually reducing the loss in effect of the winding by an increase in effect of another winding.

728,976. System of Motor Control. William H. Powell, Ampere, N. J., assignor to the Keystone Electric Company, Erie, Pa. Original application filed February 27, 1902. Divided and this application filed July 11, 1902.

In the system are an armature, a field-magnet, a resistance in shunt to a winding of the field-magnet, and means for diminishing the resistance. A second winding is normally connected directly across the armature.

728,994. Telephone Lock. William H. Scott, St. Louis, Mo., assignor to the Controller Company of America, St. Louis, Mo. Application filed June 25, 1902.

A locking-dog which is normally in the pathway of a vertically movable locking-bar is removed by a deposit coin being directed against it by an actuating coin, which permits of the upward movement of the locking-bar.

729,082. Trolley Wheel and Holder. Frank D. Moon, Lockport, N. Y., assignor to the National Trolley Manufacturing Company, of New York. Application filed August 1, 1902.

An improved trolley wheel contained within a forked holder is described.

729,100. Separator for Storage Batteries. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Jersey City, N. J., and Cleveland, Ohio. Application filed November 25, 1901.

The separator for storage-battery elements comprises a thin corrugated sheet provided with a number of perforations, and means on the sheet to hold the perforations out of contact with one of the battery elements.

729,103. Method of Electrical Distribution and Selective Distribution. John S. Stone, Cambridge, Mass., assignor to the American Bell Telephone Company of Massachusetts. Original application filed April 4, 1894. Divided and this application filed July 10, 1902.

The method of selectively regulating and controlling the flow of vibratory electric currents simultaneously impressed upon a main line or signaling circuit, consists in varying or adjusting one of the elements of a resonant circuit associated with the main line or signaling circuit.

729,104. Electrical Apparatus and Circuits for Electrical Distribution and Selective Distribution. John S. Stone, Cambridge, Mass., assignor to the American Bell Telephone Company of Massachusetts. Original application filed April 4, 1894. Divided and this application filed July 10, 1902.

Means are provided for impressing a multiperiodic current upon the main line, and resonant circuits associated with the main line are attuned to the frequency of one of the simple harmonic components of the vibratory current. Means for varying one of the elements of the associated resonant circuits are provided.

729,108. Thermoelectric Generator. Albert Tissier, Paris, France. Application filed November 30, 1900.

By the method described a substance is manufactured for use as a thermoelectric generator by reducing to fine powder a natural quartz mineral, the molecules of which are of a tubular or funicular formation, mixing powdered metallic zinc with the powdered quartz mineral and working the two together until a homogeneous mass is obtained, and then subjecting the mass to an intense heat.

729,114. Alternating-current Arc Lamp. Malcolm H. Baker, East Liberty, Pa., assignor to the Westinghouse Electric and Manufacturing Company. Application filed June 26, 1902.

The resistance of the arc is regulated by two coils, each provided with a separate core, one coil being in series with the lamp-electrodes and the other in shunt thereto. The cores are so placed as to act differentially upon each other. (See cut.)

729,117. Motor-control System. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company. Application filed February 12, 1902.

The device consists of a motor circuit, a controller in the circuit, a separate switch which operates to open the circuit either on overload or underload, and means are provided for automatically resetting the switch when the controller is moved into its first operative position.

729,120. Third-rail Electric-railway System. Gustav Bertram, Brooklyn, N. Y. Application filed February 28, 1903.

A contact arm adapted to be connected with the truck of a car is provided with an upright member, to the bottom portion of which a shaft is transversely mounted and a trolley arm is pivoted thereto. Collars are loosely mounted on the shaft and connected with the side portions of the trolley arm below its pivotal support. Springs are placed on the shaft between the collars and the upright member, and a trolley wheel is mounted in the end of the trolley arm.

729,130. Trolley-wheel Bearing. George E. Chapman, Cleveland, Ohio. Application filed October 29, 1902.

An improved bearing inclosed within a casing and having an upper and lower oil-chamber is described.

729,134. Switch-control Mechanism. Paul L. Clark, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 11, 1902.

The system comprises a number of separately controlled switches and automatic means for opening or closing one or more switches simultaneously.

729,136. Electric Railway. Albert N. Connett, London, England, assignor to the General Electric Company of New York. Application filed February 21, 1901.

The system consists of a conduit structure having means accessible from the roadway for actuating the same.

729,137. Plow-raising Means for Conduit Railways. Albert N. Connett, London, England, assignor to the General Electric Company of New York. Application filed February 21, 1901.

A collector is suspended from an electric car by chains so arranged as to raise or lower the flow in a conduit system.

729,140. Storage Battery. Robert Darling, Rye, N. Y. Application filed December 26, 1901.

In the combination are a negative element and a positive element consisting in part of mercury, of a metallic connector extending from the positive element up through the electrolyte, and a protector for the portion of the connector not in contact with the element composed of a coating of a greasy substance and a sheathing of insulating material.

729,159. Telltale for Ships' Running Lights. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed July 30, 1901.

Means are provided for indicating the extinguishment of an electric signal lantern and consist of an audible electric signal, a lamp connected in parallel, an electromagnet in circuit with the lantern, an armature for the electromagnet connected with the line, and a contact adjacent to the armature connected with the audible signal and the lamp. When the lantern circuit breaks, the armature will close through the audible signal and the lamp, and shunt the electromagnet.

729,164. Indicating Instrument. Caryl D. Haskins, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed February 28, 1901.

The instrument is provided with two relatively movable parts having indicating members intersecting each other at acute angles. One of the members has an inclination which throughout its indicating length subtends only a fractional angle of the extreme deflection of the instrument, whereby a selected angle of scale reading may be effected.

729,166. X-ray Tube. John O. Heinze, Jr., Chelsea, Mass. Application filed March 19, 1903.

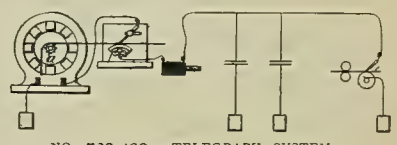
In the tube are an anode, a cathode and a metal funnel-shaped means insulated from and located between the anode and cathode to concentrate the cathode stream so as to form a small fixed area of bombardment on the anode.

729,171. Electric Heating Fabric. Joseph M. C. Herrgott, Valdoie, France. Application filed August 12, 1902.

The fabric is of weft-threads forming both textile material and conductor of electricity in which an insulated metallic conducting element is wound spirally around a central core of textile material, such combination having the desired qualities of conductibility, flexibility and strength.

729,172. High-potential Line Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed August 16, 1900.

A line switch for high-potential currents comprises a casing containing an insulating liquid submerging the contacts, clamps for attaching the casing to a pole or other support, an overhanging top for the casing and insulators on the under wall of the overhanging top, through which the line terminals may be led.



NO. 729,420.—TELEGRAPH SYSTEM.

729,173. Contact Device for Electric Railways. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed January 31, 1900.

A contact shoe comprising a rigid strip of conducting metal and a separate vertically resilient conducting member mounted on each end is described.

729,175. Dynamo-electric Machinery. Henry M. Hobart, Berlin, Germany. Application filed February 6, 1902.

In dynamo-electric machines the combination of winding is provided with end connections and permanently closed circuited conducting paths in inductive relation to the end connections and adapted to form the seat of induced currents.

729,182. Incandescent Electric Lamp. Herman J. Jaeger, New York, N. Y. Application filed January 27, 1903.

The lamp comprises a vacuum chamber, a hollow stem with platinum wires sealed therein, and an exhaust tube joined or fused to the inside wall of the hollow stem between its bottom end and the platinum-wire seal.

729,184. Transmitter Arm. William Kaisling, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 8, 1902.

A transmitter arm arranged to receive and carry a telephone transmitter is described.

729,199. Induction Motor. Hans S. Meyer, Rugby, England, assignor to the General Electric Company of New York. Application filed January 11, 1901.

In combination with an induction motor are automatic means constructed and arranged to vary the potential at the motor terminals in such a manner as to cause it to increase with an increase of the load on the motor and to decrease with a decrease of the load.

729,206. Self-regulating System for Electric Light and Power. Morris Moskowitz, Brooklyn, N. Y., assignor to James H. Young, trustee, New York, N. Y. Application filed March 3, 1902.

A motor is provided for actuating the field coils of a generator, and there are means for varying the speed of the motor and the field magnetism of the exciter inversely with variations in the armature current of the generator.

729,211. Circuit-breaker. Clarence H. Norwood, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed November 4, 1899.

In combination with an electromagnet having suitable circuit connections for increasing its effective energization upon overload and permitting of effective de-energization upon underload is a single armature for the electromagnet normally held in an intermediate position, and a single means for holding the switch in a closed position, the armature being adapted when further attracted by the electromagnet upon overload to operate the means to release the switch, and being further adapted when re-

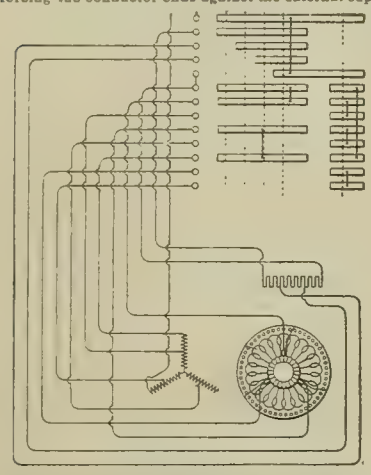
leased by the electromagnet upon underload, also to operate the means to release the switch.

729,216. Electric Railways. Jesse S. Pevear, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed January 28, 1903.

A sectional-conductor electric railway is described, having a number of vaults located at intervals along the way, a number of switches in each vault adapted to control a certain number of the sections of the sectional conductor. Means independent of the switches for rendering each vault dead when no current is being taken from any of the sections of the sectional conductor controlled by the switches in the vault are provided.

729,219. Dynamo-electric Machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 6, 1903.

Contained in the machine of the internal revolving field type is an armature having a hollow cylindrical core, armature conductors projecting beyond the core, supports carried by the core for supporting the projecting ends externally, and adjustable means applied internally for forcing the conductor ends against the external support.



NO. 729,441.—ALTERNATING-CURRENT MOTOR.

729,222. Electric Heating Pad. William Rickards, Los Angeles, Cal. Application filed April 29, 1901.

An electrotherapeutic pad is constructed in two or more parts or sections, each section comprising an insulating medium, having radiating conductors included therein, and independent terminals therefor. A connecting device extends between the adjacent sections to join them to one another.

729,234. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1901.

The combination consists of a power-transmission line and a source of current connected thereto, the electromotive-force wave of which differs from the sine form. A consumption circuit is supplied from the transmission line, and means for allowing only a sine wave of current to pass from the transmission line to the consumption circuit are provided.

729,235. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1901.

A combination of a constant-potential circuit and a constant-current circuit is electrically connected by a current-carrying medium having its electrical constants so proportioned as to automatically transform current of the character flowing in one of the circuits into current of the character flowing in the other.

729,236. Electric Protective Device. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 16, 1901.

The device consists of a constant-potential circuit, a constant-current circuit fed thereby and a device responsive to voltage of the constant-current circuit for opening the constant-potential supply circuit.

729,240. Electric Battery. Edmund Tweedy, New York, and Isaiah L. Roberts, Brooklyn, N. Y., and George R. Tweedy, Danbury, Conn. assignors to the Roberts Battery Company. Application filed May 22, 1900.

An electric battery is described.

729,255. Electric Switch. Henry Bayer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1901.

A spindle, a contact block mounted loosely thereon, lugs on the spindle to rotate the block with lost motion, and a spring to move the block transversely with respect to the spindle constitutes the device.

729,267. Telephone-receiver Holder. Arthur J. Briggs, Allegheny, Pa. Application filed September 6, 1902.

The device described consists of a stand, receiver and receiver-rest of a portable telephone, having an upright arm removably secured to the stand, and supporting means for the arm.

729,269. Transmission of Power. Harold W. Buck, Niagara Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 7, 1901.

In the combination are a source of direct current, a motive device, a number of electrodynamic intensifying devices, a number of circuits connecting the source to the intensifying devices, means for introducing resistance into one of the circuits and simultaneously withdrawing resistance from another, and circuit connections between the motive device and the intensifying devices.

729,276. Electric Signal. Albert E. Caughey, Omaha, Neb., assignor of one-half to J. E. Hollenbeck, Pottawattamie County, Iowa. Application filed February 11, 1902.

An electric signal in combination with a track mechanism is described.

729,304. Moisture-proof Switch Casing. Ernest L. Etheridge, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 13, 1900.

A moisture-proof casing for an electric switch consists of a body having substantially uniform radial dimensions and contains a transverse chamber with two shoulders in its lower side for the switch. A cap covers the entire top of the chamber, and means are provided on the cap for packing the stem of the switch.

729,308. Current Transformer for High-voltage Circuits. Augustine R. Everest, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 21, 1902.

The transformer comprises an annular secondary core and winding, tubes of insulation inside and outside of the secondary, and a primary winding passing through the inner tube and outside of the outer tube.

729,315. Electric Arc Light. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 27, 1902.

An arc lamp is described having a number of arcs connected in series, independent clutches for the several movable carbons, a common regulating magnet governing all arcs, and a branch circuit for materially weakening the power of the magnet at a determinate position of its core, whereby all carbons are fed simultaneously. (See cut on preceding page.)

729,317. Means for Treating Nervous Diseases by Electromusical Vibrations. Henry Fleetwood, Los Angeles, Cal., assignor to the E. M. M. Curative Company of California. Application filed May 5, 1902.

The apparatus consists of a static machine, a musical instrument and suitably insulated conductors connecting the electric machine with the musical instrument. Suitable insulated conductors and magnets connected with insulated conductors are provided with means for applying the musical vibrations and magnetism to the patient being treated.

729,323. Circuit-breaker for Storage Batteries. Henry Garrett, Dallas, Texas. Application filed August 5, 1902.

In the device are feed-wires of opposite sign to be connected with the battery terminals, and a switch mechanism for connecting and disconnecting the feed-wires. An electrically operated mechanism is connected by a normally open shunt-circuit with the switch mechanism for controlling the same, and an electrical relay mechanism is connected with the mains of opposite sign and energized thereby. The relay mechanism has a contact connected with the shunt-circuit for energizing the same.

729,343. Power-factor Meter. Otto Holz, Schenectady, N. Y., assignor to the General Electric Company of New York. Application filed January 31, 1901.

One claim reads: The combination of multiphase mains produces a power-factor meter consisting of relatively movable members, one of which is free to adjust its position with respect to another, means for supplying one member with current of a given phase, and means for supplying another member with relatively phase-displaced currents from the mains.

729,366. Trolley. Frederick Lehrmann, Turtlecreek, Pa. Application filed April 2, 1903.

A trolley having devices for holding the trolley wheel in engagement with the trolley-wire is described.

729,369. Electric Heater. Max Loewenthal, New York, N. Y. Application filed December 8, 1902.

An electrically heated iron having a body portion provided with socketed contacts, a removable resistance within the body of the iron, and spring-contacts connecting the resistance electrically with the socketed contacts constitutes the heater.

729,411. Surface-contact Railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1899.

The system comprises a combination of a source of current, sectional conductors, and electromagnetic switches for connecting the conductors in sequence to the source of current as a vehicle passes over the road. Means carried by the car for shunting leakage currents from the sectional conductors directly through the car to ground are provided.

729,414. Field-magnet Structure. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 11, 1902.

A field-magnet structure together with coils and braces applied to the sides thereof is described.

729,420. Art of Telegraphy. Henry A. Rowland, Baltimore, Md., assignor to the Rowland Telegraphic Company, Baltimore, Md. Application filed December 2, 1899.

An improvement in the art of telegraphy is described which consists in impressing an alternating electromotive force upon a line, adjusting the difference of phase between the impressed electromotive force and the resultant current to zero at or near the point of transmission, and modifying a predetermined number of the semicycles of current to represent each character transmitted. (See cut on preceding page.)

729,422. Volt-ampere Meter. Maurice C. Rypinski and Joseph Le Conte Davis, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1902.

A hot-wire volt-ammeter comprising a wire responsive to amperes and one responsive to volts, and means for multiplying together their expansions is described.

729,441. Alternating-current Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady N. Y. Application filed February 12, 1903.

In combination with an induction motor having its primary member provided with a multiphase winding and its secondary member with a short-circuited winding and with a winding of the direct-current type, are means for connecting the motor windings to a single-phase source of supply in such a manner that a starting torque will be produced. (See cut.)

729,449. Induction-motor Armature. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1903.

In the laminated structure of an armature is a combination of sheet-metal pieces, so shaped that they may be assembled at different angles relative to each other, and means for holding the sheet-metal pieces together are provided.

729,458. Brush and Method of Making Same. William J. Wallace, New York, N. Y., assignor to Goldmarck & Wallace, New York, N. Y. Application filed February 27, 1903.

Brushes for dynamo-electric machines and the process of manufacturing them are described.

729,471. Gas Burner and Self-igniter. Charles T. Willson, Amenia, N. Y. Application filed February 9, 1903.

A device consisting of a burner and gas receiver is described as having an element movable by gas pressure, a seal vessel detachably secured to and opening into the gas receiver, a gas-conducting element carried by the movable element and operating in the seal vessel, and a flexible gas-conducting tube connected to the gas-conducting element and to the burner.

729,472. Lightning Arrester. Adoniram J. Wilson, Westfield, N. J., assignor to the Hall Signal Company, New York, N. Y. Application filed April 24, 1899.

In the lightning arrester is a combination of a soft-iron core, a coil of coarse wire surrounding the core and insulated therefrom, the turns composing the coil being insulated from each other, and a ground terminal insulated from and in proximity to the coils.

729,481. Electric Railway. Granville T. Woods and Lyates Woods, New York, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed November 24, 1900.

The mechanism for controlling the service-conductor switch for an electric railway is described.

729,482. Mechanism for Making and Breaking Electric Circuits. Harry B. Wren, Washington, D. C., assignor of thirteen-fortieths to John J. Cassedy, Forest Glen, Md., and Walter R. Hensey and M. Leroy Gough, constituting firm of Hensey & Gough, Washington, D. C. Application filed May 27, 1902.

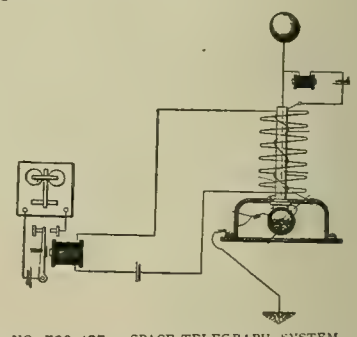
A device for making and breaking electric circuits consists of a series of terminals and a series of switches for each series of terminals. The switches are adapted to connect the terminals and a series of key-operated levers are adapted to operate simultaneously each series of switches successively.

729,497. Wireless Telegraphy. James F. King, New York, N. Y. Original application filed February 5, 1902. Divided and this application filed July 23, 1902.

In the receiving apparatus for wireless telegraphs are a coherer and a combined magnetic decoherer and induction coil, the primary of the induction coil comprising the exciting coil of the decoherer. (See cut.)

729,499. Igniter for Gas Engines. John MacHaffie, Schenectady, N. Y. Original application filed August 12, 1901. Divided and this application filed October 3, 1902.

An electric igniter is described consisting of two terminals which rotate with respect to each other, each carrying a disk.



NO. 729,497.—SPACE-TELEGRAPH SYSTEM.

729,503. Electric Switch. Tage Muller and Charles O. Thompson, New York, N. Y. Application filed November 19, 1902.

The mechanism for operating an automatic electric switch is described.

729,505. Attachment for Electrical Conduits. Adnah McMurtrie, New York, N. Y., assignor to Thomas & Betts, New York, N. Y. Application filed January 11, 1902.

The attachment for electrical conduits comprises an attaching member, and a stud or supporting member capable of angular axial adjustment relatively to the attaching member.

729,506. Coupling for Electrical Conduits. Adnah McMurtrie, New York, N. Y., assignor to Thomas & Betts New York, N. Y. Application filed November 21, 1902.

A threadless coupling is described comprising a compressible member to be seated upon and engage a conduit end and presenting outwardly cam surfaces, and a compressing member to be seated upon the compressible member and provided with co-operating cam surfaces to compress the same when rotated thereupon.

Reissue.

12,115. Receiver for Electromagnetic Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed May 5, 1903. Original No. 727,331, dated May 5, 1903.

A receiver for electromagnetic waves having a small heat capacity and consisting of a small quantity of liquid is described.

WESTERN ELECTRICIAN

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Marconi Space-telegraph Station in Chicago.

Mention has been made heretofore in the Western Electrician of the Marconi space-telegraph station in Chicago, between which and a similar station in Milwaukee, 81 miles distant, messages were exchanged for the first time on June 1st. Readers of this journal will be interested in the brief description of the equipment, herewith presented, with the accompanying pictures.

Nearly all of the "wireless" work that has been done in the United States by the American company operating under the patents of Marconi has been done on the Atlantic seaboard, and the Chicago and Milwaukee stations, with the exception of three in Alaska, are the first regular Marconi outfits to be established west of New York. Both the Chicago and Milwaukee plants are on the shore of Lake Michigan, the former at the foot of Oak Street and the latter in Lake Park. It is the Chicago equipment that is illustrated.

The masts, which are essential to the system, are about 230 feet high, and at the foot of each is a small house for sheltering the transmitting and receiving instruments. The apparatus in use is similar to that in all of the Marconi stations. Fifteen aerial wires run to the top of each mast, and the "ground," which has of necessity to be very good, forms a circle around the mast 25 feet in radius. The ground consists of zinc plates, and these extend about two feet into the earth. Connections with the aerials and the ground are brought separately into the house.

The Marconi system of space telegraphy consists of producing a Hertzian wave with the transmitting apparatus and detecting it either by the coherer or the later instrument called the magnetic detector. Up to the present time the only practicable method of producing a Hertzian wave is by means of a spark. Originally transmission was effected by connecting one side of a spark gap to the aerials, and the other side to the ground. The resulting wave more closely resembled the crack of a whip than a musical note. It was found that in receiving the wave, although fairly long distances could be spanned, atmospheric disturbances interfered greatly with reading. This system is occasionally used now, as it has great carrying power over land and a comparatively small amount of energy is required. A centimeter spark gives a range over land of about 60 miles with a 180-foot mast, although a great deal depends on the number of aerial wires put up. This is equivalent to 100 miles at sea.

At the Chicago-Milwaukee stations a tuned wave is always used. The method in use consists of bridging the spark gap with impedance and capacity calculated to give the wave required. Every time a spark is produced an oscillating current is formed in this circuit. The impedance forms the primary of a transformer of several turns of wire in the secondary. The ends of this secondary are connected, respectively, to the aerial and ground. Whenever the oscillating current is produced in the primary it starts the secondary and the aerial oscillating. The aerial wire must be arranged so that it is accurately in tune with the primary oscillating circuit.

This combination of circuit produces a very much less damped wave than the original and enables several tunes to be sent from the same wire.

The receiving instrument in general use is the combination in which the coherer takes the chief place.

The coherer consists of a very small quantity of metal filings between two silver plugs, all enclosed in a glass tube from which the air has been exhausted. The first arrangement Marconi used for receiving was to connect one side of the coherer to the ground and the other side to the aerial; but this was found to give only a very small range. Now its ends are connected to the ends of a transformer, the primary of which is connected to the aerials and ground. This enables accurate tuning to be done, and it is asserted that only the waves sent out by the transmitting station with a similar tune can be picked up. By means of two, three or more tunes several messages can be sent at once from the same wire and received on the same wire, it is said.

The action of the coherer is not quite understood, although several theories have been advanced. One thing is certain: Whenever a difference of potential over a certain value is established at the ends of the coherer its resistance suddenly decreases from somewhere in the neighborhood of a million to about 500 ohms. This property is used to actuate a relay which works a sounder or inker.

The later form of receiver, the magnetic detector, works on an entirely different principle. A varying magnetic field is produced in iron. The induced magnetism lags slightly behind the inducing magnetism. Now Marconi discovered that when a rapidly oscillating magnetic field was brought to bear on this iron, the lag was immediately reduced, and this sudden change in magnetism was made to produce a sound in a telephone receiver. In its practical form the magnetic detector consists of a band of iron moving through two coils, around one of which the oscillations pass, the other coil being connected with a telephone. The band is kept moving past a magnet. The sound heard in the receiver is like the sound of the spark at the transmitting end. This receiver is wonderful in its possibilities. No adjustment whatever is needed. It cannot get out of order unless the clockwork motor goes wrong, and the speed of receiving is limited only by the operator. Experiments are being conducted so that it will be possible to record the message this instrument receives, although any addition of apparatus always tends to increase the difficulty of operating.

The two types of receiving instruments described are in use at the Chicago and Milwaukee stations.

At Chicago the power is supplied from the direct-current mains at about 220 volts. This drives a two-horsepower motor directly coupled to the alternator, which generates current at 500 volts to the 20,000-volt transformer. The spark is produced across the terminals of the transformer. About one-quarter of the full power is at present used, as it is found sufficient for transmission to Milwaukee. The spark gap is about four millimeters in length.

At Milwaukee alternating current is taken at 500 volts from the mains and used directly on the transformer. In all other respects the stations are similar.

The stations were erected primarily for the purpose of testing fresh-water conditions, and soon others will be erected on the Great Lakes. Vessels will be fitted with smaller apparatus sufficient to keep them in communication with land at any part of their course.

The Chicago and Milwaukee stations have been erected under the personal direction of W. W. Bradfield, chief engineer of the American Marconi Company. H. W. Beauclerk is the Chicago manager of the company.

MARCONI SPACE-TELEGRAPH STATION IN CHICAGO.

Bids for an electric-light plant will be received by the village of Grantsburg, Wis., on June 23d, subject to the sale of bonds. The plant will consist of a 60-horsepower engine, 35-kilowatt dynamo and pole line and wiring. The boiler and the building are not included. Oscar Claussen of St. Paul, Minn., is the consulting engineer.

Life of Storage Batteries.

(From the Question Box of the National Electric Light Association)

QUESTION.

What is the opinion of the association regarding storage batteries after they have been in operation three or four years, under conditions of moderate use, as compared with the efficiency when first installed?

ANSWERS.

Lamar Lyndon, New York city: Replying to your request to answer this question, I would say that the word "efficiency" is used so often in connection with storage batteries where "capacity" is meant that I feel that what you desire to know is whether or not there is a marked change in capacity after batteries have been in service for some time.

As a matter of fact, there is practically little or no change in efficiency. Possibly a little sulphate may accumulate, raising the internal resistance slightly, but the effect of this on the watt efficiency of a battery is practically negligible. The capacity, however, decreases with the age and number of discharges of any cell. The capacity of the positive plate decreases slightly, due to the gradual accumulation of sulphate clogging the pores, and to loss of active material. This active material lost is in part replaced by the electrochemical action in the battery itself, and the positive plate does not begin to lose capacity until after the fourth or fifth discharge. These remarks refer to pasted plates.

Planté positive plates gradually increase in capacity with use, up to the point where the working away of active material from the ribs and exposed surfaces begins to cause a decrease in the available active surface, after which the capacity will decrease.

Negative plates of either type of battery continue to decrease in capacity from the time they are in service, and no reforming action takes place at this electrode. Consequently the negative plates are always made with an excess of capacity over that of the positives (in practice, from 40 to 60 per cent.), and it is intended that a set of negative electrodes shall not lose enough capacity to bring them down to the capacity of the positives before the two sets of positives are worn out; by this time, the negative plates themselves have to be renewed. In actual practice, we find that as a battery nears the end of its life its capacity decreases from 10 per cent. to 25 per cent. less than the capacity when new. Of course, if the use of a battery be sufficiently prolonged, the electrodes will finally disappear and the capacity be reduced to zero. This has no practical bearing, however, and the figures given represent about the decrease that may be expected up to the point where the battery becomes practically useless, unless the plates be renewed.

No rule can be given, because all the conditions upon which this loss of capacity depends are different

MARCONI SPACE-TELEGRAPH STATION IN CHICAGO. RECEIVING BY COHERER AND INKER AND BY MAGNETIC DETECTOR WITH TELEPHONE. (PAGE 461.)

in each and every plant, and depend on rates of discharge, number of discharges, whether overcharged or "boiled" at proper intervals, density of electrolyte, temperature at which operated, the voltage down to which cells are carried on discharge, and other minor factors.

I trust that this covers the question, and regret that the inherent characteristics of storage batteries are such that definite data can seldom be furnished.

Ernest Lunn, Chicago Edison Company, Chicago: A battery that has been installed for three or four years and operated under conditions of moderate use, having from the beginning had careful attendance, should continue to give good satisfaction and its efficiency should be comparatively near to its efficiency at the time of installation. Emphasis must be placed upon the expressions "moderate use" and "careful attendance," for the length of time a battery will do good work depends entirely upon the conditions of operation and upon the care given it. The life of a battery should not be rated in terms of years, for batteries are seldom operated under the same conditions, and the results obtained from one may not compare at all with those from another. As a rule, the life of a battery is inversely proportional to the total number of ampere-hours discharged, other conditions being favorable.

The most important factors in determining the length of time for which a battery will do good service are: The rates of discharge and charge, the

MARCONI SPACE-TELEGRAPH STATION IN CHICAGO.—POWER PLANT AND TRANSMITTING APPARATUS. (PAGE 461.)

per per amount of charge, the temperature at which the cells are kept, and the care given them, which includes cleaning the cells, watering, and protection from impurities in electrolyte. The most important, perhaps, are the amount of charge and the cleaning. As to the charge, it is absolutely necessary that it be brought up to the right point and then stopped, if good capacity and long life are desired. The time to cut off the charge must be determined after the battery has been in operation a sufficient length of time to adapt itself to the work it has to do. One of the surest ways to shorten the life of the battery is to overcharge it continuously. The work of keeping the battery free from the collection of growth on the plates should be carried on systematically and carefully, and an inspection, with the aid of a lamp, of all cells cleaned should be made as soon after cleaning as possible, to make sure that the work was thorough, for many batteries have been ruined because this very important work was neglected. It may be said, in general, that if the same conditions exist at the end of three or four years that made it necessary to install the battery in the first place, and if care has been used in handling it, while there will have been some plate renewals and some loss in ampere-hour capacity, the efficiency of the battery as auxiliary apparatus will be just as high as at the time of installation.

W. S. Barstow, New York city: Ordinarily, if a battery has received proper care it should be as efficient at the end of three or four years as when first installed.

Gas-engine Central Station in Franklin, Pa.

An interesting example of the application of gas engines to central-station service is afforded by the new plant of the Franklin Electric Company, Franklin, Pa. The gas power equipment will supplant a large steam plant which the company has in operation at the present time, and will supply current for electric-light and power service throughout the city. The present equipment comprises five 125-horsepower Westinghouse vertical three-cylinder gas engines, which will be belted to a corresponding number of 75-kilowatt alternating-current generators. An interesting feature of the equipment is the provision made for the operation of the alternating-current generators in parallel. This has proved to be a very difficult matter up to the present time in gas-engine practice, and is made possible in the gas engines by the employment of the principle of governing characteristic of the Westinghouse gas engine. The plant operates upon natural gas.

Modern Views of Matter and Force.

An Associated Press dispatch from Berlin, dated June 5th, states that Sir William Crookes, before the International Chemical Congress on that day, dealt with the possibility of reducing all the elements of matter to one ultimate by finding that each and every element is resolvable into a single form of energy.

The subject was "Modern Views on Matter—the Realization of a Dream." Sir William cited the utterances of Sir Humphry Davy and Faraday as anticipating the possibility of reducing the elements to simpler bases and sketched the significance of the Roentgen rays and Becquerel rays and the experiments of Curie and others.

"All these observations," he said, "find internal connection in the discovery of radium, which is probably the basis of the coarser chemical elements here. Probably masses of molecules dissolve themselves into the ether waves of the universe or into electrical energy. Thus we stand on the border line where matter and force pass into each other. In this border land lie the greatest scientific problems of the future. Here lie the final realities, wide-reaching and marvelous.

"The nineteenth century saw the birth of new views regarding the nature of atoms, electricity and ether. While our views about the composition of matter are generally satisfactory to-day, will that be the case at the end of the twentieth century? Do we not again see that our investigations have only a temporary value? Will we be content to see matter dissolving into a multitude of revolving electrodes? Such a mysterious dissolution of atoms appears to be universal. It occurs when a particular piece is rubbed with silk. It is present in sunshine, in a raindrop, in lightning, in a flame, in a waterfall and in the roaring sea.

"Although the whole range of human experience is too short to form a parallax whereby we can foretell the disappearance of matter, nevertheless it is possible that formless nebulæ will again prevail when the hour-glass of eternity has run out."

It is remarked that the theory of Sir William Crookes, advanced at Berlin, is closely allied to the discovery recently announced by Professor S. M. Babcock, of the University of Wisconsin (Western Electrician of May 9th last), that the weight of an atom is inversely proportional to its inherent energy. The Wisconsin scientist's theory, simply stated, is that all atoms are the same, but endowed with varying kinds and quantities of energy, which give the atoms their varying forms. The theory of Professor Crookes, however, goes a step further and foretells possible disintegration of matter.

Canadian Electrical Association.

As this issue of the Western Electrician goes to press the thirteenth convention of the Canadian Electrical Association is in session at the King Edward Hotel, Toronto. The dates are June 10th to 12th, inclusive. The programme includes papers by Paul Lincoln of Pittsburg (long-distance transmission), R. T. E. Lozier of Cincinnati (individual shop motors), G. H. U. Holman of Quebec (submarine power cables), W. A. Layman of St. Louis (single-phase motors), and J. W. Farley (high-potential transformers). A Question Box and many other interesting features are provided, including various excursions to points of interest in and near Toronto. C. H. Mortimer of the Canadian Electrical News is secretary of the association.

Hydraulic Improvements at Niagara Falls.

All who have visited Niagara Falls or are familiar with the various power-development projects there know that the oldest and one of the most valuable power rights is that held by the Niagara Falls Hydraulic Power and Manufacturing Company. This company, it will be recalled, owns a surface canal that extends from the upper to the lower river, a distance of 4,400 feet. This canal runs right through the southern part of the city and the right-of-way enjoyed by the company is 100 feet wide.

When the present owners acquired the property

FIG. 1. HYDRAULIC IMPROVEMENTS AT NIAGARA FALLS.

the resources of the waterway had been but little developed, but for the last 25 years there has been hardly any cessation of operations in the enlargement of the canal. Some years ago the Erie Railroad Company erected a passenger station and train shed on the canal banks, between Second and Third Streets, and this was allowed to stand until the demand on the canal made it imperative that a greater water supply be obtained. Then the Erie was ordered to vacate the property, the train shed and depot being moved a block or two to the east. When this was done, the owners of the canal began cutting the bank away to give the canal the full width of 100 feet at that point, and in Fig. 1 the drill gang is seen at work breaking up the ledge of rock below the water line, while the dredge is loading the excavated material onto scows, which transport it up the stream, aided by a tug, as shown in Fig. 2.

In Fig. 2 there is also shown to the left a bench of rock that is to be removed in order that the stream may be widened between Third and Fourth Streets. The bridge seen in Fig. 2 is the Fourth Street bridge, and it will be observed that under the left end a bench of rock has been left to support the structure. A similar condition exists in connection with the Third Street bridge, which is a far larger structure, and there is a question whether

FIG. 2. HYDRAULIC IMPROVEMENTS AT NIAGARA FALLS.

the city or the power company shall make the extension on the bridges.

Further up the canal a heavy wall is being built to hold back the bank, and, in fact, at every point along this waterway and its connections everything is being maintained in first-class shape. Several of the plants of the power company's property have been enlarged during recent years, and there is a brisk, active demand for the power generated in the station at the water's edge in the gorge. Several of the mills and factories on the canal lands have their own wheels, but the main part of the flow of the canal is used to operate the turbines in the station in the gorge, the canal emptying into a basin, from which connecting canals carry the water to a forebay close by the edge of the high bank, from which point it goes to the wheels through huge penstocks.

The foundation for a new power house is being cleared in the gorge at the water's edge a short distance downstream from the present station. The development in this station will be notable. To supply the necessary water to the turbines in the new station the canal basin will be extended northward several hundred feet. It is notable, in connection with this project, that it is the company's practice to do its work by the day, awarding no contracts on the enlargement work. Ross Coddington is superintendent and has charge of the construction gangs. Under his careful management excellent headway is made and fine results obtained at all points.

D.

A Submergible Magnetic Separator.

Elmer Gates of Chevy Chase, Md., has done considerable work in designing magnetic separators, in which the fundamental idea consists in feeding the composite material upon a receiving apron located in a magnetic field of a strength so graduated that the magnetic sand (assuming that magnetic sand is the material to be treated) will arrange itself in moss-like or frond-like structures and in zigzag or wavy lines, and thereupon bodily moving these structures on the zigzag or wavy lines of force established, so as to occasion a corresponding zigzag or sinuous travel of the structures and their concurrent progressive reformation. Mr. Gates has now invented a "subaqueous magnetic separator," as an improvement in this class of apparatus, which is chiefly designed for separating magnetic sand from silicious sand. It operates upon the general principle mentioned above, and, while applicable to the separation of dry material, is particularly designed for separating wet material, or rather material to

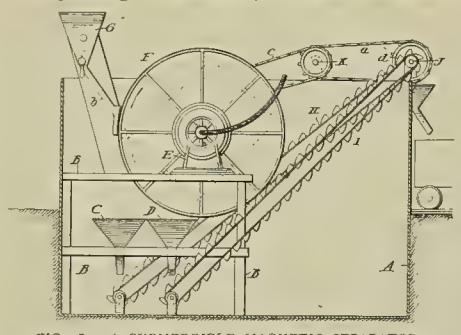


FIG. 1. A SUBMERGIBLE MAGNETIC SEPARATOR.

which water has been added, so as to make it flow freely into the magnetic field of the separator, or material dredged by means of a pump or the like and carried by a stream of water into the magnetic field, or preferably material dredged in submerged hoppers and fed into a separator which is itself submerged.

In the accompanying drawings Fig. 1 represents a side elevation of the complete apparatus, while Fig. 2 shows, partly in section and partly in elevation, the separating magnet and its associate parts.

The general arrangement of the working apparatus is illustrated in Fig. 1, wherein (A) represents a tank adapted to contain water, within which tank is located a framework (B), supporting the hoppers (C) (D) and the bearings (E) for the rotating feed-apron (F). (G) indicates a hopper for supplying material to the feed-apron (F) through the chute (b), and (H) (I) represent elevating devices operated from a shaft (J). Upon the shaft (J) is mounted a sprocket wheel (d), actuating a similar sprocket wheel upon the shaft (K), and upon the shaft (K) a sprocket chain (c) actuates a sprocket wheel (L), Fig. 2, fixed upon the rotary shaft (e).

Upon the shaft (e) is mounted a pinion (f), engaging with a gear (g) upon the rotary feed-apron (F), whereby the movement of rotation is imparted to the feed-apron in the direction of the arrow shown in Fig. 1. Upon the inner surface of the end plate (h) of the cylinder is mounted a circular rack (i), engaging with a pinion (k), fixed to a rotary shaft. The opposite end of the shaft carries a corresponding pinion (k'), which engages with a rack (i') on the inner surface of the end plate (h'). By this expedient the strain is distributed from end to end of the rotary feed-apron.

The end plates (h) (h') are preferably of cast metal, and the feed-apron itself is preferably of thin sheet metal—as, for instance, sheet brass or copper. The end plates are provided with bosses which rest upon the bearings (r) (r') of a watertight jacket, which jacket hermetically encloses the coil (M) of the separator-magnet, the jacket consisting of end plates (n) (n') and a connecting sheath (n^2). Within this watertight jacket the electromagnet is mounted in an inclined position, as indicated more clearly by the dotted lines in Fig. 1, the pole-piece of the magnet extending through the jacket by making a watertight joint therewith. The conducting cable (P), carrying the incoming and outgoing wire of the coil (M), passes through

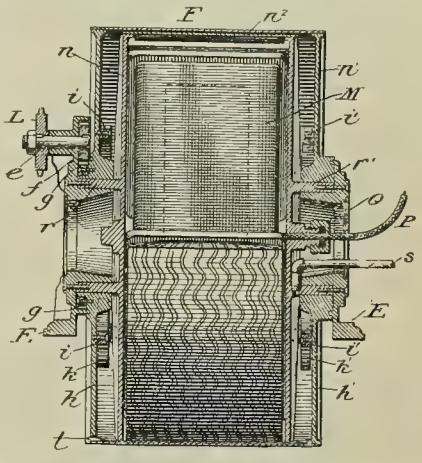


FIG. 2. SUBMERGIBLE MAGNETIC SEPARATOR.—MAGNET AND ASSOCIATE PARTS.

a stuffing box (Q), as shown in Fig. 2, so as to prevent infiltration of water at that point into the interior of the jacket. In order to sustain the apron (F) against external pressure of water if submerged too deeply to retain its shape, either air or water may be admitted under pressure through the pipe (s), thereby establishing a counter-pressure sufficient to balance the pressure from without.

The core of the magnet consists of a number of plates or laminæ of sheet iron, arranged side by side and riveted together. Individual members of these laminæ are provided with polar extensions, which are bent or expanded laterally, and which have a general circular outer periphery and at their extreme ends are of a wavy configuration. Between the expanded ends these polar extensions are preferably filled in with non-magnetic material, such as lead or brass, preferably formed into the inner space in a molten condition, and then permitted to cool and set. After finishing off the surface of the pole-piece thus formed the pole-piece is preferably electroplated, or in substitution therefor a plate of metal may be mechanically affixed to the face of the pole-piece. By this means electrolytic action is avoided between the face of the pole-piece and the inner face of the feed-apron, and a greater wear for the apparatus is consequently secured.

The mode of operation of the invention will be apparent. The material fed from the hopper (G) and consisting of magnetic sand, with its accompanying burden of diamagnetic sand or the like, diluted with a sufficient quantity of water to make it flow freely, passes through the chute (b) and upon the face of the feed-apron (F). Entering the magnetic field the magnetic sand disposes itself along the wavy lines of force produced by the zigzag configuration of the polar extensions of the core, and as the feed-apron revolves the moss-like or frond-like structures thus produced are shaken laterally, thereby relieving themselves of the diamagnetic sand which they contain, which diamagnetic sand falls into the hopper (C) and is conveyed off by the conveyer (H). The magnetic sand, on the contrary, is carried on until, as it emerges from the magnetic field, it drops into the hopper (D) and is carried off by the conveyer (I) to a suitable point of collection.

Cost of Electrical Inspection.

At the closing session of the recent convention of the National Electric Light Association in Chicago, this resolution, presented by Samuel Scovil of Cleveland, was adopted: "Resolved, That the proper officers of this association suggest to the National Underwriters' Association that they would consider it a compliment if the association named could see its way clear to include the cost of its electrical inspection in its rates."

HIGH-TENSION TRANSMISSION.

[EDITOR'S NOTE.—The following papers are "introductions" to a discussion to take place at the convention of the American Institute of Electrical Engineers at Niagara Falls on July 1st. They are not intended to be formal or complete "papers" but serve merely as a basis or framework for discussion on the subjects to which they relate. All those connected with the Institute and desiring to take part in this discussion may do so by being present at the meeting, or, if this is not possible, by sending in a written "contribution." In contributing to a discussion, whether verbally or in writing, it is requested that the matter under discussion be taken up under the several heads and in the order made use of in the introduction, and that following the treatment of these heads there be introduced any other matter which the contributor may deem advisable. When contributions are made by mail on more than one of the topics under consideration at the same meeting, it is requested that the several contributions be embodied in separate letters. Contributions will be read at the meeting for which they are intended either in full, in abstract, or as part of a general statement giving a summary of views of those taking the same position in the matter under discussion. It should be borne in mind that the introductions are written in order to provoke discussion and that there should be no hesitancy in attacking them if they do not agree with the opinions of the contributor. On the other hand, if the contributor agrees with the matter of the introductions, either as a whole or in part, he should state the fact. It should also be borne in mind that the principal object of this scheme is to enable and encourage those not in a position to attend meetings to take part in the discussion. If one does not feel himself qualified to discuss certain portions of an introduction, but is able to discuss other parts, it is to be hoped he will contribute to the latter. Contributions to the discussion of these papers should be mailed to Ralph D. Mershon, 29 Broadway, New York, so that they will be received not later than June 20, 1903. Mr. Mershon is chairman of the high-tension transmission committee of the Institute, the other members being F. O. Blackwell, C. C. Chesney, P. M. Lincoln and C. L. Cory.]

Methods of Bringing High-tension Conductors into Buildings.

BY C. E. SKINNER.

One of the points in the design of high-tension transmission lines which seems not to have received general attention is the method of supporting and insulating the conductors which connect the transmission circuit with the apparatus in the generating and sub-stations. Each engineer follows the plan which seems to him best for his particular set of conditions. In some cases the line is brought through a hole in the wall; in others, through an elaborate system of tubes placed in the wall; in others, through a piece of insulating material of some kind set in the wall; in others, the line is entered through an elaborate tower built for the purpose on the top of the building; in still others, it is taken directly through the roof of the building.

It is manifestly impossible to prescribe any fixed method for all voltages and all locations, as the requirements of each plant are varied by the local conditions, but much would be gained if the general requirements were outlined in such a way that designers of buildings and designers of plants could follow some general and accepted scheme which is known to be satisfactory for any given set of conditions. It is the purpose of this paper to discuss the general requirements rather than to give specific designs, although specific methods must necessarily be referred to in this discussion.

The method to be followed will depend on the following conditions:

(1) The voltage of the transmission circuit.
(2) The climate in which the plant is operated.
(3) The size of the high-tension conductor.
(4) The kind and height of building used.
(5) The conditions of approach to the building and the location of the apparatus in the building to which the high-tension line is connected.

The requirements which must be met are:

(a) The Maintenance of Proper Insulation of the Circuit.—To maintain proper insulation, it is necessary either to allow sufficient open space about the wire to prevent any possibility of the current striking across to the walls or surrounding material; or some insulating medium, such as a tube, must be applied to the wire to give the proper insulation.

(b) The Prevention of the Entrance of Rain, Snow, Cold Air and Dust.—The entrance of moisture, snow and dust, should be prevented, both on account of damage to the contents of the building, and on account of the weakening of the insulation at the point of entrance. In most climates it is necessary that all openings be closed for at least a portion of the year.

(c) The Proper Mechanical Fastening of the Line Wire.—The end-strain of the line must be taken up, and it is often convenient to combine the plants for taking up this strain with those for entering the building. This is particularly true where the transmission conductors are very large. It is also necessary to hold the wire in a fixed position where it passes through the opening into the building. This requires a more rigid line construction than is necessary away from the building.

(d) Reliability and Simplicity of Construction.—It is self-evident that the construction must be such that it will be reliable under all circumstances. There are usually a sufficient number of troubles on high-tension transmission lines due to circumstances beyond the control of the engineer, without introducing any extra risk at the point where the wire enters the building. Usually, as in most other work, the simplest form of construction will be found the most reliable.

In general wires are best brought through the walls of the building. The simplest form of construction consists merely of an opening in the wall sufficiently large to allow the proper air insulation between the wire and the wall, this opening being suitably protected from rain, either by means of a large pipe set in the wall, sloping outward, or by a sufficient extension of the roof above, or both. The requirements of this form of construction are that the wire be a sufficient distance from the pipe, so that there will be no possibility of striking across under any conditions. The pipe should always be considered as "ground," regardless of the construction of the building. The cross-arms holding the wire inside and outside of the building should be sufficiently near and so braced that the wire will remain central in the pipe. This construction can be used to advantage only in dry, warm climates.

With potentials of 15,000 volts or lower a disk of glass or other fireproof insulating material placed over the wire at the inner end of the pipe will usually accomplish this purpose. In this case the tube must be sufficiently large so that the surface insulation over the insulating disk used will be ample to prevent trouble under the worst conditions which may occur. When there is any danger of condensation of moisture due to differences of temperature inside and outside of the building, two disks a little distance apart should be used. These disks may be cut so as to be placed in the pipe itself, or they may be cushioned and simply swung on the wire, lying against the ends of the pipe. The surface insulation of the disks used should never be less than that of the line insulators, and as they will usually be less advantageously placed than the insulators, extra distance should be allowed, if possible.

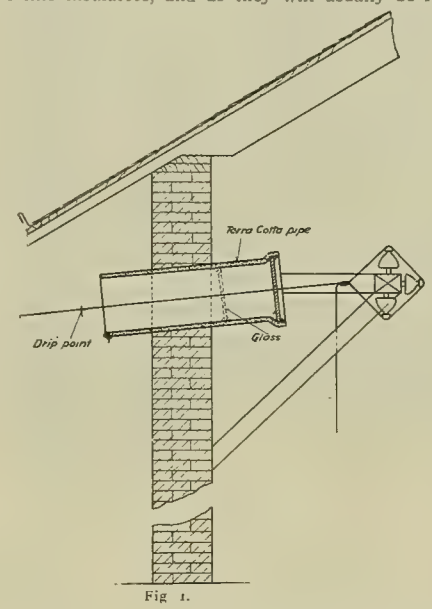


Fig 1.

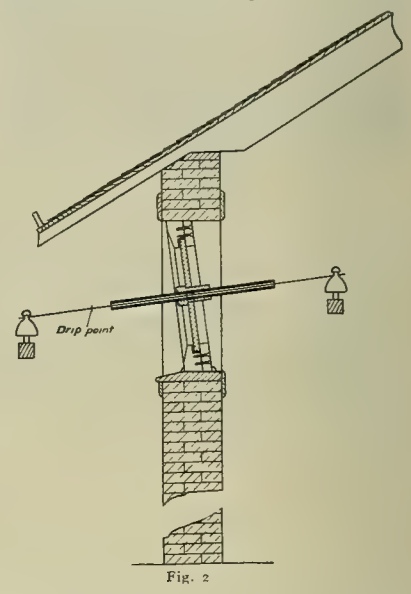


Fig. 2

HIGH-TENSION TRANSMISSION.—ENTRANCE INTO BUILDINGS.

With potentials above 15,000 volts, this form of construction becomes unsuitable on account of the large size of opening required to give the necessary insulation distance over the disks. This may be true, even with potentials below 15,000 volts under very adverse conditions. For the higher voltages, a long insulating tube of small diameter and very heavy wall may be placed over the wire and passed through a slab of insulation set in the wall of the building, the whole being protected from driving rain by an extension of the roof. The insulating tube should slope outward in all cases. Some form of drip point should be provided on the wire just outside the end of the tube. The insulation slab holding the tube should be large enough to prevent actual breakdown, even though the tube is broken. Both tube and slab should be of fireproof material. This form of construction has been successfully used for potentials as high as 50,000 to 60,000 volts. The chief difficulty is in securing the proper insulating tubes. Glass and porcelain are, electrically, the best materials for the purpose, but when these are used it is usually necessary, on account of their lack of mechanical strength, to take up the end strain outside of the building by a suitably guyed pole.

The tower construction may be necessary where the building is low, and the line wires must be carried at a considerable elevation in the immediate neighborhood of the building. It is generally very cumbersome and unsightly, and the bringing of the wires through the side of the tower presents the same problem as bringing them through the side of the building.

The bringing of the wires directly through the roof of the building, while possible, requires that extra precautions be taken to secure sufficient insulation and to keep out all moisture. This method, however well carried out, will probably constitute a danger point in the system.

In general, no combustible material should be used near the line wire, even when separated from it by insulating material sufficient to withstand the strain. Leakage or brush discharge is liable to cause burning sooner or later, and such burning is more serious at the building than the burning of a pin or cross-arm on the line.

The accompanying Figs. 1 and 2 are intended to show diagrammatically the two general plans recommended in this paper. Both plans, practically as shown, are in successful use by important transmission plants. It is expected that each engineer will find it necessary to make changes in details to suit his particular case, but it is believed that the plans proposed may be made effective for any transmission circuit.

The method of bringing high-tension wires into buildings should be carefully considered at the time the building is designed, and proper provision made. It often happens that this point is given no consideration whatever, and the result is an unsightly and unsuitable arrangement made after the completion of the building, and at an increased expense.

It is hoped that those having practical experience with the design and construction of this particular feature of the transmission line will take an active part in the discussion of this paper, and that by this means the Institute may be able to furnish general recommendations covering this subject.

Y or Δ Connection of Transformers

BY F. O. BLACKWELL.

The two alternative methods, Y or Δ, of connecting transformers to a three-phase system come up for discussion with every three-phase installation. A general statement of the advantages and disadvantages of both connections, as they appear to the writer, is given here with the hope that those engineers who have had most experience with power transmission will contribute their views on the subject.

Transformers.

Assuming that three transformers are to be used for a three-phase power transmission and that the potential of the line is settled, each of the transformers, if connected in Y, must be wound for $\frac{1}{\sqrt{3}}$ or about 58 per cent. of the line potential, and for the full line current. If connected in Δ, each transformer must be wound for the line potential and for 58 per cent. of the line current. The number of turns in the transformer winding for Y connection is, therefore, but 58 per cent. of that required for Δ connection and the cross-section of the conductors must be correspondingly greater. The greater number of turns in the winding, together with the necessary insulation between turns necessitates a larger and more expensive coil for Δ connection. The larger coil calls for a longer magnetic circuit and consequently a larger and heavier transformer throughout. This is of no importance when the potential of the coil is low or when the transformer is large and the current high. In fact, in transformers in which the current is heavy, it is usual to divide the conductors into several multiple circuits for ease of handling and to avoid eddy-current losses that occur when the cross-section of the conductor is too large. A few turns more or less in the winding under such conditions is, therefore, immaterial.

In transformers of small capacity wound for high potential, the cost and weight are both considerably in favor of the Y connection of the high-potential coils.

Where it is desired to secure the smallest transformers that can be wound for any given potential, the minimum size of wire that can be employed in the windings of the high-potential coils and give sufficient mechanical strength, is the limiting feature. A smaller transformer is, therefore, practicable for Y connection than can be commercially considered for Δ connection.

The Y connection requires the use of three transformers, and if anything goes wrong with one of them, the whole bank is disabled. With the Δ connection, one of the transformers can be cut out, and the other two still deliver three-phase power up to

their full capacity; that is, two-thirds of the entire bank.

Combined three-phase transformers are generally of small size, and on that account are preferably Y connected on the high-potential side.

Grounding the Neutral.

If the common connection of transformers joined in Y is grounded, the potential between windings and the core is limited to 58 per cent. of that of the line, and the insulation between the windings and core might be proportionally reduced. The same argument applies to the transmission circuit, and would allow the size of the line insulators to be reduced.

The saving that can be made in insulating transformers by grounding the neutral is not great with large transformers, but is important on small ones, as the space taken up by the insulation for any given potential is relatively greater in a small transformer. Under normal conditions, the potential between any conductor of a three-phase transmission circuit and the ground is 58 per cent. of the line potential, with either Y or Δ connection, but the neutral may drift so as to increase the potential with an ungrounded system. If one branch is partly or completely grounded, the potential between the other two

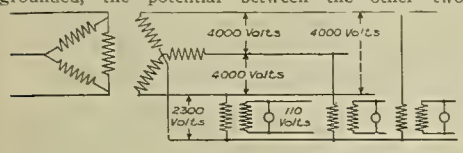


FIG. 3. HIGH-TENSION TRANSMISSION.—STEP-DOWN TRANSFORMER FOR 4,000-VOLT Y DISTRIBUTION.

branches and the ground is, of course, increased and may be the full line potential. With a grounded-neutral Y system, a ground is a short-circuit of the transformers on the grounded branch and the transmission becomes inoperative.

From the point of view of safety to life and prevention of fires this is a desirable condition, especially if the low-tension distribution is also grounded. If the high-tension circuit makes contact with the ground or low-potential system, it can be immediately cut out by fuses or automatic circuit-breakers.

The difficulty is that a power transmission is likely to be frequently shut down by temporary grounds, such as would be caused by a tree blowing against one of the wires. Even if the circuit is not opened,

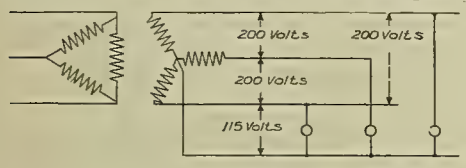


FIG. 4. HIGH-TENSION TRANSMISSION.—STEP-DOWN TRANSFORMER FOR 200-VOLT Y DISTRIBUTION.

the drop in the pressure due to the sudden "short" on the line will cause synchronous apparatus to fall out of step. Under the same conditions, a system without a grounded neutral would give uninterrupted service.

Unstable Neutral.

If two transformers are connected in series, there is no certainty that they will divide the potential equally between them. A system in which all the electrical apparatus is connected in Y has somewhat the same characteristics. The neutral may drift out of its proper place, and there will be unequal potentials between it and the three conductors of the circuit, due to unequal loading and differences in the transformers or transmission circuits. Such unbalancing would cause unequal heating of the transformers and if a four-wire, three-phase system of distribution were employed, would seriously interfere with the regulation of the voltage. If transformers, therefore, have Y secondaries, it is desirable that the primary should be Δ connected. Two systems in common use with which Δ primary windings should be used are shown in Figs. 3 and 4.

Rise of Potential.

The high-potential windings of transformers are necessarily of high reactance, and if left in series

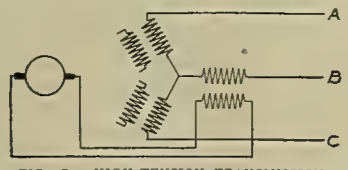


FIG. 5. HIGH-TENSION TRANSMISSION.

with a circuit of large capacity, as shown in Figs. 5, 6, 7 and 8, the leading charging current flowing over the reactance may set up extraordinarily high pressures. Figs. 5 and 6 represent Y-connected banks of three transformers, each connected so as to cause such a rise of potential. In Fig. 5 the primary of one transformer is excited by a generator, the primary of the other two transformers being open-circuited. In Fig. 6 the primary of one transformer is open-circuited, the other two being connected to the generator. Figs. 7 and 8 show T-connected banks of two transformers, which might be used to transform from either two-phase or three-phase to three-phase, or vice versa, and are similar in action to Fig. 5. If in any one of Figs. 5, 6, 7 or 8 the secondaries are connected to a long-distance transmission circuit, a pressure of many times the normal potential will be set up between (A) and (B) and between (B) and (C), that between (A) and (C) not being affected.

It is theoretically possible for a potential 100 times that for which a transformer is wound to be caused by opening the primary switches of one or more of the transformers of a bank connected in Y before the secondary switches are used. Of course, actually,

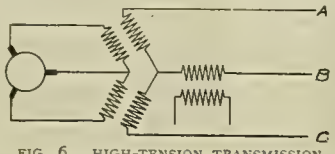


FIG. 6. HIGH-TENSION TRANSMISSION.

the current jumps across the insulation at some point in the system before there can be any such increase in pressure. If there are a number of banks of transformers in parallel, this phenomena cannot occur except when all but one bank are disconnected. This source of trouble could be obviated by employing oil switches on the high-potential side which disconnect the line before the low-tension switches are used, or triple-pole switches on the primary which opens all three branches of the bank of transformers at once.

The selection of Y or Δ connection of transformers for long-distance transmissions should only be determined after a careful consideration of the conditions in each case. There is little choice between Y or Δ without a grounded neutral.

In small installations, the cheaper cost of transformers for Y with a grounded neutral will be a

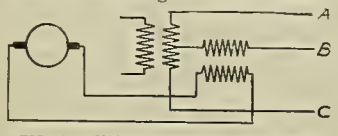


FIG. 7. HIGH-TENSION TRANSMISSION.

determining factor. Larger plants will be guided by the greater importance of giving uninterrupted service and will not employ a grounded neutral unless demanded on the score of safety. Where the amount of power is great and the system extensive, Δ connection will be generally preferred, on account of its avoiding the possibility or rises of potential from any cause. Many plants can have advantageously a mixed system, with both Y and Δ transformers, each installation of transformers being considered by itself.

Choice of Frequency for Very Long Lines.

BY P. M. LINCOLN.

Although other frequencies are in use in this country, there are only two which by the extent of their use can be called standard, viz., 60 and 25 cycles per second. Without discussing the relative merits of other frequencies, the question now presented is, which is the better frequency for a very long line, 60 or 25 cycles per second, considered purely as a transmission problem?

In the present state of the art, 200 miles may be considered as very long for a transmission line. Although longer ones have been proposed, only one of this length has been put into actual operation, and no other line approaches this length. The reasoning

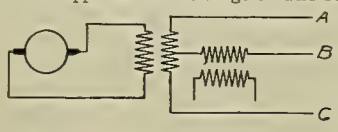


FIG. 8. HIGH-TENSION TRANSMISSION.

which follows will, therefore, be made to apply to a typical line 200 miles long.

Frequency has a direct bearing upon voltage regulation and charging current, and its influence on a possible condition of resonance may also be profitably discussed.

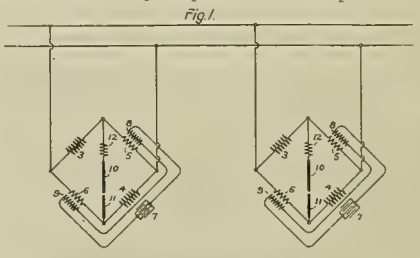
1. Voltage Regulation.—The difference between the voltage at the transmitting and the receiving stations, termed the "drop," is dependent upon several elements, among which are the resistance and the inductance of the circuit. The volts for overcoming the resistance are the same as would be required for sending a direct current equal to the normal alternating current through the line, if it be short-circuited at the receiving end. The volts for overcoming the inductance at any frequency are measured by the pressure which would be required for sending the alternating current at that frequency through the short-circuited line, if the ohmic resistance were negligible. The inductance volts are directly proportional to the frequency. The difference in voltage between the transmitting and receiving stations, or the "drop," is a function of the resistance volts, the inductance volts and the power factor of the load.

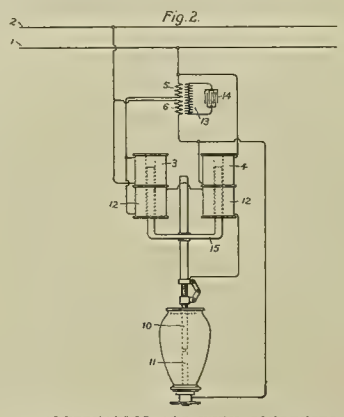
Consideration of voltage regulation at the receiving end limits, according to best practice, the resistance

[*Continued on page 468.*]

Alternating Arc with Condenser.

Albert G. Davis of Schenectady, N. Y., has secured a patent on an improvement in arc lamps which is of some interest. It is intended more particularly for alternating-current constant-potential arc lamps. The idea is to maintain constant current in the arc not through the regulating action of the carbon-controlling mechanism, but through the interaction of lagging and leading currents flowing in circuits operatively related to the lamp. The relation of these circuits to the lamp itself is indicated, perhaps, best in Fig. 1, which illustrates the connections of lamps across constant-potential mains. In this figure the upper lines represent constant-potential mains constituting a source of alternating currents. Across these mains is connected for each lamp a circuit for supplying current to an arrangement somewhat similar to a Wheatstone bridge, this arrangement being, however, more commonly known in the art as a "monocyclic square." Two opposite sides of the square are formed by inductance coils (3) (4), while the two remaining sides (5) (6) include, respectively, sources of leading current—such, for example, as condensers. The condensers may be connected directly in circuit or indirectly, if so preferred. By the artifice of inductive connection the same effect may be produced in the present case





ALTERNATING ARC WITH CONDENSER.

by one condenser as would be obtained by two if direct series connection were employed. The inductive connection in the present instance is such that a single condenser (7), connected in series with two secondary windings (8) (9), acts to produce leading currents in the primary windings (5) (6) corresponding to these secondaries.

The arc-light terminals (10) (11) and the arc-striking coil (12) of each lamp are connected across the diagonal of a bridge, above described, and form what is commonly known as the "Bridge circuit." The inductance coils (3) (4) of the bridge, instead of forming separate pieces of apparatus, constitute regulating coils on the lamp magnets, these coils acting in opposition to the arc-striking coil (12).

Fig. 2 illustrates more clearly the arrangement of the arc-regulating coils in the lamp. In this figure the coils (12) represent the coils of the arc-striking magnet similarly designated in Fig. 1. Acting differentially or in opposition with respect to these arc-striking coils are the regulating coils (3) (4). These coils form opposite sides of the monocyclic square, while the two remaining sides are formed of the primary windings (5) (6), shown in the present case as inductively related to the same secondary winding (13) across which is connected the condenser (14). The arc-striking coils or windings (12) and the electrodes or carbons (10) (11) are connected in series with each other, and constitute the bridge circuit of the monocyclic square. It will be noted that the conductor extending from the main (1) is connected to one end of the coil (4), the other end of which connects with the electrode (11), thereby corresponding to the diagram in Fig. 1, while similarly the same conductor is also connected to one end of the primary winding (5), the other end of which leads to a terminal of the arc-striking coil (12).

By a suitable proportioning of the condenser effect with respect to the inductance of the regulating coils (3) (4) in the arrangement shown a constant electromotive force supply by the mains (1) (2) will give rise to a constant current in the circuit, including the arc, or, in other words, in the bridge circuit of the monocyclic square.

It is reported that W. S. Porter has sold the electric-light and heating plant at Eldora, Iowa, to Chicago men.

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DATES AHEAD.

Pacific Coast Electric Transmission Association, Hotel Rafael, San Rafael, Cal., June 16th and 17th.

Independent Telephone Association of the United States of America, Chicago, June 24th and 25th.

American Society of Mechanical Engineers, Saratoga, Springs, N. Y., June 22d to 26th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

International Association of Municipal Electricians, Hotel Rudolf, Atlantic City, N. J., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

WHATEVER may be the future of space telegraphy—and we must confess to an entire lack of the gift of prophecy in this respect—the establishment of Marconi stations in inland cities like Chicago and Milwaukee is an event of considerable interest. The stations in these two cities are about 80 miles apart, both on the west shore of Lake Michigan, and they have already communicated with each other and are to communicate with such lake vessels as are fitted with the wireless apparatus. The result of the tests over a considerable body of fresh water should be instructive, and we have no doubt that the existence of the stations will be of decided value to lake captains. An illustrated description of the Chicago Marconi station is given in this issue.

ALTHOUGH Mr. Alex Dow, in his recent paper on "Salt as a By-product," says that he could name a dozen electric-light plants in the state of Michigan operated in combination with a salt block and saw mill, we fancy, nevertheless, that the idea of producing salt as a by-product of central-station operation will be new to the great majority of electric-light men. Of course, this particular by-product can be produced only in certain localities; but in such localities—and Mr. Dow gives a list of them—central-station managers will do well to give the subject attention. The idea is to utilize the idle hours of the investment in electrical apparatus—and that there are too many such hours all will admit—and the author, in his characteristic succinct, straight-to-the-point fashion, tells how this idea is to be worked out in Detroit. The brief comparison between salt manufacture and district heating as a central-station side issue is especially interesting.

CONSIDERABLE space is devoted in this issue to four papers, or "introductions to discussions," as they are called, on "High-tension Transmission." These papers are to be read (in abstract probably) at the forthcoming convention of the American Institute of Electrical Engineers in Niagara Falls, and their advance publication is sanctioned by the Institute with the idea that they may draw out further discussion of the subject, either oral by those attending the convention or in the shape of written communications. This idea of advance publication is an excellent one, and might be carried out at greater length with advantage, not only by the Institute but by other technical societies. We commend these papers to the attention of our readers and hope that many of them will avail themselves of the invitation of Mr. Mershon, chairman of the high-tension transmission committee of the Institute, and prepare themselves for the discussion or else submit contributions in writing.

IN A thoughtful paper on "The Development of Electric Station Power Plant" prepared by Professor Elihu Thomson for the recent convention of the National Electric Light Association and given elsewhere in this issue, the author makes some judicious observations on types of prime movers—disregarding waterwheels—for central stations. Whatever Professor Thomson writes is always worth reading, both for the intrinsic worth of the ideas set forth and the charming clearness of expression. The present paper, although unpretentious, is no exception to this rule. The writer, after reviewing, briefly, the history of belted and direct connection and of high-speed and low-speed engines in the central stations, speaks hopefully of the prospects of the steam turbine. "The dynamo machine and other electric machines are essentially high-speed machines, and any straining for low speed must always be paid for in excess of material or diminished efficiency, or both." Therefore, although the direct-connected, slow-speed machine is satisfactory, engineers are not content, and we seem to be on the eve of an important change. Professor Thomson devotes some attention to the development of the steam turbine and concludes that "the low-speed direct-connected unit—the huge generating plant of to-day—must probably eventually yield to the much smaller, relatively high-speed and less costly turbine-driven plant." Further on he says: "The [steam] turbine seems destined to play a large part in the future development of the electric power and lighting station." But internal-combustion engines, such as the gas engine or oil engine, are to be considered also, although they are susceptible to improvement. As to the suggested gas turbine, the writer has serious doubts of its practicability. The paper contains other suggestions and deductions of value, and will repay an attentive perusal.

FOREIGN scientific societies are devoting considerable attention to the subject of purifying the water supply of cities by means of ozone. The ozone is, of course, electrically produced, and the subject is of considerable interest to electrical men. It is said that the ozonizing of the water results in a very thorough purification and that the cost is less than the sand filtering process. After a recent demonstration at the Chemical Congress in Berlin it was declared that there was no obstacle in the way of the general establishment of ozonizing towers in connection with all waterworks, as the water so treated is of superior quality in every respect.

It is, indeed, probable that the ozone will prove an efficient germicide, and it may be that the cost of the plant, on a large scale, will not prove prohibitive, although there is some doubt on this score. At any rate, the experiments now proceeding in Europe are well worth watching, primarily from the point of view of the public, of course, but also, to some extent, from that of the electrical fraternity.

THE mysteries of "radiant matter" continue to fascinate many scientific investigators. R. Blondlot, for instance, has endeavored to find some rays resembling the radiation he discovered mixed with Röntgen rays. These Blondlot rays penetrate metals, but exert no photographic action, and are reflected and refracted. They are discovered by their stimulating action on small electric sparks in air. Now Mr. Blondlot has found that similar rays are contained in the light from an Auer burner. He directed the rays from the Auer lamp on to an aluminum window behind which a quartz lens of 12 centimeters focal length was mounted. Behind that lens was placed a spark gap giving very feeble sparks, and which was moved to and fro along the axis of the lens. The sparks shone out brightly at a distance of 13.9 centimeters from the lens, thus showing that there were dark rays emerging from the Auer lamp which underwent refraction by quartz and penetrated aluminum. A photographic method of investigation consists of the indirect process of exposing sensitive plates to the light from the sparks. In this manner, the investigator found that the rays penetrated one millimeter of glass, one millimeter of black rubber, one centimeter of paraffin, 0.2 millimeter of copper, 21 gold leaves and 0.05 millimeter of steel.

A SPECIAL word of commendation should be extended to the Question Box of the recent convention of the National Electric Light Association. Under the excellent management of Mr. H. T. Hartman of Philadelphia a great deal of valuable data was collected and printed, in the shape of questions and answers, in a pamphlet of 200 pages. The number of questions asked was 257, and answers were received from some 125 persons, a large proportion of whom answered more than one question. Naturally, the questions and answers, being made by practical men, afford a mass of valuable information, and the range of topics covered is a wide one, covering various departments of the station, outside construction, methods of charging, relations with customers, and the like. The Question Box was introduced into the National Electric Light Association by Mr. H. L. Doherty, and under President Ferguson's administration the feature was improved and developed, the printing of the questions and answers in a volume provided with an index being a decided advancement. At the convention but little actual time was needed for the Question Box, which was, nevertheless, one of the most valuable features of the year's work of the society. Readers of the Western Electrician have already had some specimens of the deposit of instruction made by Mr. Hartman's report; and it will be strange if we refrain from dipping into it again for further hints and counsel for future issues.

Development of Electric-station Power Plant.[1]

By Elihu Thomson.

Twenty-five years ago the electric station had its beginning. In 1878 a number of dynamos of the alternating type were belted to steam engines and used for lighting the Place de l'Opera and Rue de l'Opera in Paris. The practice of belt driving, in which the dynamo speed is much higher than the engine speed, was well-nigh universal for a period of 10 to 15 years thereafter. The earliest machines, which were direct-connected to the engine without belting, were probably the Edison Jumbo dynamo and the Gordon alternator, each of which was brought out in 1883.

The machines up to that time were of very limited capacity. A dynamo that would use 25 to 50 horsepower to drive it was one of large output.

The movement toward direct connections was simultaneous with a great increase of capacity over the then existing machines. The Edison Jumbo was a direct-current constant-potential dynamo of about 1,200 16-candlepower incandescent capacity or about 100 kilowatts in output; small enough, it is true, as compared with our present standards. The Gordon alternator was a revolving-field machine, the field being about eight feet in diameter, revolved by the engine direct (and forming a flywheel for the same) at a speed of from 140 to 180 revolutions per minute, the periodicity being about 45 cycles. Its capacity was about 5,000 incandescent lights, or roughly, 350 kilowatts output. These were very large machines in their day. The Edison Jumbo weighed 25 tons, and the Gordon alternator 22 tons. It is interesting to note that the Armington & Sims engine which drove the Edison Jumbo was specially designed to secure relatively high speed, so as to meet, as far as possible, the dynamo conditions. Later on, these same high-speed engines were extensively employed in electric stations belted to dynamos running from 600 to 1,500 revolutions per minute, and employed for incandescent or arc lighting in small units. The example of direct connection gradually spread and the direct-connected electric plant has at last almost entirely displaced belt-driven machines.

The growth was rather slow and less rapid in the United States than in Europe. There was, of course, much work to be done in perfecting details, and the substitution of the large direct-connected unit for belt-driven types may have been retarded by the exceedingly rapid development in various electrical fields.

The replacement came about partly on account of the increasing output, not only of the stations, but of the units themselves, up to 5,000 or 6,000 kilowatts each in some of the large generating stations to-day. As the size of the unit increased, the speed, of necessity, came down to accommodate the heavy reciprocating steam engines employed. This, however, so far as the dynamo was concerned, was only to be accomplished by the use of very massive machines. The dynamo machine and other electric machines are essentially high-speed machines, and any straining for low speed must always be paid for in excess of material or diminished efficiency, or both. Nevertheless, the direct-connected, slow-speed machine of sufficiently large capacity has proved itself very satisfactory in practice, and has become almost universal. Still, engineers have not been content, and it seems as if we are on the eve of another decided change.

In some cases in cities, the vibrations caused by reciprocating engines have, in fact, forced a change in the character of the motive-power machines. Instead of bringing down the dynamo to steam-engine conditions, we now bring the steam engine to dynamo conditions by changing the type of engine employed. In fact, the new problem was to bring down the turbine engine, with the excessive speed required for economy of steam, to such speeds as were within the range of feasible dynamo construction. It is now about 12 to 15 years since the Parsons turbine was applied to drive direct-connected dynamos of small capacity. The earliest of these ran at about 10,000 turns per minute, and really presented the difficulty that the speed was far in excess of reasonable dynamo speeds. The thing had, in fact, been overdone. Growth in size of units and perfection of design allowed the speeds to be lowered to about 3,000 turns in moderately sized units, and still lower in the largest units, thus adapting the speed to a proper proportioning of dynamos.

The lower limit of speed depends on the size or capacity of the turbine engine, but it will probably not go much below 500 turns per minute, even in the largest units.

In the DeLaval turbine the construction is such that reasonable speeds for dynamo work are only to be obtained by a remarkable development of reducing gear. In such a case the plant becomes no longer direct-connected. While in the Parsons form of turbine the steam entering at one end over the whole wheel and passing in succession sets of vanes carried thereby and stationary vanes or guides alternating therewith, progressively expands until it reaches the exhaust end, in the DeLaval the expansion takes place in a nozzle or set of nozzles directed against the vanes of a portion of the periphery of the vanes-carrying disk. The form of jet or nozzle is flaring toward the wheel, and the conversion of the kinetic energy of the stream into motion in one direction takes place in the expanding nozzle itself and the fall of temperature and pressure therefore occurs largely before the stream reaches the wheel, which itself revolves in a fairly good vacuum provided by the condenser. In the lately developed form of turbine due to Mr. Curtis the work of the steam is divided into distinct stages, part of the expansion taking place definitely in each stage, and part only of the periphery of the wheels being acted on by the jets or by steam passing the intermediate guides. The action of compounding is somewhat analogous to that in a compound engine in which the turbine wheels of the successive stages are taken to represent the succession from the high-pressure to the lowest pressure cylinders.

The turbine engine is essentially a machine the efficiency of which depends in large measure upon its exhausting into a vacuum. The condenser is therefore a very important auxiliary.

In the Curtis turbine the ability to secure relatively low speeds is shared with the Parsons form, and the ability to govern output by increase or decrease of steam entering the nozzles is shared with the DeLaval form. This latter feature is valuable in governing and in meeting overload conditions. The present intention, however, is not to go into the details of turbine construction. It is rather to point out and emphasize the apparent fact that the low-speed direct-connected unit—the huge generating plant of to-day—must probably eventually yield to the much smaller, relatively high-speed and less costly, turbine-driven plant. While, perhaps, there will be little if any gain in steam economy at full load, the turbine has the decided advantage that the efficiency curve holds up for partial loads, even for below half-load, particularly when the governing is accomplished as above indicated. This valuable feature is, as is well known, entirely absent in the compound engine of ordinary type, the efficiency curve falling off very rapidly with decrease of load to a point which soon neutralizes all the advantage of compounding. The turbine is essentially a high-speed rotary engine, an ideal for electric machinery, with simple bearings, constant angular velocity, high light-load efficiency and light weight. It is particularly adapted to the large units now in use so extensively. The turbine seems destined to play a large part in the future development of the electric power and lighting station.

While it does not promise great gain in steam economy under full load as compared with the reciprocating types, the average result where load changes are taking place will doubtless be that a much better economy is obtained. The gains in original outlay in space taken up and in maintenance costs seem to be so considerable as to be decisive as to its adoption.

Looking still further ahead, can we be assured that it is the ultimate step? Laying aside, as improbable, the direct conversion of the energy of fuel into electric energy, inasmuch as we see no promising signs of its possibility, and considering the fact that the cost of fuel will probably advance steadily as our near-the-surface coal supplies are worked out, it would seem that we must perforce at last turn to those forms of prime movers which have inherent possibilities of developing much higher efficiencies in the use of fuel than are existent in the steam engine. Even at the present day, in certain relatively very small units, the internal-combustion engine, such as the gas or oil engine, has shown efficiencies nearly double that of the best steam-engine plant, and the partial load efficiency is also satisfactory. There can also be no question that the internal combustion engine is susceptible of improvement, such that in large units the present attained efficiency will be far surpassed. It seems even probable that an efficiency of heat conversion up to between 40 and 50 per cent. will some day be practicable—a result about three times better than is attained with steam. The engines which would be used would naturally be of large reciprocating type and comparatively slow speed, unless some form of gas turbine be developed—a matter upon which serious doubts may be expressed.

What is meant by a gas turbine is a turbine driven by gas expanding from a chamber in which the gas is burned at high pressure and temperature with the requisite amount of air. Such a machine demands the pumping of the air and gas prior to their combustion. The waste gases are, of course, incapable of condensation in a condenser.

The problems involved in a gas turbine are, then, altogether different from those of a steam-turbine engine, and they are necessarily more difficult of solution. In favor of the ordinary gas engine is the fact that all grades of fuel gas may be used with almost equal facility, and even the poor gas, of very low calorific value, such as is sometimes a waste product of blast furnaces in iron smelting, may be used. Coal dust, culm and waste of mines of low-fuel value may be made to yield gas suitable for feeding gas engines. Liquid fuel, as oil of various grades, is also available, and engines have been run, experimentally at least, by feeding them simply with coal dust itself. The richest fuel, down to the lowest and poorest grade, may therefore be employed directly or indirectly in gas-engine work, and a good efficiency, much exceeding that obtainable with any form of steam engine, is even now obtainable, although the units are not very large. Much remains to be done, however, to render the larger types of gas engines equally available with steam engines, and the day of their rapid introduction is probably still far enough away to cause little need for hesitancy in the adoption of turbine plants for electric stations.

Where soft coal is first converted into gas by a gas producer, useful by-products may be obtained which have sufficient value to warrant their being collected and sold. Moreover, the gas may be continuously produced and stored until needed. These conditions are, of course, well known. An advantage obtained from the gas engine, and one which has been frequently pointed out, is the short time required to get it into work and the equally quick shutting down of running expense when it is stopped. Provided only the store of fuel is ready to be drawn upon, there is no expense for fuel except during running; neglecting, of course, interest on plant. A quickly stopped and started gas-engine plant can take care of load peaks most effectively and efficiently. But if the gas engine should ever become a general source of power, what becomes of our driving? Will it be brought again to belting or some form of gearing up for increase of speed, or will the heavy direct-driven dynamo again be found coupled to gas engines instead of reciprocating steam engines?

It is not probable that large gas engines will be run much faster than steam engines of equal power, so that the queries just propounded will need to be answered by future engineering, provided we are right in assuming that the future economical conversion of the energy of fuel into power must come through improvement and increase of size of gas engines.

In the considerations above advanced the use of waterpower is purposely neglected. The amount of waterpower which can be rendered available with economy is limited, and it is fairly local in spite of long-distance transmission, while the need of electric generating stations will be more extended and universal as time goes on. The heavily trafficked trunk-line railroads will need them, and the replacement of small powers by electric motors is a future business which has only just begun, according to all present indications.

1. Paper presented to the National Electric Light Association at Chicago, May 28, 1903.

Saginaw and Bay City (Mich.) Traction and Light Companies Unite.

The traction and lighting companies of Saginaw and Bay City, Mich., are about to pass under control of a New Jersey syndicate organized by E. W. Clark & Co. of Philadelphia, Pa., and Hodenpyl, Walbridge & Co. of New York. The capital of the new company is $7,000,000. The companies to be combined are the Saginaw Valley Traction Company, covering all the electric lines in Saginaw, with the 12 miles of interurban line to Bay City, making a total of 33 miles; the Bay City Consolidated Railway Company, covering all electric lines in Bay City and West Bay City, and a line to Winona Beach, a total of 21 miles; Bartlett Illuminating Company, covering all the electric-lighting business of Saginaw; Bay City Gas Company, covering all gas and commercial electric lighting in Bay City, and a small electric-lighting plant in West Bay City.

It is also expected that the Saginaw City Gas Company will come in under this management, but negotiations are not yet complete. It is expected that the new company will build the interurban road between Saginaw and Flint, part of the roadbed of which is completed.

Mr. Tesla and His Oscillator.

The New York Sun, which is supposed to have excellent sources of information in matters relating to the work of Nikola Tesla, published this short but interesting editorial in its issue of May 31st:

"It is now a little more than two years since the Sun gave to the world Mr. Tesla's announcement that, some time within the eight months following, he would send a wireless telegram across the Atlantic Ocean.

"With the failure of that prediction the public is familiar, although not with the immediate cause. As we understand it, progress toward fulfillment revealed possibilities so much greater that it was determined to aim at a higher mark, and we are now authorized to say, in Mr. Tesla's behalf, that some time within the present year he will send wireless telegrams to the other side of the world. The Tesla oscillator is to deliver to the earth the shock that will be felt and recorded on its uttermost confines.

"As before, we have to wait and see, doubtful because of the miraculous character of the task, but hopeful on the strength of the wonders that science has already done."

The Faraday Society.

English electrochemists have organized a society "to promote the study of electrochemistry, electrometallurgy, chemical physics, metallography and kindred subjects." It is known as the Faraday Society, and is analogous to the Bunsen Society of Germany and the American Electrochemical Society. The first ordinary meeting will be held on June 30th. F. S. Spiers of 82 Victoria Street, London, S. W., is honorary secretary of the organization, of which J. W. Swan is president and Lord Kelvin, Sir Oliver Lodge, Lord Rayleigh, Alexander Siemens, James Swinburne and others are vice-presidents.

High-tension Transmission.

[*Continued from page 465.*]

volts in a transmission line to about 15 per cent. as a maximum, and the same consideration should keep the inductance volts within a maximum of 20 per cent. This will mean a line reputation of about 24 per cent., with a load power factor of 85 per cent. Best economy may reduce the resistance element below the maximum given. The resistance volts may be reduced to any given amount by the addition of copper, while inductance volts are little affected by increasing the size of wire. An increase in size of conductor which will reduce resistance volts by one-half will reduce inductance volts only about five per cent. The matter of inductance volts, therefore constitutes a limit to the amount of power that can be delivered over a single line. This consideration will limit the amounts of power which can be delivered by a three-phase line 200 miles long to approximately the following:

Table Showing Limits of Transmission-line Capacities.

Voltage at Receiving End. 200-Mile, 3-Phase Line.	Power Delivered with 20 Per Cent. Inductance Volts.	
	60 Cycles.	25 Cycles.
20,000 Volts	500 k.w.	1,250 k.w.
30,000 "	1,125 "	2,800 "
40,000 "	2,000 "	5,000 "
50,000 "	3,125 "	7,800 "
60,000 "	4,500 "	11,250 "
80,000 "	8,000 "	20,000 "

For longer or shorter lines the kilowatt in the above table may be decreased or increased in direct proportion.

If the amount of power to be transmitted is large, the multiplication of lines necessary at 60 cycles unduly increases expense both of pole lines and of right-of-way for same. This point is evidently in favor of the lower frequency.

2. Charging Current.—Charging current is, of course, a direct function of frequency and voltage and, to a slight extent, of line construction. At 60 cycles the apparent energy represented by the charging current in a 200-mile, three-phase line is practically equal to the ultimate capacity of that line as limited by the 20 per cent. inductance volts consideration. At 25 cycles it is only about 15 per cent. of the ultimate capacity as limited by the same consideration. In a 60-cycle installation, therefore, it is necessary either to operate the generators on such a line at about full current output all the time, no matter what the load, or to compensate for the charging current, in part or in whole, by the installation of choke coils, either horn of which dilemma is not pleasant to consider. The problem of taking care of the charging current at 25 cycles does not enter the discussion as compared with 60 cycles.

The effect of a large charging current on the regulation of the generator should also be considered. As is well known, a line-charging current, when circulating in a generator armature, has the effect of assisting the field-ampere turns to magnetize the fields. The percentage of magnetizing done by this charging current depends upon its amount and the inherent regulation of the generator. Since the charging current depends upon the voltage, the generator exciting power of the charging current also depends upon the voltage. The effect of sudden load changes, therefore, which tend to change the voltage delivered, will in turn affect this element of the excitation. That is, to a certain extent, the generator assumes the regulation which inherently belongs to a direct-current shunt generator. The effect of large charging currents on generator regulation is, therefore, not toward an improvement.

3. Resonance.—As is well known, every combination of a condenser and choke coil in series has a natural period of oscillation, whose value depends upon the square root of the product of the condenser capacity by the choke-coil inductance. If a frequency of its natural period be applied to such a combination, resonance will occur. That is, a small exciting force of the proper frequency will cause comparatively large currents to circulate between the condenser and the choke coil and therefore comparatively large voltages across both the condenser and choke coil. This is an example of resonance in its simplest form.

A transmission line possesses both capacity and inductance, and therefore the possibility of becoming resonant under certain conditions. The fact that both the capacity and inductance of a transmission line are distributed throughout its entire length, and the disturbing effect of concentrated inductances and capacities at transmitting and receiving stations, makes the problem of determining under what conditions resonance will occur an extremely intricate one. A first approximation may be obtained, however, by assuming that the inductance and capacity of a line are concentrated instead of distributed, and omitting the effects of translating devices. Under this assumption, we may consider that the capacity of a distant portion of the line is in series with the inductance of the intermediate portion.

The natural period, that is, the applied frequency at which resonance will occur between the parts of a transmission line, will be a minimum when the two parts are equal or each is equal to one-half the total line. The number of natural periods above this minimum is infinite, since it is possible to divide the line into two parts, the inductance of one of which multiplied by the capacity of the other may be any quantity less than that obtained by dividing the line into two equal parts.

The minimum period of a 200-mile line is approximately 200 cycles per second. There is, of course, no danger that the fundamental applied frequency will produce resonance until the length of line largely exceeds 200 miles, but the same cannot be said of some of the harmonics if they are sufficiently prominent. The lower the fundamental frequency, the less is the danger from this source. So far as the writer is aware, no actual trouble has ever been experienced in existing plants from this source even on the longest lines and highest frequencies in use, but it nevertheless constitutes an advantage for 25 over 60 cycles that cannot be dismissed with a scoff.

It is a fact that the longest transmission line in the world—the Bay Counties line in California—as well as the highest voltage line—the Missouri River Power Company in Montana—are both operating at 60 cycles. This fact, however, does not detract from the force of the preceding reasoning.

It is not claimed that this discussion contains all of the arguments pro or con. The bringing out of additional points as well as the soundness of those presented is left to the discussion which it is hoped the above will provoke.

The Testing of Electrical Apparatus for Dielectric Strength.

BY P. H. THOMAS.

It is evidently very desirable before depending upon apparatus for commercial service, to have assurance that it is in proper operating condition and also, where the apparatus is built to specification, that the specification has been met. The only practical method of determining the condition of the apparatus as regards its insulation is by means of over-potential tests. This method has been used for a number of years, and has been found to be in general quite satisfactory. However, in common with all types of tests which depend upon the application of abnormal strains, over-potential tests have certain drawbacks and involve certain risks. A brief discussion of such objections, especially in regard to insulation tests upon very high-tension apparatus, will be found in the following pages:

(1) A disruptive test fails partially of its object in testing the fitness of the apparatus for actual service, because the conditions of the test do not approximate closely the conditions of the service, either normal or emergency conditions.

(2) Serious injury may be done to the insulation of the apparatus by the test, even under apparently favorable conditions, so that failure may result afterward in actual service.

(3) In making tests on finished apparatus, it is impossible to test each portion of the insulation separately, and the result of many types and forms of insulation being coupled together, is that only that which is weakest with regard to the particular conditions existing at time of test will be tested.

(4) In general, electrical apparatus is never in a condition so poorly adapted to stand dielectric strains as when first installed.

(5) Insulation tests require special testing apparatus and expert and experienced direction, which are very often not available, and without which great risk is run in attempting such tests.

(6) As an exception to the above (paragraph 5), it is evident that some simple types of apparatus, such as insulators, high-tension bus-bar insulation, high-tension series transformers, etc., may be readily tested without great danger.

(7) Fuller consideration of paragraph 1. Potential strains upon dielectrics cause effects of two kinds:

(a) A constant tendency to puncture the dielectric, which is due to the presence of the potential and depends on the physical dimensions and nature of the dielectric, and which probably remains constant as long as conditions are unchanged, e. g., physical or chemical state. This strain is almost mechanical in its nature.

(b) A tendency to heat or produce chemical change in the dielectric, largely the former. This also is due to the presence of voltage and is very much more marked with alternating current than with direct current. Though comparatively small in actual amount, this generation of heat is a dangerous thing, as it occurs within the body of the insulating material, which is usually a poor conductor of heat.

As insulation heats up, it becomes much less able to withstand the strain described in paragraph (a) above, and, further, the rate of generation of heat within the insulation itself becomes much greater. As a net result, if insulation under strain once reaches a sufficiently high temperature, it is practically certain to get still hotter and ultimately to break down. In other words, for continuous running, it is necessary that the heat generated by the potential upon the dielectric be dissipated as fast as generated. In actual apparatus, the critical rise of temperature may be reached in as short a time as one-tenth of a second, perhaps, or, in other cases, only after a long time, perhaps an hour. The latter time would be required only in large bodies of insulating material; e. g., in large-capacity or high-tension apparatus.

Different kinds of insulating material combine the characteristics described under (a) and (b) in very different proportions. Gaseous dielectrics suffer substantially no heating, while solids and liquids practically have their breaking-down strength determined by this heat factor.

In actual service, injuries to electrical apparatus usually result from overheating, dirt, moisture, chemical exposure, mechanical injury or wear due to vibration, and occasionally a strain from lightning or over-potential stress. The latter strains, however, are rarely extremely severe, except as they may cause local concentration of potential in the windings of apparatus, as will be discussed later.

Thus the voltage time test, which is usually applied to finished electric apparatus, by no means reproduces all the conditions of actual service. On the other hand, it is, of course, true that apparatus which will stand a high disruptive test will usually stand better in service, so that such a test is of value.

If a high disruptive test is relied upon by a purchaser to determine the acceptance of apparatus and terminate responsibility on the part of the manufacturer, the latter will be tempted to design his insulation in such a manner as best to stand the disruptive test at the sacrifice of some features more valuable for preventing a deterioration in actual service. This difficulty becomes a very serious one where unusually severe disruptive tests are specified in a contract.

(8) Fuller consideration of paragraph 2. With low-tension apparatus, little or no harm is to be expected from reasonable over-potential tests carefully made, provided insulation is in good condition. An exception should perhaps be made of dangers of local concentration of strain in high-tension generators or motors of small size, as will be explained later. The following discussion applies to high-tension apparatus chiefly:

The amount of heat generated within the body of a dielectric increases at least as fast as the square of the voltage. Further, this loss, with constant voltage, may be increased several times by an increase of 100° C. in temperature. This means that a strain of double potential continued for any length of time strains the solid insulating material far beyond any condition it will meet in service. Further, the ability to stand the strain will be determined rather by the facility for getting rid of the heat, which is usually of little consequence in commercial work, than by other features of the insulation more desirable for actual service; further, the hottest part of the insulation will be inside, so that the center portion of the material may be badly charred, while the outer portion, the only part visible to the eye, has been kept cool, and appears uninjured. This means that very serious injury to high-tension apparatus may be entirely beyond the possibility of detection until further developed by actual service.

Potential strains above a certain critical point cause a tendency for brush discharge over any insulating surface. If continued, this will deteriorate the insulation so that a discharge may continue afterward at a lower voltage. This effect will occur even under oil, and, like the internal heat, will not be visible to the eye until in a very advanced stage.

When a coil is charged to a high potential and one end is suddenly discharged, there is a strain equal as a maximum to the full value of the discharge voltage, tending to cause the charge upon the turns of the coil to jump to the terminal through the insulation between the turns rather than pass around these turns. Since the total discharge voltage may be the abnormal voltage at which the apparatus is being tested and since this abnormal strain may be concentrated on a portion of one coil, where many coils are used to withstand the normal voltage of the circuit, it is evident that certain turns of the coil (which lie next to the terminal which is being discharged) will receive excessive strain. The condition which is essential to produce this concentration is that the discharge of the terminal of the coil shall be extremely sudden. This can usually occur only when the terminal is discharged by a spark close to the terminal itself, electrically speaking, e. g., any accidental or other discharge between the wires used in applying the test, or in the apparatus itself, will tend to puncture insulation between turns at certain points within the winding. Such injury will oftentimes not be discovered, as the apparatus being tested is not in a condition to show a short-circuit when it is not connected to a generator. This danger is very serious with extremely high voltages. Apparatus may be protected against this strain by the use of choke coils, or high resistances, or static interrupters in the leads of the apparatus to be protected, provided no discharge occurs nearer the apparatus than the protective device. In this connection it should be noted that if the spark gap is used as an auxiliary to measure the potential of the test, that satisfactory means must be used to prevent a discharge on the spark gap from causing injury to the apparatus being tested.

The emphasis placed upon this particular phenomenon is not for theoretical reasons only, but because, in a number of cases, serious injury has resulted to apparatus therefrom. Furthermore, such conditions have been reproduced for purposes of investigation.

(9) Fuller consideration of paragraph 3.

In testing finished apparatus, it is manifestly impracticable to subdivide the windings into more than a very limited number of parts, e. g., in case of the

transformer, into more than possibly four parts. When such a portion is subjected to disruptive test, a breakdown may evidently occur in a number of ways, e. g., between portions insulated only by air distances; over a surface of insulating material, which may be marble on terminal block, fibrous material, or possibly the surface of oil in an oil-insulated piece of apparatus. Furthermore, breakdown may occur through solid material, which in some places will be well ventilated and in other places will not be well ventilated. Sometimes portions of this material which in the disruptive test receives full strain, may, when running in commercial service, be so located as practically to receive a very much less strain. Such a point, for instance, would be the neutral point of a three-phase, star-wound generator. It is thus clear that if the severity of a test (as it must necessarily be) is determined by the strength of the insulation of the weakest spot of these various types and qualities of insulation, the other parts will receive an insufficient test. It may occur that a portion of the insulation less likely to give trouble in subsequent service will be this weakest portion, and will determine the whole test, leaving the condition of the other more vital portions of the insulation insufficiently tested.

(10) Fuller discussion of paragraph 5.

In tests made by persons inexperienced in such matters, there is grave danger of injury to apparatus which would not result when tests are properly made. Such difficulty may arise by the use of testing apparatus having too high an inductive factor or field reaction, so that current to the apparatus may either raise the voltage beyond the usual ratio or so deform the electromotive-force wave as to cause an excessive strain; or by making tests when insulation is not in good condition; or in preliminary trials, in allowing tests to be on too long, though perhaps at a slightly lower voltage than the voltage of final test; or by improperly determining the temperature of the transformer; or in a number of other ways unnecessary to enumerate. Difficulty from this source is by no means of rare occurrence, and it is very difficult to avoid in large high-tension apparatus.

(11) Precautions to be observed in testing:

The most important precautions to be observed in making disruptive tests are here summarized:

(a) Insulation of all apparatus to be tested should be definitely known to be thoroughly dry.

(b) All insulation surfaces and the apparatus in general should be clean and free from all kinds of foreign matter.

(c) The measurement of the insulation resistance will sometimes give an idea of the fitness of the insulation for test. This condition will usually be determined, not by the absolute value of the insulation resistance, but by a curve of the variation of insulation resistance as the apparatus is being dried out. When it has been increasing for a period and finally becomes steady with steady temperature, the drying operation is probably fairly complete. However, when air or oil spaces are included in the bulk of the insulating parts, these spaces may determine the insulation resistance, so that no indication is given of the condition of the actual solid material.

(d) Before applying disruptive test, it should be definitely determined that the temperature of no part of the apparatus to be tested is above that at which the test is to be made, remembering that tests of apparatus when hot, especially when very hot, are extremely severe.

(e) Electrical apparatus of large capacity, which necessarily contains considerable masses of iron and copper, lags behind the atmosphere in temperature changes, consequently, when the atmosphere is damp and warmer than the apparatus, there is a tendency for the latter to "sweat" or condense moisture upon its surface. This moisture will at least partially be absorbed by the insulation material and render the apparatus unfit for test; consequently, it is important in unpacking to open the packing case only when the air is cooler than the apparatus. In case of oil-insulated apparatus, the insulation should be protected from moisture when once dried out until immersed ready for service.

(f) The determination of the high-tension voltage actually reached during test is sometimes a difficult matter. The things to be avoided chiefly are the distortion of wave form or the change in ratio of transforming apparatus, or excessive drop due to the use of apparatus for applying the testing voltage, which is of insufficient size to supply the charging energy required by the apparatus to be tested. This subject deserves a full consideration, but has been so fully discussed elsewhere that further space will not be given here.

(g) In applying the potential of test to apparatus, the voltage should not be raised on the testing set to full value and then applied to the apparatus, but after connection should be increased rapidly by small steps, or continuously from a voltage not over one-half the final. Also the voltage should be raised so quickly that the time during which the last 10 per cent. or 20 per cent. of the voltage is being applied will be short, as compared with the duration of the full potential test.

(h) To prevent local concentration of potential which results from any spark or breakdown occurring near the apparatus to be tested when the latter contains coils, choke coils, static interrupters, or resistance in series with the terminal of the apparatus to be tested may be used. The result essential to the avoidance of this local strain is the prevention of the strain caused by the above-mentioned breakdown from being transmitted without being smoothed out to the windings under test.

Evidently a choke coil in the lead of the apparatus will allow a change of potential to pass through it only slowly, and if this coil can be made to have several times the choking effect of the smallest portion of the winding to be protected (next the terminal) which is considered to be able to stand the voltage of the test momentarily, the necessary protection will be obtained. It would seem that a resistance in the place of the choke coil would serve the same purpose, and, in a measure, undoubtedly will. However, since the resistance does not absorb voltage until after considerable current strength has been attained, is it not as well adapted to protect from sudden changes of potential as the choke coil. The static interrupter being merely a choke coil whose power is increased by the use of the condenser, will act in same manner as the choke coil described above. Usually, however, except where static interrupters are provided for other purposes, the choke coil will be found more convenient.

(12) No complete recommendations are here made for specifications for testing apparatus for dielectric strength, but a few suggestions will be offered on topics in which there is probably a considerable diversity of opinion.

(a) In high-tension apparatus, e. g., 20,000 volts and above, only moderate, short-time, over-voltage tests should be specified in contracts.

(b) Such tests should be made once for all when the apparatus is known to be in good condition, preferably at the factory, by experts, to give assurance that the specification has been met. Such tests should not be made a second time.

(c) After installation, a considerably lesser test should be made upon the apparatus, which will detect any serious injury in transportation and installation. Any moderate deterioration due to absorption of moisture, etc., will right itself with service, provided no abnormal deterioration has occurred.

(d) It is preferable to make high-potential tests by increasing the voltage upon the apparatus as it is designed to operate, one terminal at a time remaining grounded, rather than making a high breakdown test by voltage from an external source.

(e) On tests of very high-tension apparatus, such as generators and transformers, no breakdown gap should be used in connection with the determination of voltage. Any error in the voltage of test, provided precautions as to the proper size of testing apparatus are used, will be comparatively unimportant. In some cases the voltage of the testing device may be determined by means of a spark gap before the apparatus to be tested is connected to the circuit.

It must be borne in mind that in the above discussion the objections to over-potential tests and the dangers to apparatus involved, only, have been considered, and that it is not recommended that disruptive tests be abolished. Such tests may be and regularly are made successfully, and are very desirable to insure good insulation in electric apparatus and to determine the fulfillment of specifications. The point it is desired to emphasize is that great care should be taken to avoid injury to apparatus and that excessively severe tests, especially long-time tests at high potentials, should be avoided.

J. A. Lawrence, Henry H. Fuller and Herbert J. Shannon have organized the Fulton County Electric Railway at Canton, Ill. The company is capitalized at $10,000, and the object of the incorporators is to build and operate street railways.

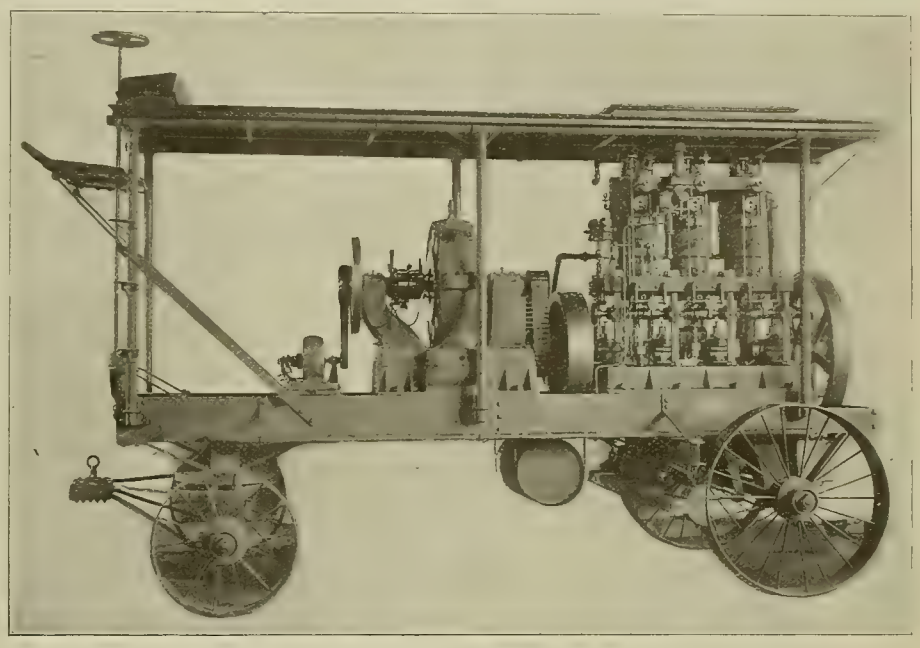
BOOK TABLE.

American Street-railway Investments. Tenth Annual Volume. New York: McGraw Publishing Company. 1903. Pp. (9¼ by 13 inches) 305, with maps. Price, $5.

This excellent reference book is published annually by the Street Railway Journal for the use of bankers, brokers, capitalists, investors and street-railway companies. Arranged alphabetically by states it gives valuable data of the street-railway companies of the country, big and little. This, the tenth annual volume, contains reports of 1,361 companies, showing in detail the financial and physical condition of the properties. Of this number nearly 1,300 reports are of an official character, the information being furnished by the railroad companies themselves. These figures include both operating and leased roads, and include data of many new roads. All important consolidations during the year are recorded. The book contains about 25 folding maps, some in colors, of the most important street-railway systems in the United States. It also contains a table showing by comparison the gross receipts of all companies earning $25,000 or more for the years 1901 and 1902. The report in each case is followed by the date of the information as supplied by the street-railway company making the report.

Investors' Manual. The Economist Publishing Company. Chicago. 1903. Pp. (9½ by 12¾ inches), 114, with 12 maps. Price, $1.

As a book of reference for corporation statistics, range of stock quotations, data on railroad and industrial companies, etc., the Investors' Manual is very convenient and complete. About 75 pages are devoted to statistics of large corporations, mostly in Chicago, giving complete history of the companies. Maps of all the Chicago surface and elevated railroads are given, showing the district covered by each system. A list of large industrial companies throughout the United States, giving capitalization, yearly rate of dividend, earnings, etc., is of interest to business men, as is also the table of railroads of the United States, giving mileage, capitalization, equipment, earnings, etc. All told, it may be said with truth that much valuable information for investors and financial men is contained in the 114 pages of this book.



PORTABLE ELECTRIC-LIGHTING OUTFIT FOR CIRCUS.

Portable Electric-lighting Outfit for Circus.

The accompanying illustration shows a portable generating set built for and now in use by Ringling Bros.' circus. The outfit is mounted on a steel truck, very substantially built, as shown in the picture, and designed to be drawn by horses. It consists of a Walrath three-cylinder gas engine, of the open-base type, connected by a Chicago link-belt chain drive to a Fort Wayne 18-kilowatt, 60-cycle alternator. As shown, the exciter is driven by belt from the generator shaft. The whole set is strongly made to withstand the knockabout usage of hurried handling. It was built by the Marinette (Wis.) Iron Works Manufacturing Company, the manufacturer of the gas engine, which also furnished a duplicate set, the two being used for supplying current at 220 volts for lighting the Ringling circus and animal tents. Nernst lamps are used for this illumination, as described in the Western Electrician of May 23d. Ringling Bros. express themselves as well pleased with their two lighting sets.

DEVELOPMENT OF THE TELEPHONE FIELD.

Proposed Electro-magnetic Regulation on a Loaded Telephone Line for Controlling the Loading Devices.

By J. J. O'Connell.

It is a difficult matter to determine precisely what happens in an operating telephone circuit on account of the infinite-imal current employed, and the complication introduced by varying impedance, capacity, leakage and extraneous inductive disturbances. Although Professor Pupin has attacked and successfully solved the problem in its scientific aspect, indicating that it is possible to compensate for the distributed line capacity by the introduction of concentrated inductances, so that one is enabled to carry on telephone conversations through greater distances than was hitherto possible, it is doubtful if the solution suggested will be entirely satisfactory in the practicable working of aerial lines, on account of the variable conditions above referred to.

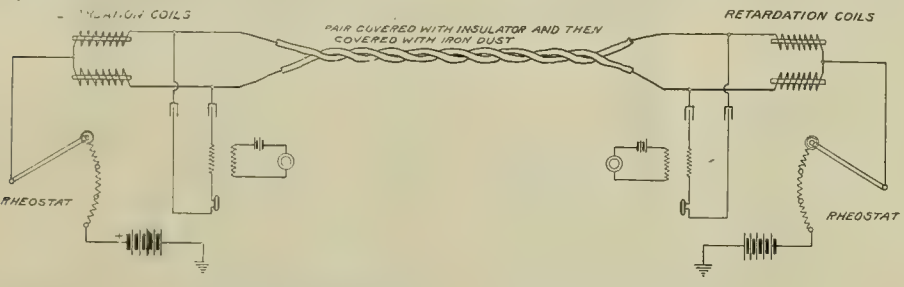


FIG. 1. O'CONNELL'S METHOD OF LOADING TELEPHONE LINES.

Aside from the changes in conductivity caused by temperature variations, it is a comparatively simple matter to control the line resistance. The capacity of the line cannot be so satisfactorily adjusted to surrounding influences, however. It seeems advisable, therefore, to employ some means of altering the other principal quality of the line, that is, the inductance. If this can be made to vary with, and in the same proportion, as the capacity, it should be possible to produce a close regulation. For accomplishing this result, the scheme illustrated in the attached sketches is proposed. Fig. 1 shows the line loaded with impedance coils distributed over its length, the coils having an excess of impedance, so as to overbalance the line capacity. In order to make these coils adjustable, it is proposed to form them as shown in Fig. 2, with a permanent magnet acting as a core about which is wound a solenoid of wire. This coil is wound in such a manner, and the current sent through it in such direction as to oppose the magnetization of the permanent magnetic core, producing thereby more or less neutralization of it. A continuous current is intended to be sent over the line, controlled by rheostat or otherwise, and adjusted so as to produce the best possible transmission with the conditions obtaining upon the working line.

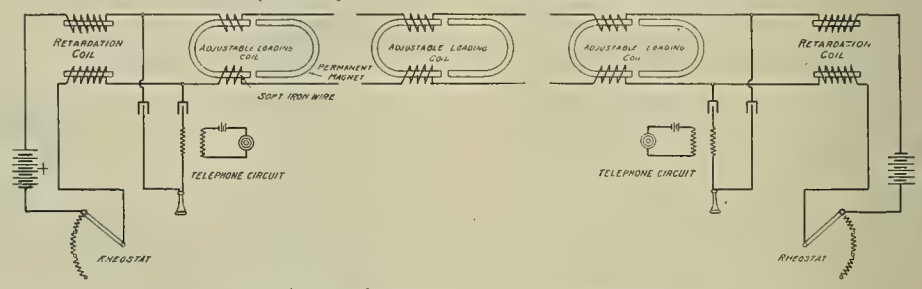


FIG. 2. O'CONNELL'S METHOD OF LOADING TELEPHONE LINES.

Fig. 3 shows a similar method, with the impedance coils and batteries cut in sections. This drawing shows one section, with condensers placed in position to close the telephone circuit to the next section.

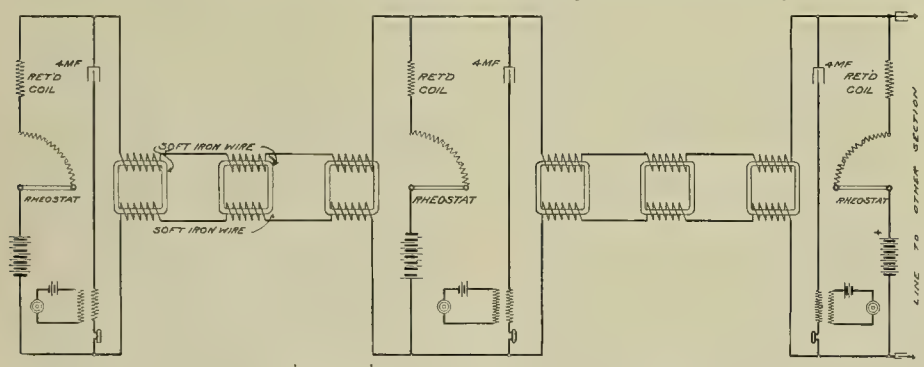


FIG. 3. O'CONNELL'S METHOD OF LOADING TELEPHONE LINES.

NEW COMPANIES.

The Watseka Home Telephone Company has been incorporated with a capital of $20,000. The headquarters of the company are at Watseka, Ill., and the incorporators, J. E. Bundy, J. A. Bundy and H. M. Fisk, will operate a telephone system.

The Western Telephone and Telegraph Company has been incorporated, with offices in Chicago, and a capital of $2,500. F. W. Pringle, G. H. Johnson and H. S. Pringle are the incorporators. The company proposes to operate telephone and telegraph lines.

Indiana Telephone Items.

The franchise of the Central Union Telephone Company in the city of Wabash has expired by limitation, and no application has yet been made for renewal. The council at its next meeting is expected to take steps to have the company's property removed from the streets or to secure favorable terms for a renewal of the franchise. The stockholders of the Home Telephone Company of Wabash, which has practically all the business of the city, are active and influential men, and are said to be opposed to granting a new franchise to the Central Union.

A controlling interest in the Richmond Home Telephone Company has been purchased by Colonel Orr and L. M. Flesh, capitalists of Piqua, Ohio, with Edward L. Gates, banker of Richmond. The Home is one of the most successful Independent companies in the state.

The linemen of the Central Union Telephone Company were called out on a strike June 3d in Anderson, Elwood, Alexandria, Newcastle and Summitville. The linemen were joined by other employes of the company, and business is badly crippled. The strike is caused by the refusal of the company to grant the demand for an increase in wages.

The striking linemen of the Central Union and the New Telephone Company at Indianapolis are still out, and there is no prospect of an immediate settlement.

The City Council of Portland, at its last meeting, granted a franchise to the Hoosier Telephone Company, an organization of local men. The company will put in a telephone plant in Portland to compete with the Home Telephone Company, which now has a monopoly of the business.

The Winchester Telephone Company, operating a plant in Winchester, and the Eastern Indiana Telephone Company, with 200 miles of wire throughout Randolph County, have consolidated. The company will file new articles of incorporation and will be known as the Winchester Telephone Company.

The Star Telephone Company at French Lick has increased its capital stock from $2,000 to $15,000. The company proposes making extensions and improvements. W. F. Moore is president of the company.

The New Long-distance Telephone Company of Indianapolis has bought a controlling interest in the Lebanon Telephone Company. This movement is thought to be a primary step toward securing many of the county-seat companies along the company's lines.

The Posey County Construction Company has incorporated for the purpose of manufacturing telephone poles and other supplies, and will contract to construct telephone plants and lines. The company's principal office and plant will be in Mount Vernon. Braddock McGreggor, William Ford and Allen Gray are the incorporators.

The grand jury in session at Evansville during the last week investigated the charges of four councilmen against a fellow-councilman of attempted bribery in connection with an ordinance repealing the franchise of the Cumberland Telephone Company. There is no evidence, whatever, that the Cumberland Telephone Company was in any way connected with the attempted bribery.

The following-named telephone companies filed articles of incorporation with the secretary of state during the last week. The name of the company, capital stock, territory to be served and name of one official is given: The Allerton Telephone Company of Hancock County, $160; Allerton and neighborhood; service to be free to subscribers; Daniel W. Lineback, Greenfield. The Deer Creek Co-operative Telephone Company, West Sonora; $3,000; West Sonora and community; A. C. Cook. The Home Telephone Company, Huntington; $10,000; Huntington County; Adolph Taylor. The Hoosier Telephone Company, Portland; $100,000; counties of Jay, Adams, Wells, Huntington, Wabash, Miami, Howard, Grant, Blackford, Randolph, Delaware, Madison, Tipton, Hamilton, Marion, Hancock, Henry, Wayne, Union, Rush, Fayette, Shelby, Johnson, Bartholomew, Decatur and Franklin; Judson A. Jaqua. F.

Telephone News from the Northwest.

C. A. Pearson has been granted a franchise for a telephone exchange at Roseau, Minn., and has begun installing the system.

The Stevens County Telephone Company of Morris, Minn., has increased its capital stock from $10,000 to $15,000.

The Board of Fire Commissioners of St. Paul has an exclusive contract with the Northwestern Telephone Exchange Company, allowing that company to use the poles of the Fire Department for its wires. Where a pole line of the Fire Department exists on one side and the Northwestern has a line on the other side of the same street, it makes it necesary for the Twin City Company to parallel one or the other. Hence, when the superintendent of fire alarms objected to the Twin City paralleling the fire-alarm wires on Lafayette Avenue, the fire board withdrew its objections when the circumstances were explained.

The Alto Telephone Company of Alto, Wis., has been incorporated with a capital of $3,000.

The Northwestern Telephone Exchange Company has offered the County Board at St. Paul a reduction of its telephone bill of $1,750 at one-half, and to give the county telephones at half the regular rates.

The strike of some of the operating force of the Twin City Telephone Company's exchange in Minneapolis is over as far as the company is concerned, the strikers being replaced. The new operators' union has enlisted the sympathy of the Trades and Labor Council, which pledges its moral and financial support. There is a threat of a sympathetic strike, but no move has yet been made.

The Slater (Ia.) Mutual Telephone Company has been incorporated with a capital stock of $10,000.

The advertised sale of the property of the Mutual Telephone Company of Des Moines for delinquent taxes was prevented by an injunction secured by the Iowa Loan and Trust Company, which has a mortgage on the system. The trust company asserts the sale to be illegal, because if the property is, for the purposes of taxation, real property, it must be sold only in accordance with the laws governing such sales. If the property is regarded as personal, it is covered by the mortgage given to the trust company.

C. F. Singmaster of Keota, Iowa, has bought the Dobie telephone line at Sigourney. It is 65 miles long.

The Menominee Range Telephone Company proposes to extend its lines from Mountain Iron to Pembine, Mich., where it will connect with the line of the Wausaukee system now being extended to Menominee. The Upper Peninsula is to be covered by Independent telephone lines. R.

Chicago Telephone Rates.

Unlimited metallic telephone service at the rate of $50 a year was urged at a meeting of the gas, oil and electric-light committee of the Chicago City Council, when the ordinance of the United Telegraph, Telephone and Electric Company of Hyde Park for right to use all the streets of the city was being considered. The rates recommended in the ordinance were placed at $60 to $118 for direct lines, $44 to $80 for two-party lines, and $28 to $58 for four-party lines. Alderman Blake moved to attach a provision to the ordinance providing that "any patron of the company may apply for and be entitled to unlimited metallic service at $50 a year, if he should not wish to use the measured service." Alderman Dever declared that telephone rates are extortionate now, and stated that in fixing rates for the new company the city is also fixing future rates for the Chicago Telephone Company. He demanded that care be taken and that something be done to relieve the present unsatisfactory condition of the telephone situation.

The committee decided to defer the subject of rates and to request City Electrician Ellicott and the company officials to be present at a future meeting to give the cost of installing telephones and tell what the profit would be on a given maximum rate for unlimited service, on a basis of $50 and upward.

Kellogg Stock in Litigation.

Some of the minority stockholders of the Kellogg Switchboard and Supply Company of Chicago allege that the control of the company has passed into the hands of the American Telephone and Telegraph Company. The Kellogg company has been reckoned among the Independent telephone manufacturing companies, and the American company is, of course, the parent Bell company. The dissatisfied stockholders allege that the sale of stock is in restraint of trade, as furthering a telephone monopoly. They ask the Circuit Court of Cook County to set the sale aside. The complainants in the bill are Francis W. Dunbar, K. B. Miller, Franz J. Dommerque, William W. Dean, Joseph C. Belden, Mrs. Amanda W. Belden, Anna A. Poole, George L. Burlingame and Frances D. Kellogg. Judge Tuley has granted a temporary injunction.

Inefficiency of Telephone Service in Paris.

There have been so many complaints by subscribers in relation to the poor service given by the telephone companies in Paris that an investigation is being made to discover the cause of the inefficiency. One of the first criticisms the investigating committee made was of the ridiculous manner in which telephone girls are chosen after a competitive examination. It appears that 950 young women who recently applied for situations as telephone girls were required to write an essay on storms in the Pyrenees Mountains, but only 450 storms were considered sufficiently well described to entitle the writers to a position. The opinion of the investigating committee was that a young woman who could poetically describe a storm would be, perhaps, the least fitted to operate a section of a telephone switchboard to the satisfaction of the public.

GENERAL TELEPHONE NEWS.

A merger of telephone companies has occurred at El Reno, Okla., the consolidated company purchasing the properties of the Western Oklahoma Company for $20,000.

The Southwestern Telegraph and Telephone Company is to erect a two-story fireproof brick office building and central exchange at Little Rock, Ark. An additional switchboard capacity of 7,000 telephones will also be installed. T. L. Powell is the local agent.

The Citizens' and New England Telephone Companies sustained heavy losses through the destruction of instruments, poles, and wires in the recent fire at Lakeport, N. H. The electric-light plant that was destroyed was valued at $40,000 and was insured for $10,000.

The Vermilion County Telephone Company recently completed plans for improvements to be made that will cost about $61,000 and which will greatly increase the capacity and efficiency of its service. The company has just closed a contract with J. F. Butterfield of Chicago to build and install a complete underground-conduit system throughout the central portion of Danville, Ill. This will cost about $50,000.

It is said that $1,500,000 will be spent by the Pacific States Telephone and Telegraph Company during the next 12 months in the rebuilding of its plant in San Francisco. The changes will include new buildings, large additions for all the exchanges, new and improved switchboards and exchange connections, and new telephones of the most improved type. The company now has about 40,000 subscribers, and the improvements will allow accommodation of 60,000 more.

X-ray Emanations from the Human Body.

Much attention has been attracted by the announcement that Prof. Arthur W. Goodspeed of the University of Pennsylvania has discovered that secondary radiation from the human body or from other bodies or articles is induced by X-rays. Prof. Goodspeed's own account of his discovery, in The Pennsylvanian, the university's official organ, is as follows:

Having occasion last winter to examine critically some radiographic records, I was surprised to find the clear outlines of some metallic bodies that had been behind the plate during exposure. This recalled that I had been consulted once by somebody who had found similar anomalies, and that I had been unable to throw any light upon the subject. For obvious reasons, I determined now to spare no trouble to hunt down the cause of the effect which I had observed, and after a series of upward of 100 progressive experiments I was convinced that when an X-ray tube is in operation not only is every particle of matter which is impinged by the X-rays secondarily radiant, but that also in some cases this secondary radiation had in all probability imparted activity of some sort to air particles and to portions of the wall which had not been impinged directly by the primary rays.

The cause, then, of the impressions on the plate of articles behind it was established. All of the later experiments leading up to this conclusion had been made with the Crookes tube completely inclosed in a dark box, eliminating thereby every trace of fluorescent emanations which one usually does not take the trouble to cut off and which are always emitted by the glass with which the bulb is made.

Next, from a portion of the space outside the box, the X-rays, which, of course, passed freely through the wood, were completely cut off by heavy lead plates, properly placed on the top of the box, and it was on these plates, screened thereby from the X-rays, that the radiographic films employed for receiving the records were placed. Above this and to one side, freely accessible to the X-rays, the various bodies to be tested for secondary activity were arranged, including zinc, brass, wood, my hand, and a variety of articles too numerous to mention. In every case unmistakable evidence of secondary action appeared upon the plate.

Presuming, of course, that others besides myself may have been working along similar lines, I proceeded to look up carefully the literature on the subject in order, if possible, to determine what parts of the investigation, if any, might claim priority as well as originality. Two Frenchmen, Perrin and Sagnac, I found had demonstrated the property of secondary activity induced by the X-rays, and along some lines of investigation had given some interesting quantitative values; and still a third Frenchman, Guillox, had demonstrated the possibility of using the hand as a secondary source.

None of these three, however, seems to have excluded the optical fluorescence which always accompanies the X-rays, unless special care is taken to cut it off, as already explained. Inasmuch as I found that an Englishman of the name of Townsend had demonstrated that some differences in the numerical values given by Perrin and by Sagnac must have been due to a difference in the primary rays they employed, it seemed to me that putting everything in absolute darkness, from an optical point of view, and then experimenting in the night, thereby cutting off every trace of optical light, was a distinct step in advance of the work of the men referred to.

In brief, then, it has been shown possible to produce secondary radiograms on a sensitized film, inclosed in a perfectly dark receptacle, by means of absolutely invisible emanations from various articles, including the human body, which have been excited by X-rays generated within a black box in a perfectly dark room.

This apparently startling conclusion loses much of its mystery when we contemplate that it is entirely proved at the present time that only about two per cent. of the radiant energy that comes to us from the sun is capable of affecting the human eye. That bodies on the earth, therefore, while bathed in a portion of the other 98 per cent. may be capable of diffusing some of it is what any thoughtful person will admit.

A piece of white paper in a beam of sunlight, or even in a space diffusely illuminated, as is the room of a house, receives a small portion of the two per cent. of the total energy incident upon its path, and diffuses again a small portion of what it receives, thereby making it visible to the eye. Why, then, might we not expect that a piece of zinc or copper favorably posed to receive a portion of the other 98 per cent., i. e., of the dark energy, should be capable of diffusing some part of that in such a way as to be objectively visible to some appropriately devised apparatus for observing it?

It is to be noted in passing that the most favorable location for getting some of the 98 per cent. without some of the visible two per cent. is in a dark room. We have been using the word dark, of course, as applied to the human eye. It is quite possible to my mind—entirely probable—that a mouse, and very likely a cat, could, if it had the proper intelligence, give us valuable assistance in rooms to us totally dark which are doubtless to them comfortably illuminated.

In connection with the work just referred to, a somewhat painful personal experience seems to me to be suggestive as to the possible cause of the well-known inflammation which sometimes follows prolonged exposure to the X-rays. A year ago I had occasion to sleep in the same room in which experiments had been conducted during the day. At the end of that time I left town, but developed at once an aggravated attack of inflammation of the eyes and throat, which yielded to treatment after a few days. During the first week of this month again I found it convenient to sleep in the same room where I had been conducting experiments during the day and evening. At the end of about the same time all the symptoms reappeared with which I had suffered a year ago, with same result—on changing sleeping rooms the difficulty at once disappeared.

In drawing conclusions from these experiences, it must be noted that no trouble has been experienced in the meantime nor before, although I have frequently, during the last six weeks, spent several hours each day for a week or two at a time around the X-ray apparatus. In the night the room had been nearly or quite closed, preventing free air circulation, and the potent protection of eyeglasses was wanting.

I am forced, under the circumstances, to believe strongly that the immediate cause of the troublesome inflammations was the secondary emanations from the air or bodies in the room, or the human body itself, rather than the primary X-rays. This theory would, of course, necessitate the assumption that the activity lasts for an appreciable time after the exciting cause has ceased.

To prove this by objective experiment would indeed be difficult, since the ions developed by the passage of the X-rays through the air are, of course, present for a considerable time after the cessation of the rays, and the electroscope, which would be expected to indicate the activity sought, would be discharged by these ions, and we would still be in the dark.

Chicago Street-railway Situation.

Nothing has transpired within the last week which would tend to indicate the outcome of the Chicago traction negotiations. Everything seems to hinge upon the attitude of the courts toward the 99-year act, the validity of which is to be discussed before Judge Grosscup on June 18th. A resolution presented at this week's meeting of the City Council to the effect that the city take no part in the discussion before Judge Grosscup was laid over for one week. To intervene in these proceedings might force the city to become a party in a legal adjudication of the validity of the act, and this the aldermen wish to avoid.

The Chicago Union Traction Company is said to be doing all in its power to block negotiations between the Chicago City Railway Company and the city, knowing that if the City company waives its claims under the 99-year act it will have to do the same. A resolution presented by Alderman Race at the last meeting of the council demanding that all negotiations between the local transportation committee and the Chicago City company be broken off until the Union Traction Company could take part in them was defeated by a vote of 53 to 12.

Mayor Harrison denies the report that the Union Traction Company's franchise troubles are to be settled by a private conference between himself and Judge Grosscup. He says that that is a matter for the City Council to attend to, and that he is ready to do his share. Colonel E. R. Bliss and President Hamilton of the City company, in discussion with the committee on franchises demanded to know what assurances could be given the company as to the disposition of its property after the 20 years of the proposed franchise had expired, whether it would be bought by the city, by another company, or remain in its own hands pending another settlement, but nothing was agreed on.

In compliance with the instructions of Judge Grosscup, the receivers of the Union Traction Company will offer no objections to formal demands made for one-fare privileges on all street-railway lines controlled by the corporation. As a result, residents of Oak Park will get a five-cent fare to the city without opposition, this being demanded in the ordinance passed by the Oak Park Village Board. The double fare will continue to all points west of Oak Park, including Maywood and Melrose Park. It is stated, however, that these villages will make demands for a five-cent fare.

The United States Supreme Court, in the case of the Atlantic and Pacific Telegraph Company, practically the Western Union Telegraph Company, against the city of Philadelphia, involving the taxation of telegraph companies' wires and poles by the city government, has decided in favor of the telegraph company. The lower court's decision was reversed on the ground that the court took from the jury the power of saying what would have been a reasonable tax. Justice Brewer said that there was no question as to the right of the municipality to legislate for a tax of this character, but that it did not follow from this fact that a municipality is not subject to any restraint in such charges. In this case, he said, the city had undertaken by the imposition of an unreasonable tax to force the telegraph company to put its wires underground.

Salt as a By-product.[1]

By Alex Dow.

[illegible] economic age prescribes that, for the continuing commercial success of any business, that business shall be conducted without waste. The management which fails to realize all its possibilities of thrift invites competition that will undersell its market; and this competition, continuing to make lower prices will ultimately occupy the market to the exclusion of the wasteful producer.

Second—Not only by the adoption of economical processes of manufacture, but by the utilization of all by-products, must the manufacturer of to-day keep down his production cost. In some cases he has apparently the choice between economical manufacture of his chief product without a by-product, and a less economical process which leaves as residue a valuable by-product. A correct choice between these two alternatives requires commercial instinct as well as technical knowledge.

Third—Our friends, the gas companies, have long ago let the public know that their profits are in their by-products. Many of them have modified their gas-producing processes toward lower efficiency in order to increase the value of the by-products. Our other friend, the Standard Oil Company, is somewhat secretive. Nevertheless, we know that the commercial success of that corporation has to no little extent resulted from the utilization of all the contents of the crude oil, whereof in the beginning only illuminating oil was marketed.

Fourth—In our business—the production and sale of electric light and power—our greatest waste has been time—18 or 20 hours out of each 24. We have had, and still have, at best only work enough fully to employ our investment 20 to 25 per cent. of the time. Our interest, insurance and depreciation—and our taxes—accumulate during every one of the 8,760 hours of the year. No improved efficiency of generation, no reduction of the losses in distribution, can possibly help us so much as would the discovery of profitable work to which our investment might be set during its hours of idleness. This is not a new theory; it is a long-established and well-recognized condition, and the suggested ameliorations of the condition have been very many.

Fifth—This paper presents the latest of these suggestions, as adopted by the Detroit Edison Company, to wit: The combination with the electric-light and power industry of the manufacture of common salt by the evaporation of saturated brine. Obviously, this combination can be made only within well-defined geographical limits. The first requisite is the existence of a sufficient deposit of salt. The greatest store of salt is in the water of the oceans, which contains approximately three per cent., by weight, of sodium-chloride. To recover this percentage involves the evaporation of 97 per cent. of water, which is unprofitable except in a limited way, and in warm climates where the sun furnishes the requisite heat. In the United States salt is produced from four principal deposits of rock salt, located as follows:

1. In Western New York.
2. In Ohio and Michigan, running from Southeastern Ohio northwest through Cleveland; under Lake Erie to Detroit and across the state of Michigan to Lake Michigan at Manistee and Ludington.
3. In South Central Kansas.
4. Louisiana.

A limited amount of salt is obtained by mining—running shafts and tunnels directly into the rock salt. There is an excellent demand for this class of salt, which, taken with the cost of production, maintains it at a good price. The more common method and the method that is used exclusively in the Ohio and Michigan field, is to pump water down to the salt vein, where it dissolves about one pound of salt to each three pounds of water, forming a 25 per cent. brine. This brine, returned by the pressure of the pumps through a separate pipe, is evaporated in open vats or vacuum pans by contact with steam pipes or steam jackets. The building, equipped with vats (called grainers) and vacuum pans, together with the pumps and other machinery required, is in common parlance called a salt block.

Sixth—It is customary to use exhaust steam, when such is available, to heat the brine. This practice has led to the combination with the production of salt of other industries using steam power. In the state of Michigan the most frequent combination with the salt block is a saw mill, this particular combination being so common that it is almost standard. A saw mill raises steam by burning its own refuse strips and sawdust; that is to say, fuel is produced in sufficient and sometimes in excessive quantities by the operations of the mill. Old lumbermen said, therefore, that their fuel cost them nothing, and when they, moreover, utilized their exhaust steam in a salt block, the commercial result was exceedingly good, and many Michigan fortunes have been earned thereby. These saw-mill salt blocks have had possession of the salt market of the Upper Lakes for years, and they virtually still control it.

Seventh—In more than one instance an electric-light plant has been operated in combination with a salt block and saw mill. I could name a dozen such electric-light plants in the state of Michigan. The electric-lighting load comes on at dark, when many saw mills shut down either partly or altogether. Salt evaporation is preferably, though not necessarily, a continuous process, and the addition of the electric-lighting load is a step toward continuity.

Eighth—The pine which was the beginning and the strength of the Michigan lumber industry has nearly disappeared, and with it will go the control of this salt market by the Michigan salt blocks. At Manistee and in that vicinity the supply of pine still holds out, and the saw mills and salt blocks are as busy as ever; but on the east shore of the state the pine has been worked out, and the original combination is there no longer possible. Around Detroit, where the greatest salt beds in Michigan have been explored and developed within the last 10 years, there is no pine nor available lumber of any kind, and salt is produced only with fuel bought and burned expressly for the purpose. This leaves but a narrow margin of profit, and if it were not for the lower cost of distribution the industry in the vicinity of Detroit could not exist in competition with that at Manistee. The cost of distribution is a controlling element in the salt business. The material is heavy, and the freight from the salt block to the point of use is frequently greater than the first cost of the salt. In this respect salt and coal are on a similar basis. Each salt field, like each coal field, has a certain area which is its natural area of distribution, and beyond which it comes into competition with the product of some other district. Special qualities of coal, such as the anthracite coal of Pennsylvania, are shipped for special purposes all over the United States; similarly, table salt and other special grades are shipped all over the country; but bulk salt, such as is used by packing houses and in manufacturing and chemical processes, has a well-defined radius of distribution from each producing district. Low first cost will, in some cases, offset high freight rates; and special freight rates (which are not unknown to the salt industry) will extend the radius of some producer who is favored with the same; but these are exceptions not affecting the general rule.

Ninth—The Detroit salt bed is worked to a very great extent by companies producing the salt products—the alkalies—carbonate of soda, soda ash, etc. The Solvay Process Company, whose main works are at Syracuse, N. Y., has established works at Detroit, which were the first on a large scale in that district. Other makers of salt products have followed the lead of the Solvay company, until the alkali industry has become one of the most important in Michigan. These chemicals have a very much wider radius of distribution than has common salt, and the immense salt beds at Detroit, in combination with good water, cheap coal and limestone, and excellent lake and rail transportation facilities, now give Detroit an advantage that it is likely to retain for many years.

Tenth—As I have already said, it is not new to turn the exhaust steam of an electric-light plant into a salt block. What is new about the Detroit proposition is the recognition of the possible reaction of salt production on the electric-light and power business. Economically, it would be just as profitless to operate a salt block during the few hours when an ordinary electric-light system would give it a liberal supply of steam as it is to operate that same electric system only during those hours. To work the electric-light investment to good purpose requires a better load factor than is usually obtained. To work the investment in a salt block to the best purpose requires continuous operation. A salt block that takes and utilizes the exhaust steam of a lighting plant at its peak load and is idle or using live steam at times when the electric-light plant is lightly loaded, cannot be made to pay. But if a continuous load can be obtained for the electric-light machinery, a continuous and profitable operation can be assured to the salt block. The converse is true; namely, that if all the exhaust steam of the continuously running electric plant is profitably used in the salt block, the reduced or extinguished cost of fuel will make the electric-lighting business profitable. To obtain this very desirable state of affairs it is necessary to find the continuous electric load. The use of electric light has physical limitations. People are not going to turn on lights in the daytime merely to be kind to the electric-light companies. Differential rates will improve your electric-light daily load curve and will bring you business that would otherwise go to kerosene or gas; but, after all, it is essentially a night business—I may even say, an evening business, because all-night lighting is a comparatively small portion of the maximum demand. Electric power is a different proposition. Industries that use power 24 hours a day have always existed, and their number is increasing. To these must be added the industries—mostly chemical—that use electricity for heating or for electrolysis. To these may be added—if the inducements are sufficient—industries that now use power only eight or 10 hours per day, but that, if power be cheap enough, can profitably work a night shift, or even establish continuous 24-hour operation.

Eleventh—The possibility of creating a manufacturing district of such industries has been demonstrated at Niagara Falls. Cheap power, cheap and convenient transportation and cheap land are the essentials. With these it is desirable to have an existing population which takes kindly to factory work. All the conditions except the cheap power are existent in Detroit, and our proposition is to furnish the missing essential. We believe that among the industries already established in the city of Detroit, and among those which can be brought to locate in the city or in its vicinity, we can find such a demand for our electric product as will enable us to operate with a good load factor 24 hours a day and 365 days a year. Under these conditions the exhaust steam from our engines can be profitably utilized in the evaporation of brine—that is to say, in the production of salt; the sale of the salt will reduce or extinguish our cost for fuel; and it will be practicable for us to sell electric energy—the fuel cost being reduced or extinguished—at such figures as will secure the stability of our economic combination.

Twelfth—You will observe that I do not say that salt as a by-product will in itself make the difference between profitless and profitable operation. It is good to utilize your exhaust steam; but because you don't utilize it you are not necessarily throwing away your dividends, nor sending them out of the chimney, according to advertisement. If the proposition merely afforded a use for our exhaust, we should run condensing. Indeed, we are providing condensers for use under certain conditions, of which more hereafter. What we see in the plan, and what I am trying to show to you, is the possibility of utilizing the idle hours of our electric investment. The business we expect to get during these idle hours can only be obtained at low prices—virtually at cost of production. The profit lies in the fact that the salt business will reduce or extinguish the fuel cost. Wherefore it is hard to say whether during these hours of sometime idleness the electric supply will be our business and the salt will be our by-product, or whether we shall be truly in the salt business, with electricity as the sideshow.

Thirteenth—About those condensers. We don't expect to do away with the peak of our electric load. That will be always with us, like the poor and the tax collector. We shall have to put up with it, more or less, as with them. But we can provide for the peak in either of two ways. We can have spare engines and boilers, continue to run non-condensing, and crowd the salt block to use the excess steam, or turn it into the atmosphere. Or we can shut down part or all of the salt block for the hour or two and run some or all of our engines condensing. The latter plan suits us best, and requires less investment. It does not pay to crowd a salt block—it affects the quality of the salt. And it does not hurt to shut it down, except to the extent of the loss due to the investment being idle. That latter loss is less if the block is idle during the few hours of winter peak, and the condensers idle the rest of the year, than if spare engines and boilers, and land and building to accommodate them, were idle all the year and busy only during the peak.

Fourteenth—I have just indicated one aspect in which the salt block as a user of exhaust steam is preferable to a steam-heating system. I can shut down my block the week before Christmas, and no one will complain. The men who work in the block will probably even be happy to take a holiday just then. But please shut your eyes and imagine the lovely row there would be if I undertook to shut off my steam-heat distribution that same week. Then I can run my salt block all summer and ship my summer product up lake till navigation closes. I wish I could sell steam heat all summer. Also, the salt block will use what steam I give it at the times I give it, and will not want to be specially warmed up at six o'clock each winter morning; neither to have the heat turned on again for a Fourth of July celebration that has failed to make seasonable arrangements with the Weather Bureau.

Fifteenth—There are many interesting engineering problems connected with our proposed combination of industries. For instance, the question of the economical limit of the back pressure on our engines (which are to be turbines) is exceedingly complex. We can make that pressure just about what we please by proper design of the salt pans; but the first cost of the pans, the rate at which they can be worked, and the quality of the salt produced, are all varied by variation of the back pressure. Again, although we run non-condensing, we shall have an ample supply of distilled water for our boiler feed in return from the pans; but the economical temperature of this feed water is a matter of discussion. Still more interesting is the question of how to utilize the waste heat of flue gases—whether in heating brine or in heating feed water.

Sixteenth—These matters, although interesting, are secondary. Moreover, this paper is already long enough. Like the cowboy who was chased by Indians through the Bad Lands, I have hit only the high places of the trail. If you want to hear from me of what lies between, I must make another trip at another time. When that time comes I shall know more about the subject.

1. Paper read before the National Electric Light Associatio at Chicago May [illegible] The author is manager of the Detroit Edison Company.

The Springfield and Jacksonville (Ill.) Rapid Transit Company has applied for articles of incorporation. The principal office is to be in East St. Louis and the capital stock is $500,000. The road is to be constructed from Springfield to Jacksonville. The incorporators and first board of directors are James W. Buel, E. C. Donk and Edward H. Conrads of St. Louis, L. H. Coleman of Springfield, E. C. Greenleaf of East St. Louis and M. W. Brown of New Berlin.

Four-ampere Series Alternating Enclosed-arc Lamps for City Lighting.[1]

By J. Henry Hallberg.

It is interesting to note that about 20 years ago, when the electric arc was first applied to street lighting, the open-arc lamps of high candlepower were used and were usually placed a considerable distance apart. These lamps operated at a high amperage (about 10 amperes) with low arc voltage, producing a powerful, white, glaring light near the lamp, and as a general rule all street lamps were fitted with clear globes. This method of illumination impressed and satisfied the general public, who became accustomed to it, and thought the more glaring the light, the better the lamp and system. Such a system, however, though at that time a necessity, was not based on correct theories and principles. The main objections to this style of illumination are excessive shadows, unsteadiness of arc, and uneven distribution and poor diffusion of the light.

Later on, the "half-arc" (1,200-candlepower) system was introduced to meet the demand for arc lamps from cities and towns that could not afford the "full-arc" (2,000-candlepower) system, and from others that appreciated the importance of lamps of lower energy placed closer together. The introduction of this system was really a step in advance, although it was generally considered that a city or town that did not have a "full-arc" street-lighting system, was not of much account. Some operators of street arc lamps realized the value of half-ground globes, and others went still further and placed "opal" globes on their lamps. Both ground and opal globes improved the diffusion and distribution of the light, but the general public would still, as a rule, object to anything but a clear globe.

Thus the street-lighting industry continued during the first 10 years of its existence, with 6.8-ampere (300 watts at the arc) and 9.6-ampere (450 watts at the arc) open-arc lamps connected in series and operated by special arc dynamos. The lamps were usually fitted with clear globes and were as a general rule hung at least 400 feet apart.

In 1893 the first demonstration of the successful application of low-energy arc lamps to city lighting materialized, when the New York Edison Company equipped Fifth Avenue with six-ampere open-arc lamps operating two in series on about 118 volts direct-current.

The lamps were equipped with "alabaster" globes and consumed about 270 watts each at the arc. Two lamps hung on each ornamental iron post, and there were two posts at each street intersection, placed on diagonally opposite corners, and between each cross-town street one post was located supporting two lamps. This method of street lighting proved successful beyond expectations, but it was, of course, expensive, on account of the large original investment, low efficiency, and cost of carbons and trimmings. The efficiency of the system, exclusive of generators and cables, did not exceed 76 per cent.

In order to reduce the carbon and trimming expenses, three-ampere, 118-volt, multiple direct-current enclosed-arc lamps have now been installed on Fifth Avenue, in place of the low-energy open-arc lamps. The efficiency of the present system, exclusive of generators and cables, does not exceed 70 per cent.

The commercial success of the already described and similar low-energy arc-lighting systems for city lighting led the Board of Legislation of the city of Cincinnati to specify low-energy, four-ampere alternating arc lamps for the lighting of the streets and alleys of the city of Cincinnati and its suburbs and surrounding towns.

The four-ampere series alternating enclosed-arc lamp, fitted with light alabaster inner and clear outer globes, with porcelain enamel metal reflectors and solid copper shells, was adopted and installed by the Cincinnati Gas and Electric Company.

In the "underground" or down-town district the lamps are mounted on ornamental aluminum-painted all-iron posts. There are two posts at each street intersection, one each at diagonally opposite corners, and in addition thereto other lamps are so placed that at intermediate points no two consecutive lamps are farther than 133 feet apart. The lamps are placed on alternate sides of the street. On a few down-town streets the lamps are 300 feet apart.

Each downtown circuit has a capacity of 60 lamps, and they are fed by underground lead-covered cables. There are about 1,000 lamps operating on the underground system, which is controlled directly from the generating station. About 1,100 additional lamps, operating on part overhead and part underground circuits are also controlled from this station.

The "overhead" district, comprising equipment for 3,300 lamps, covers a large territory and is divided into three sections; each section is controlled from a sub-station, where the switching and regulating apparatus for about 1,100 lamps is located. Each sub-station is supplied with current from the generating station through two three-phase cables; one cable carries the load and the other can be switched in case of a breakdown.

The lamps in the overhead district are hung from 12 to 20 feet above the street, and are in no case more than 400 feet apart.

Ornamental metal brackets, mounted on painted wooden poles, support each lamp in the overhead district, and absolute cut-out hangers with special glass-insulating bells support each lamp.

The larger part of this magnificent installation, comprising 90 automatic, constant-current, 60-light transformers, 90 combination static dischargers and lightning arresters, 90 60-light switch panels and 4,500 series alternating-current copper-cased arc lamps, with absolute cut-out hangers, is now completed and the first circuits have been in operation about one year.

The entire arc-lighting system operates on a three-phase, 4,500-volt, 60-cycle generator. Switching devices and automatic transformers in the generating station are arranged in three groups. Each group consists of 12 60-light transformers, and any or all groups can be switched on either of the three phases, which arrangement permits the proper balancing of the load on the three-phase system. The commercial efficiency of the system, exclusive of generator, lines and cables, is over 91 per cent. The initial power factor of the apparatus is between 70 and 75 per cent. at all loads above quarter-load.

Due to the capacity of the lead-covered cables connected to the apparatus, the commercial power factor of the entire system is maintained from 10 to 15 per cent. above the initial power factor of the apparatus; consequently the operating power factor of the installation is about 80 per cent. The current is maintained at exactly four amperes, and the lamps are adjusted for about 75 volts at the arc. Each lamp consumes 240 to 260 actual watts at the arc, and is equipped with half-inch carbons. Although this is a large diameter for the carbon for such a low-energy arc, the regulation of the lamp is perfect, and the light alabaster inner globe is well fitted with a steady diffused light.

The life of one 0.5 by 10-inch carbon is depended upon to be 115 hours. The trimming of 4,500 lamps is taken care of by eight trimmers, who work on specially constructed tower wagons. The open-base inner globe is used, and all globes are cleaned at the sub-stations, where the carbon stubs are also cut to proper length and fitted in an extra set of lower carbon holders for the next trim.

There are comparatively few people outside of those interested in street lighting who understand the value of low-energy series alternating-current arc lamps as applied to city lighting. Due to this fact, complaints may be expected from the public when a 9.6-ampere open arc is replaced with two low-energy series alternating lamps. It is, however, an interesting fact that when a change of this kind is made and established, the public soon realizes the advantage of a steady, shadowless, well-distributed and diffused light, and would not willingly go back to the old method of illumination.

The writer's experience at Cincinnati during the past year has established the following facts:

First—The open-base inner globe is safer and more economical than the closed-base globe.

Second—The large metal reflector is not necessary on four-ampere series alternating-current lamps hung only 12 or 15 feet above the street, but a small enamel reflector immediately above the arc is beneficial.

Third—The initial or natural power factor of a four-ampere series alternating-current system should not be depended upon to be greater than 75 per cent., varying between 70 and 75 per cent.

Fourth—The 75-per-cent. power factor applies to ordinary overhead circuits. When the current is supplied underground in lead-covered cables, the capacity of such cables introduces leading currents; hence the operating power factor of the underground circuits at Cincinnati is maintained above 90 per cent.

Fifth—The efficiency can be maintained above 91 per cent. and the regulation still be perfect.

Sixth—Four amperes is the lowest practical limit at which successful alternating-current arc lighting can be practiced.

Seventh—Half-inch diameter carbon is the most practical size to use in a four-ampere alternating-current lamp.

Eighth—Notwithstanding the large size of the carbon (considering the low-energy arc), the regulation of the system is perfect, and there are no objectionable shadows from the carbons.

Ninth—It requires only eight trimmers to take care of 4,500 lamps.

Tenth—The outages or lamps requiring starting in the underground district are less than one-fourth of one per cent., and in the overhead district the outages average one per cent.

Discussion.

W. D'A. Ryan, Schenectady: There is no question that the four-ampere lamp, as compared with the six-ampere lamp, has advantages in distribution; that is to say, the greater distribution of the small unit more than compensates for the higher efficiency of the large unit, so that there is considerable gain in effective illumination on the street by the use of the small unit in places where you are not limited by the enforced distance between the lamps.

Arthur Williams, New York: I would ask Mr. Hallberg, if I may, what the city pays for these lamps? I would also ask him how he figures this difference in efficiency between the low-tension Edison system, which he gives as between 70 and 75 per cent., and his system at 91 per cent. I should like to ask also whether the amperage is correctly stated; that is, whether it is approximately or exactly four amperes, because I have understood that the system at Cincinnati has not been, at four amperes, an entire success, and I also understand there is some difficulty in getting entirely satisfactory results from four-ampere alternating-current arc lamps. The author makes the statement that "the open base in a globe is safer." I would like to have the word "safer" explained.

Mr. Hallberg: I think the city pays $73 a lamp in the "underground" district and something like $8 or $10 less in the overhead district. I have not the actual contract figures, but that is my impression. As to the word "safer," the lamps as originally put out were equipped with the open-base inner globe. Later on lamps were placed on the market with the closed-base inner globe. When this style of globe was put on the lamp it became necessary to provide means to hold the lower carbon, and a metal arm had to be inserted from the base of the lamp down through the inner globe for supporting the carbon. If you consider a high-tension series arc system you will see that there are likely to be high feeding points in lamps, so that if the lamp adjustment has been disturbed, especially when new carbons are put in the lamp, the arc is liable to flame. At that time the arc is in its highest position in the globe, near this metal arm, inside of the globe. Therefore, it is only a matter of chance that the arc will jump over to the lower carbon holder. I believe most of the manufacturers who tried the closed-base inner globe have gone through a period of trouble with these lamps on this account. I know this to be a fact with one manufacturer in particular. It then became a question of moving the arm a little further from the carbon, but the moment you do that the globe must be larger, which will cause a greater condensation of gases and shorter life. If you use a closed-base inner globe, you introduce an element of danger which you ought not to have, especially with high-tension arcs, because if the arc produces a flame the chances are 10 times in 100 that it will jump over to the frame, and not only put the lamp out, but it ruins the lower part of the lamp. Many lamps are operated under these conditions, and some people are willing to put up with them; but at Cincinnati it was decided that the open-base inner globe would be used; and the above-mentioned facts are the reason for the adoption of the open-base inner globe. I understand it has taken some prominent manufacturers a considerable length of time to decide whether they should adopt the closed-base globe at all. That is sufficient evidence that it is not quite as good as the other one, at least it has not been tried so thoroughly, and I believe that the smaller globe, that is the open-base inner globe, with small opening at the top, is actually less liable to damage and breakage than the large closed-base globes which have a much larger top surface than the open-base inner globe. Furthermore, the closed-base inner globe is more expensive.

The Cincinnati system operates at exactly four amperes, and the service is entirely satisfactory.

W. Worth Bean, St. Joseph, Mich.: Are the four-ampere lamps at Cincinnati hung at 12 and 15 feet so hung that they cast a shadow?

Mr. Hallberg: No; we use alabaster inner globes. There is practically no shadow. As compared with the open arcs there is no comparison. The light is absolutely steady and well diffused. You could stand under the lamp and observe the illumination, and then go 10 or 15 feet away from the lamp and you would have practically as good illumination.

Mr. Hallberg [concluding the discussion after several others had spoken]: It is true I did not recommend a four-ampere lamp for the city of Cincinnati. The contract was practically closed when I entered into the matter, and I simply fulfilled the specifications. If I had known in advance what an engineering proposition it would develop, I might have hesitated about it. It is a different proposition to build 50 or 100 four-ampere lamps and put them up for a test, from what it is to build 4,500 lamps and to get them to work in harmony on a system such as in the city of Cincinnati. Would it be possible for the company in Cincinnati to get $146 for one 7.5 ampere lamp? Now it gets $146 for two four-ampere lamps. When it put in two four-ampere lamps the lamps pleased probably double the number of people. One or two individuals might say they were getting a weaker light than they used to have, but 10 others are being satisfied by getting an additional lamp. Many of the citizens in any city object to a high candlepower lamp directly in front of their houses. In Cincinnati they had a number of complaints from people who objected to having any arc lamps in front of their houses, and others were pleased with the situation. I think it is up to each individual company to decide for itself and the citizens of the ctiy whether they will have the four-ampere lamp or not. It has worked all right in Cincinnati, and the conditions are improving.

1. Paper read before the National Electric Light Association at Chicago, May 27, 1903.

The Westinghouse Traction Brake Company has recently received from the St. Louis Transit Company an order for from 1,500 to 2,000 air-brake equipments for street-railway service. This is the largest single order for air brakes for electric-railway cars ever placed in this country or abroad.

CORRESPONDENCE.

London Letter.

[illegible] May 29—The Wolverhampton Corporation [illegible] been having a big debate as to whether [illegible] should definitely decide upon the Lorain surface-contact system of electric traction for its streets. At present there is 11 miles of track actually in use upon the Lorain Steel Company's system, and while on the one hand it is stated that the company has not fully carried out the terms of the agreement between it and the corporation, something like 95 per cent. of the taxpayers of Wolverhampton are in favor of the retention and extension of the system. Mr. Shawfield, the corporation electrical engineer, recently prepared a long report upon the system, in which he showed that if the Lorain maintenance was estimated on the type of contact plate and granite casing at present in use, the extra cost of the system as compared with the overhead system would be 1 8d. per car-mile, and the extra annual cost on the whole of the Wolverhampton system was put at nearly $50,000. To this he added interest and sinking fund, which put the total annual extra cost of the system over an average overhead system at $55,000. In face of these figures, the mayor voted against the proposal to continue and extend the system. The argument in favor of the proposal contended that if the corporation went to arbitration over the matter it would have to pay the Lorain Steel Company some $125,000 if the decision went against it, in addition to having to spend $10,000 to take up the boxes and reinstate the roadway and $45,000 to put up the overhead poles and wires. An amendment to the effect that the corporation declined to take over the track as the company had not carried out the terms of its contract, was eventually carried by a majority of 11. By this decision the Lorain Steel Company has to withdraw its system from the streets of Wolverhampton, reinstating all the affected roadway, and leaving all cables and underground works as the property of the corporation.

A new electric central station has recently been put into operation at Worcester. In 1894 a station was erected to make use of the river water for working the dynamos, but owing to great fluctuations in the river this was not found to give the anticipated satisfaction. So that in 1898 some steam-driven machinery had to be installed as an auxiliary. Since then, however, the network has increased to such an extent that the question had to be decided whether to extend the buildings of the original works, which were over two miles away from the center of supply, or build a new plant. It was eventually decided to build a new steam-driven station and to supply a three-wire, direct-current system at 240 volts. The station equipment consists of three 250-kilowatt direct-current sets and a 75-kilowatt motor-alternator, the latter being specially designed to run in conjunction with the machinery at the original waterpower station when there is not sufficient water to keep the plant there running at top capacity. The boiler room contains three boilers. A street-railway company is about to convert some horse railways to electric lines, and the corporation is under a contract to give a supply of current when the railway system is ready.

Some trials of electric automobiles have been arranged for May next year, and a movement is on foot by the Automobile Club here to institute quarterly trials of such vehicles over distances from 50 to 100 miles. The trials in May, 1904, will not take into account the life of the accumulators, but solely the all-around reliability of the vehicles. The trials will include six hill-climbing tests, and a long-distance run.

Gradually the influence of the large electric-power companies with which we are now becoming so familiar in Great Britain, is making itself felt in the direction of developing the small provisional electric-lighting and railway orders which have been lying dormant for several years. At Ilkeston, in Derbyshire, the local authorities have been in possession of powers for four years, and, thanks to the proximity of one of the large power stations of the Nottinghamshire and Derbyshire Electric Power Company, it has at last been able to put these orders into force, and is now giving an electric-lighting and railway service with electric power purchased "in bulk" from the company.

The advantage of large centralized power stations is, indeed, becoming more and more recognized in Great Britain as the years go on. An instance of this happened a few days ago, when a large local authority near London having parliamentary powers to supply electrical energy, sought for and obtained sanction to take a supply of current from a neighboring borough which had built a big power station—too large for its own immediate needs—and could supply much cheaper than the other could if it had to erect its own works.

In 1897 there were only 40 miles of electric railways in Great Britain, but, according to Mr. Gerald Balfour, the president of the Board of Trade, there are now 900 miles of double track, carrying 1,400,000,000 passengers yearly, as against 800,000,000 in 1897.

The chairman of the highways committee of the London County Council recently stated that since that body had been the tramway authority of London, $350,000 had been paid over to the relief of the rates, $120,000 put by as a reserve fund, and $450,000 paid off the capital debt. The council has now purchased 88 miles out of the 100 miles of street railway in London, 44 miles of which is leased to a company.

Several central-station companies have been bought out by the local authorities this year, including the companies at Norwich and Dover. W.

New York Notes.

New York, June 6.—It is announced by persons in this city who are interested in the enterprise that a test will shortly be made of electric motors for hauling boats on the Erie Canal. Two motor cars are being made at Schenectady by the General Electric Company, and Superintendent of Public Works Boyd has authorized the test. Poles are to be erected for a mile and a half along the Erie, and an experimental system is to be installed. There are three rails to the system, one above the other. One electric "mule" or car will run on the lower rail guided by the rail above, upon which another car will run in the opposite direction. The cars are small, and each will be operated by a man. The cable will be stretched from the car to the boat.

A steel tower, 105 feet high, on the top of which is a pole 25 feet high, is in position on the roof of the Western Union telegraph building in this city. Down the length of this pole a time ball drops at exactly noon each day. The ball consists of a framework of brass rods, bent into spherical shape and covered with stout canvas. It is dropped by an electrical impulse sent from Washington, and the instant it reaches the base of the pole this fact is automatically communicated to Washington through the medium of an electric telltale. The noon signal is transmitted from New York by a bank of relays to 142 circuits connecting all the principal cities and towns throughout the country. The services of the telegraph company are at the exclusive disposal of the government for three or four minutes immediately before and after 12 o'clock, noon, for the carrying out of this programme.

The final meeting of the Arbitration Board of the Rapid Transit Contractors' Association and the Central Federated Union over the readjustment of wage scales has been held in the office of Contractor McDonald. It was agreed that the wages of the rock drillers should be advanced from $2.75 to $3 a day. The other trades asking advances are the teamsters, pipe calkers and house shorers. An agreement was reached by which they will be given until July to show that the wages they ask are the prevailing rate. The other trades, 20 in number, will work at present rates until the subway is finished.

Extended improvements for the elevated railroad stations throughout Manhattan and the Bronx have been planned by August Belmont, president of the new Interborough system, which has taken over the Manhattan elevated railway. The most elaborate of these improvements will be at the Thirty-third Street station on the Sixth Avenue line. There two large escalators are to be constructed, one for the down-town side and the other for up-town trains. Further facilities will be afforded for this, the heart of the shopping district, by a large bridge that will be constructed over the tracks so that passengers may pass freely from the up-town side to the down-town side and vice versa. Several new stations will be built and all the down-town stations are to have new waiting rooms. About $200,000 will be expended in these improvements.

A waterspout running in from the sea at a high rate of speed struck a train on the Brooklyn elevated road, bound cityward, from Rockaway Beach. The motorman saw the spout just as the train reached a trestle over Broad Channel, Jamaica Bay. He threw on full power in an effort to get past, but the flood of water struck between the third and fourth cars. The platforms were crowded with persons who were almost swept off into the bay. Hundreds of pleasure seekers were drenched to the skin.

The Amityville and Huntington Railroad Company, with principal office in Brooklyn, has been incorporated to operate a street surface electric road over 14 miles long from Amityville to the Long Island railroad station in Huntington. The capital is $250,000, and the directors are W. K. Putnam, A. S. Sanborn, J. S. Sherman, Harry A. Hanbury, Robert A. Sharkey, Frank Jacobs, J. D. Brown, Ernest Houchin, and C. B. Smith of Brooklyn.

The Brooklyn Rapid Transit Company announces that it has begun the operation of through electric elevated trains between the ferries at the foot of Broadway, Williamsburg and Jamaica, in Queens Borough. The trains run over the elevated road to Cypress Hills where they descend to the surface tracks on Jamaica Avenue by means of an incline which has been built there. From Cypress Hills to Jamaica the trains run on the Jamaica Avenue surface line, taking the place of the trolley cars recently operated on this road.

Space telegraphy was brought into service in novel fashion this week when the corporation counsel, by the use of the Marconi space telegraph, notified W. R. Hearst, who was on board a steamship at sea, of a $25,000 damage suit against him and the city, arising from the explosion of part of Hearst's fireworks display in Madison Garden on election night, through which several were killed and wounded. The message was first cabled to Queenstown, Ireland, and from there forwarded to the Marconi station at The Lizard, England. That the message was received and delivered was verified when the ship reached port. O.

New England News.

Boston, June 5.—The Connecticut Senate has passed a bill authorizing the extension of the Hartford Street Railway Company's lines from Wethersfield to Rocky Hill; the extension of the Middletown and Meriden Traction Company's lines from Highland Lake to Meriden; extending for two years the charter of the Watertown and Litchfield Tramway Company and allowing the company to build over several additional routes; extending to July 1st, 1905, the time within which the New Milford and Lake Waramaug Tramway Company may build its road in Litchfield County; amending the East Lyme Street Railway Company's charter so that it can build an electric railway between New London and East Lyme along the shore of Long Island Sound; and authorizing extensions by the Winchester Avenue and the Fair Haven and Westville Railroad Companies.

The Boston Transit Commission has decided that it is inexpedient to build a tunnel under Washington Street for elevated trains. By the law adopted last year, the commission is authorized to build two tunnels or subways under that street—one for elevated trains and one for surface cars. The commission will not consider the problem of the subway for surface cars to run into until they decide whether they will select a new route for a subway for elevated trains to enter where they pass from their overhead structure to their tunnel section.

The Caribou, Washburn and Perham Railway Company has filed articles of incorporation with the Maine secretary of state. It has a capital of $210,000 and its officers are as follows: President, S. L. White; vice-president, J. D. Emery; treasurer, George W. Irvine; clerk, E. A. Holmes; directors, S. L. White, J. D. Emery, G. W. Irvine, H. E. Jones, E. A. Holmes, Corydon Powers and E. C. Sampson. The company proposes to build an electric railway 15 miles long through the towns of Washburn, Perham, Woodland and Wade Plantation, Maine.

The interstate electric railway between Providence, R. I., and Danielson, Conn., has been opened for business, and there is now electric railway communication between Worcester, Mass., and Providence, via Danielson.

Stockholders of the Edison Electric Illuminating Company of Boston have voted to increase the company's capital from $8,635,500 to $9,499,100, the directors to issue the increase at their discretion. The directors have offered the 8,636 shares of new stock to the stockholders at $200 per share, in the proportion of one new share for 10 old shares.

Ex-governor Thomas M. Waller of New London, Conn., and other capitalists are endeavoring to secure a charter for the Middletown and Middlefield Traction Company which proposes to build an electric railway in the towns of Middletown and Middlefield, Conn., connecting with the Middletown Street Railway Company's road. The company will have a capital of $150,000.

The Middletown and Meriden Traction Company proposes to reduce its capital from $200,000 to $100,000.

The Connecticut legislative committee on railroads has favorably reported a bill authorizing the state railroad commissioners to order all electric-railway companies to place vestibules on all cars operated from December 1st to April 1st and to equip all double-truck cars with air brakes. B.

Michigan.

Detroit, June 6.—The Edison Illuminating Company of Detroit will erect a two-story sub-station on land recently purchased in the central part of the city.

By an arrangement made by a committee of the Common Council of Lansing with the Public Lighting Commission and private firms having wires in the city streets, most of the poles will be taken down and all of the principal streets vacated. The city is to control the poles that remain, receiving compensation for their use by private concerns.

L. J. Fick is at the head of a new street-car company which will ask for a franchise to build a new line in Springwells, a suburb of Detroit. The line will skirt the north and western part of the city, running from Delray, on the Detroit River, to Warren Avenue, a distance of about four miles. The power will undoubtedly be furnished by the new Detroit Edison plant, which will be located at the end of the line on the Rouge River.

Mayor Hammell of Lansing put a stop to the operation of the Lansing street railway for a time this week, owing to the number of times the trolley wire broke and the general unsafe condition of the overhead wiring. The attorneys for the street railway assured the mayor that the wires would be put in a safe condition, and the cars were allowed to run again.

The village of Litchfield, at a special election, decided not to bond for an electric-lighting plant.

Union City bids fair to be an electric-railway center if all of the seven projected lines are built. The residents of Union City and vicinity hope that at least

one of them will "materialize," for this section is greatly in need of north and south railway connections with other points.

Spontaneous combustion in the stock room of the Detroit Edison Illuminating Company's plant this morning was the cause of a $3,000 fire.

Franchises and rights-of-way are being quietly secured for the building and operation within the next year of an interurban system connecting Jackson, Mich., and Fort Wayne, Ind. This line was surveyed a year ago and was believed to have been abandoned, but options are now being taken, subject to closure in 60 days, for rights-of-way in Indiana counties.

The newly organized Hiawatha Electric Company, with capital stock of $60,000, is negotiating for a factory site in Detroit. It will manufacture incandescent lamps and other electrical specialties.

The T. E. Clark Electrical Company will erect a factory in Pontiac, Mich., and will soon have a large factory in working order. It is figuring on extensive machinery for space-telegraph stations at Isle Royale, Eagle Harbor, Duluth and Port Arthur. It is expected the system will be used in connection with life-saving stations.

Niles, Mich., will celebrate the Fourth of July and the completion of the interurban railway between that town and South Bend, Ind., on the same day.

C. G. W.

Information from Indiana.

Indianapolis, Ind., June 8.—The Southern Indiana Interurban Railway Company has filed a petition in the Circuit Court at New Albany to change its corporate title to Louisville and Northern Electric Railway Company. It proposes to build north to connect with the Indianapolis-Columbus line. It is now opening an entry into Louisville over the Big Four bridge, and expects to be landing passengers in the heart of Louisville in a short time.

Indianapolis and Richmond were connected by electric line on last Wednesday, and the first car to run the entire length of the road was occupied by the officers of the road with their wives and a few invited guests. The line is 69 miles long. Through connection to Dayton, Ohio, will be inaugurated July 15th. A dollar and five cents pays the fare one way, or $2 for the round trip.

The Fort Wayne and Southwestern Traction Company has been placed in the hands of a receiver to prevent execution upon the property for debt. Suit was brought by J. M. Haines of Augusta, Maine, who owns a majority of the stock in the company. This line runs from Fort Wayne to Wabash and is about to build a spur to Marion. S. L. Nelson, the present general manager, is receiver.

Another Indiana-Kentucky electric line is assured to run from Owensboro, Ky., via Rockport and Jasper to Vincennes. The road will cross the river at Iceland and Rockport, and run north to Lincoln City, thence to Jasper and Vincennes.

Promoters of traction lines have been busy during the past week securing franchises. The City Council of Decatur granted to the Springfield and Fort Wayne Traction Company a franchise to enter the city and to build a local system. The county commissioners likewise granted the company a franchise through the county. The road is to be completed and in operation by December 1, 1904. George F. McCulloch and others are projecting a line through Marion and Decatur to Lima, Ohio.

The Union Traction Company has purchased 1,000 acres of coal land in Sullivan County and will open up mines. The traction company has enough cars to handle its own coal to its Anderson power house. The Indianapolis Terminal Company may draw its supply from the same source.

Motormen, shopmen and engineers of the Citizens' Street Railway of Vincennes, of which D. G. Hudnut of Terre Haute is principal owner and president, have won their fight for a reduction of hours and from $1 to $1.50 per week increase in wages.

The Terre Haute Electric Traction Company has been incorporated with $3,000,000 capital stock to take over the property of the Terre Haute Electric Company, capitalized at $1,000,000. The property is owned by the Stone-Webster syndicate of Boston, which takes this course to secure the benefit of laws enacted in recent years favorable to traction companies. This company owns the only electric-light and power plant in Terre Haute. It also has a power station at Brazil, and is building interurban roads to Paris, Ill., and to Clinton.

Simeon Loudenback, James C. Keeler and others have organized and incorporated the Citizens' Electric Light and Fuel Company of Washington, and will construct and operate an electric-light and power plant in Washington. The capital stock is $100,000.

F.

From the Buckeye State.

Cleveland, Ohio, June 6.—M. J. Mandelbaum and H. C. Lang were in Cincinnati a few days ago on a second visit in regard to the Cincinnati, Dayton and Toledo traction line. There seems to be some effort on the part of the Cincinnati stockholders to obtain a greater representation on the board of directors than the Mandelbaum people desire.

The Appleyard syndicate has purchased the controlling interest in the electric-light plant at Urbana. The number of directors was changed from four to nine, and almost all the places were filled by persons in some way interested in the Appleyard properties. The officers are as follows: President, J. S. Harshman; vice-president, C. H. Gansen; treasurer, A. E. Appleyard; secretary, W. R. Pomerine.

The Mansfield Railway, Light and Power Company, Mansfield, has been reorganized in accordance with the wishes of the Cincinnati people, who now own a majority of the stock. Rudolph Kleybolte & Co. are, perhaps, the largest holders of stock. The officers of the company, just elected, are as follows: President, Henry M. Byllesby of Chicago; vice-president, Charles F. Ackerman, Mansfield; treasurer, Reid Carpenter, Mansfield; secretary, W. D. Breed, Cincinnati. About $250,000 will be spent in improvements the coming year.

The new Cleveland Electric Railway Company has adopted the universal transfer system as nearly as possible although no transfers are issued from one line to another running in the same general direction in such a manner that a passenger may make almost a round trip for one fare, as is the case on the Columbus lines.

The organization of the Fort Wayne, Logansport, Lafayette and Lima Traction Company in Indiana is of great interest to the people of Lima, Ohio, who have been interested in getting an east-and-west road at that point. It is said that many of the local people there will retire, now that they feel reasonably sure that the line will be built. The new road will parallel the Pennsylvania for some distance.

Ohio men have incorporated a company to build a road from Toledo to Ann Arbor, Mich. The capital stock will be $1,650,000. Colonel Bonner and J. H. Southard, Toledo; A. H. Jackson and John Clauss, Fremont, and others are interested in it.

The Western Ohio Railway Company's lines have been completed from Wapakoneta to Sidney, making a through line from Lima to Sidney.

The Xenia Light, Heat and Power Company, Xenia, has been incorporated with a capital stock of $1,000 by M. R. Snodgrass, H. N. Schlessinger and others.

Bids for $200,000 worth of municipal electric-light bonds will be opened in Cleveland on June 15th, if the council does not yet kill the ordinance. The plans for a plant have been about completed. The plant will be of the Edison three-wire system, and a sub-station will be erected on the West Side.

O. M. C.

Northwestern Notations.

Minneapolis, June 6.—The Great Northern company has completed an electric-light plant for its ore docks at Allouez Bay, Superior, Wis. The docks are now lighted by 130 lights. The system has a capacity for 200 lights, and cost about $35,000.

The City Council of Atlantic, Iowa, has ordered the joining of the waterworks and electric-light plants, in order to secure power for both plants from the same boilers. The change will cost $12,000.

The local lighting company at Zumbrota, Minn., proposes to raise the rate paid by the village for street lighting from $600 a year to $1,100. The council contemplates returning to gasoline lighting, and may add a small dynamo at the water station to light the business section.

An electric interurban line is projected from Sioux City to Spirit Lake, Iowa, via Hartley, Sheldon, Spencer, Sanborn and other towns. George E. Ward of Sioux City is interested.

It is understood that the company which was recently organized by Minneapolis capitalists to develop waterpower at the cataract on the Escanaba River, near Negaunee, Mich., will offer the city $75,000 for its electric-light plant and pumping station.

A. A. Buck, proprietor of the electric-light plant at Mapleton, Minn., closed his plant down June 1st. Since taking control he has worked to get it on a paying basis, but finds that it is impossible.

F. R. Payne seeks a franchise at Williams, Iowa, for an electric-light plant. The town will vote on the question on June 11th.

The council of Two Harbors, Minn., proposes to install new machinery for the electric-light plant, to cost about $9,000.

The city of Marshalltown, Iowa, will vote on June 22d on granting to the Electric Street and Interurban Railway Company the right to use certain of the city streets.

An electric-light plant is to be installed at Fort Snelling, Minn., by the government during the summer.

The members of the Minnesota State Board of Electrical Examiners want pay for overtime work. The law fixes the compensation at $3 a day for the days that the board is in session. Occasionally the board is in session until late at night, and some of the members have raised the point whether they were not entitled to an extra day's pay when this occurs. The attorney-general holds that the law does not provide for dividing one calendar day to embrace two per-diem allowances.

The differences between the Winona Railway and Lighting Company and the council of Winona, Minn., have been adjusted, and the company's bid of $68 per lamp per year on a 10-year contract for lighting the streets of the city has been accepted. Commercial rates are also reduced.

The long-projected electric line from Green Bay, Wis., to Kaukauna is assured, as a right-of-way has been secured. This gives a connecting link in the continuous line of electric interurban line from Green Bay through the Fox River Valley to Fond du Lac. With other lines this will give a continuous line of 80 miles of electric railway.

The St. Paul City Railway Company has asked the Board of Water Commissioners of St. Paul for a further extension of time in which to submit a proposition of ways and means to prevent the escape of current and the resultant electrolysis. The company's expert is not yet prepared to submit his report of some means to prevent the continuance of damage by electrolysis. The report was to have been submited March 1st, but was deferred until May 1st, and now it is to go over until October.

It is reported that the John U. May Company and the Iowa and Illinois Company, both of which propose an electric interurban line from Clinton to Davenport, Iowa, have consolidated their interests and will construct but one line.

The Cedar Rapids and Iowa City Railway and Light Company of Cedar Rapids, Iowa, has been incorporated with a capital stock of $2,000,000. The company proposes to build electric railway lines radiating from Cedar Rapids.

The village of Zumbrota, Minn., has made a contract with Person & Co. for lighting the village with 40 lights of 32 candlepower each, at 80 cents per light per month, and three arcs at $6 per month each.

It is reported that the packing companies at Sioux City, Iowa, which now control the street-railway system, seek to secure the electric-light and gas system also, proposing to operate all from one plant.

Local capitalists at Mt. Pleasant, Iowa, have taken up the construction of an electric railway to Olds and to Wayne. A franchise will be asked at the next election. Further extensions to Winfield and Wayland would be made later. The name chosen for the company is the Mt. Pleasant, Olds and Winfield Interurban Railway Company.

The Light, Power and Railway Company of Sheboygan, Wis., has let a contract for the foundation work for an extension to its power house. The company is arranging to extend its line to Plymouth, Wis., and will need greater facilities for power.

R.

Canadian Intelligence.

Winnipeg, Manitoba, June 6.—The Winnipeg Electric Railway Company has voluntarily given its motormen and conductors an increase in wages, creating a scale ranging from 17 to 21 cents an hour, according to length of service.

The threatened strike of the Toronto street railway employes has been averted, the company having agreed to arbitrate all the grievances with the men, to advance their wages, and to furnish the conductors and motormen with free uniforms.

The following changes in the staff of the Canadian Pacific Telegraph Company are announced: A. E. Fenton, chief clerk in the general manager's office, is appointed manager at Fort William; M. D. Coons of Calgary is appointed chief clerk in Mr. Jenning's office, and B. U. Stiff of the Swift Current relay station is appointed local manager at Calgary.

The earnings of the London (Ont.) Street Railway Company for 1902 amounted to $154,000, or about $500 a day, an increase over 1901 of $13,000. The following board of directors has been elected: H. A. Everett, C. W. Watson and W. E. Moore of Cleveland; T. H. Smallman, P. W. D. Broderick and W. M. Spencer of London, and H. S. Holt of Montreal.

A contract has been awarded to the Ernest S. Harris Company for supplying the electric machinery at Killarney, Man., for the Killarney Electric Light and Power Company.

H.

Ottawa, Ont., June 6.—The town of Fenelon Falls, Ont., has voted to raise $75,000, and with this money the town will acquire not only a waterpower and electric-light plant but also a roller flour mill. The firm which has been running the mill controlled 500 horsepower. It has been bought out for $35,000, and the town will build a power station at an estimated cost of $25,000.

The private-bills committee of the Ontario Legislature has thrown out the bill to restore the rights given to E. S. Jennison of Chicago for developing the Kakabeka Falls power on the Kaministiquia River. These rights were withdrawn in favor of the Clergue Company. Mr. Clergue has undertaken to produce at least 10,000 electric horsepower ready for delivery by autumn of 1904.

Professor E. S. Wiggins of Ottawa, has devised a light coat of fine copper wire, to be worn outside the ordinary garments by men employed by electric companies. It need not extend below the hips or above the shoulders. A person protected by this wire coat could not, the professor says, be killed by any electric shock, no matter how great.

The city of Sherbrooke, Que., proposes to purchase the electric plant of the Sherbrooke Heat, Light and Power Company. The plant was recently valued by electrical engineers at $121,116, and the City Council decided to make an offer of $150,000 to the company for immediate possession, the difference of $29,000 being compensation for the unexpired portion of the contract with the city. It is not expected that the company will accept the offer, as it values its plant at $190,000, in which event the city will develop its own electric power.

The Montreal Light, Heat and Power Company's

second annual statement has been issued. It shows that the gross earnings of the company for the last year amounted to $1,937,560, and the net profits to $718,667. The company is now supplying all the gas and electricity used in the city of Montreal and surrounding suburbs. W.

West Virginia and Kentucky.

Lexington, Ky., June 6.—It is reported from Louisville that a holding company will be formed to operate the property of the Louisville Railway Company. This company will be made up of the present stockholders, and no outside capital will be invited. The preferred stock will be purchased with new securities, upon some basis to be fixed, and will then be converted to common stock or eliminated. It is estimated that this stock is worth $135 a share.

The council of Newport, Ky., has passed the ordinance providing for the sale of five street-railway routes in that city, and it will go to the Board of Aldermen for their consideration.

A surveying corps is at work on the route of the Williamstown and Moundsville Electric Railway Company between Williamstown and Sisterville, W. Va.

The Ohio Valley Electric Railway Company of Louisville has filed articles of incorporation with the secretary of state. It is stated that the purpose of the company is to build an electric road from Jeffersonville to Madison by way of Charlestown and New Washington, Ind., and another from Jeffersonville to Henryville, Ind. W. H. Hollbrook and E. G. Connette of Syracuse, N. Y., are said to be interested in the company. C.

Among the Rockies.

Butte, Mont., June 6.—The Butte Electric Street Railway has issued its annual statement, showing assets to the amount of $795,796 and $700,000 in liabilities. The capital stock is $1,000,000, of which $10,000 was paid in in money and the remainder in property.

S. F. Fergus will take the management of the Missoula (Mont.) branch of the Butte Electrical Construction Company, which recently purchased the repair and supply department of the Missoula Light and Power Company.

The vote which was taken on the new electric-light franchise at Bozeman, Mont., went strongly in favor of that proposition. Dr. L. S. Hogan, secretary of the newly organized company, states that the machinery has been ordered, and that the plant will be in place and ready for business by September 1st. The franchise has been approved by the City Council.

Some time during the summer the Kimberly Mining Company will build an electric plant on the stream below its mines at Bear Gulch, Park County, Mont., and will put in a motor of sufficient capacity to generate a current strong enough to operate the hoisting machinery at the mines and also furnish lights for the works, mill and cyanide plant. H.

Salt Lake, June 5.—An adjustment has been reached between the strikers of the Utah Light and Power Company of Salt Lake City, Utah, and the management. The power company merely agreed to consider the strikers' demands for a new scale of wages and a recognition of the union.

An electric road is to be constructed shortly in Grand County, Utah. The scheme is being promoted by Portland (Ore.) capitalists, and the project will involve the expenditure of a large amount of money. The power for the plant will be generated at the Grand County Falls, and the prospective line will traverse a rich mineral district. G.

On the Pacific Slope.

Seattle, Wash., June 4.—J. J. Henry of Denver, Colo., is in Salem, Ore., and it is reported that he has bought the Salem Light, Power and Traction Company, worth all the way from $150,000 to $200,000.

The Northwestern Light and Power Company of Spokane, Wash., will soon be incorporated with a capital stock of $1,200,000. The chief backers are Cyrus Pierce & Co. of Philadelphia and other eastern capitalists, among them being Mr. Boyle of Pittsburg and I. W. Anderson, who recently secured control of nearly all of the stock of the Spokane Falls Gas Light Company.

One of the most important contracts which has been made in the West in recent years for the utilization of electric power has been entered into between the Great Northern Railway Company and the Seattle Cataract Company for furnishing all power required in the construction in the railway tunnel, which is about to be constructed under the city of Seattle.

The Sanger Consolidated mines in Baker County, Ore., will install an electric-light and power plant on East Eagle Creek to generate power for the mine.

An engineering corps, headed by G. E. Howe, is near Prairie City, Ore., for the purpose of locating an electric-railway line from that section to Baker City, a distance of 60 miles.

The Great Eastern Power and Light Company of Sumpter, Ore., has completed its plans for the first plant to be installed at the head of the J. Day Valley, about 30 miles from Sumpter. This plant will generate about 200 horsepower. The promoters of the organization are R. H. Kemp and W. A. McNaughton.

Baker City, Ore., is in darkness, as far as electric illumination is concerned, as the result of the complete destruction by fire of the gas and electric company's plant. The loss to the company was between $25,000 and $30,000, and there was only $10,000 insurance on the property. The manager states that the plant will be reinstalled at the earliest possible date. P.

PERSONAL.

Arthur Leroy Cook, assistant instructor in electrical engineering at the Worcester Polytechnic Institute, has accepted a position with Westinghouse, Church, Kerr & Co.

Ellis E. Brown, chief electrical engineer of the Philadelphia and Reading Railway system is to receive the degree of electrical engineer at the Worcester Polytechnic Institute this spring. He graduated from that institution with the degree of B. S. and from the Massachusetts Institute of Technology, where he received the master's degree, in 1899.

Elwin C. Foster, general manager of the Old Colony and Boston and Northern Street Railway Companies, has decided to accept the position of general manager of the New Orleans Railways Company which controls the electric railways in New Orleans, La. Robert S. Goff, general superintendent of the Old Colony Street Railway Company, will succeed Mr. Foster as general manager of the two grand divisions of the Massachusetts electric companies.

ELECTRIC LIGHTING.

The City Council of Sheboygan, Wis., is considering the installation of a municipal electric-light plant for street and commercial lighting, in conjunction with new waterworks system. Jacob Cloos of Milwaukee is the consulting engineer.

Stockholders of the Chicago Edison Company at their annual meeting on June 8th authorized an increase in their capital stock from $10,000,000 to $15,000,000. It is not expected that any portion of the authorized issue will be put out before next year. There are two quarterly installments of the $2,276,210 authorized at the beginning of the year to be paid in. The board of directors had recommended the increase just voted. The old board of directors was re-elected.

The United Gas Improvement Company has acquired an interest in gas and electric companies in Delaware, Montgomery and Chester Counties, Pennsylvania, and will merge all the companies under the name of the Merion and Radnor Gas and Electric Company, with a capital of $1,000,000. Samuel T. Bodine, second vice-president of the United Gas Improvement Company, is to be president of the new company, which is to be subsidiary to the present corporation. The United Gas Improvement owns the gas and electric companies at Ardmore, Haverford, Bryn Mawr, Rosemont, Villanova, Wynnewood, Llanerich and Narberth, Pa.

ELECTRIC RAILWAYS.

Titus Brothers of Steward, Ill., and Shaw Brothers of Dixon, Ill., are interested in a company which has been incorporated for the purpose of constructing an electric railway covering—in prospectus—a distance of 650 miles. The plan is to build a main line from DeKalb to Rock Island, Ill., and then to branch out until the line reaches Cairo on the south and Chicago on the east. The head office will be at Dixon and the power house is to be located in Rock Falls.

Another attempt is being made by the Chicago, Milwaukee Avenue and Inland Lakes Traction Company to secure a franchise to build a street railway from Jefferson Park, Chicago, along Milwaukee Avenue, to Fox Lake, Ill. The highway commissioners of three towns have given the road permission for a right-of-way, but the commissioners of Northfield Township, through which the road would pass, refuse their permission on the ground that they don't want the road to carry freight. The franchise asked for is for 20 years, and gives the road the right to sell heat, power and electric light and to run freight trains between the hours of 11 p. m. and six a. m.

The fight which has been going on at Crawfordsville, Ind., between the Indianapolis and Northwestern Traction Company, the Consolidated Traction Company and the city has finally been carried to the courts. It seems that the city granted a franchise to the Northwestern company, which company complied with all the requirements of the ordinance and subsequently the franchise was revoked and a similar one granted the Consolidated company. The legal phase of the question is whether a city council can revoke a franchise once granted, the provisions of which have been thoroughly complied with. Public sentiment seems to be with the former company and the court's decision is anticipated with interest.

SOCIETIES AND SCHOOLS

The National Electrical Contractors' Association will meet in Detroit July 14th, 15th and 16th, and 500 members are expected to be present. Hotel accommodations have been reserved for that number. The majority of the officers will be quartered at the Russell House. The Hotel Cadillac has made reservations for over 200 members.

Professor Samuel Sheldon has declined a renomination as president of the New York Electrical Society, believing in a one-term rule. The following ticket has been nominated for the season 1903-'04: For president, J. J. Carty; for vice-presidents, N. I. Donshea (for re-election), Hobart D. Betts (for re-election), W. S. Barstow (for re-election), Douglas Burnett, F. C. Bates, H. C. Townsend; for secretary, George H. Guy; for treasurer, Henry A. Sinclair.

POWER TRANSMISSION.

At the annual meeting of the stockholders of the Niagara Falls Power Company and its allied companies, the following-named directors for the power company were elected: Edward D. Adams, John Jacob Astor, George S. Bowdoin, Charles F. Clark, Charles Lanier, Joseph Larocque, Darius O. Mills, Victor Morawitz, Daniel O'Day, William B. Rankine, Francis Lynde Stetson, F. W. Whitridge, Edward A. Wickes. With the exception of Messrs. Morawitz and O'Day, the same list of directors was elected for the allied companies. The board of directors later organized by electing the following-named officers: President, Darius O. Mills; first vice-president, Edward A. Wickes; second vice-president and treasurer, William B. Rankine; secretary, Frederick L. Lovelace; assistant secretary and assistant treasurer, W. Paxton Little.

TELEGRAPH.

The Commercial Telegraphers' Union, which was organized in Chicago in June, 1902, and has since established branches in six other cities, will hold its first national convention in New York, on June 16th. Two hundred Western Union telegraph operators in Chicago, who, through fear of losing their positions, have heretofore concealed their membership in the union, publicly announced themselves as affiliated with the organization at a recent meeting of the local body.

PUBLICATIONS.

Bulletin No. 78, published by the Electric Storage Battery Company of Philadelphia, mentions the installation of Chloride accumulators in the stations of the Edison companies in New York, Chicago, Brooklyn and Boston. The number of Chloride accumulators now in operation or contracted for in central lighting stations is given as 86, with an aggregate capacity of 841,000 ampere-hours.

The Lundell fan catalogue of the Sprague Electric Company for 1903 is an attractive and useful publication. The Lundell fans are very well known, being, it is asserted, the very first practical machines of this type to be placed on the market. The present catalogue gives data and prices of various sizes and types of desk, bracket, ceiling and exhaust fans electrically operated. A price list of parts and a telegraph code add to the value of the pamphlet for fan buyers.

The latest catalogue of the Thomas S. Clarkson Memorial School of Technology of Potsdam, N. Y., is a book of 51 pages, and is very complete, giving a history of the institution, list of students, officers, trustees etc., and full information concerning the courses, expenses, rules, etc. A summer session will be begun on July 8th, extending for six weeks. Courses are offered in mathematics, physics, chemistry, electricity, electrical engineering and domestic science and economy. William S. Aldrich is the director of the school.

MISCELLANEOUS.

A fireman in an electric power house at Windsor, Canada, has been in the habit during the night of lying upon a wide belt attached to a pulley near the floor. While in this position recently he fell asleep. Some derangement of the machinery caused the belt to be started suddenly and the man was dragged feet first, between the belt and the pulley. He was shockingly hurt and died in a few hours.

A modification of an old scheme for sounding an electric alarm in case of a store "hold-up" has been devised by L. D. Green of Chicago. It consists of a chain running continuously behind and under the counter of a store where it can be reached with the foot at any point, even though the hands may be held up. A light pressure sets a gong ringing. The gong and its actuating magnet are inclosed in a perforated octagon box made of light iron casting which is fastened over and outside the door. There is also a small circular disc which may be placed in the ice box, enabling one imprisoned there to communicate with the outside world.

TRADE NEWS.

The Buffalo Steam Pump Company, whose works are at North Tonawanda, N. Y., has been purchased by William F. and Henry W. Wendt, who are also owners of the Buffalo Forge Company and the George L. Squier Manufacturing Company. The North Tonawanda works of the Steam Pump com-

pany are to be continued as heretofore, and the main offices will be in Buffalo.

Francis Granger of New York city has found it necessary to remove from his suite in the Havemeyer Building to larger quarters on the floor above. One of the prominent specialties for which Mr. Granger is the New York agent is the Sterling lamp, made by the Sterling Electrical Manufacturing Company of Warren, Ohio.

Sealed proposals will be received until 3 p. m. on July 8th, for the construction (including plumbing, heating apparatus, electric conduits and wiring) of the extension of the United States courthouse, postoffice, etc., at Waco, Texas, in accordance with the drawings and specifications, copies of which may be had at the office of the custodian at Waco, Texas, or of James Knox Taylor, supervising architect, Treasury Department, Washington, D. C.

The Employers' Association of Niagara Falls, N. Y., has been organized. Arthur C. Hastings is president; S. P. Franchot, manager of the National Electrolytic Company, is vice-president, and Clarence I. Collins is treasurer. A secretary, to have charge of permanent quarters, will soon be selected. In the organization of this association the employers of labor at Niagara Falls seek to avoid, or, at least, satisfactorily adjust, differences which now and then arise between them and the persons in their employment. The concerns represented in the organization comprise both power companies and the employers of labor numbering between 3,000 and 4,000 employes.

It is reported from Berlin, Germany, that one of the obstacles to the union of the General Electric and Allgemeine Elektricitaets Companies is that neither C. A. Coffin of the General Electric Company nor President Rathenau of the Allgemeine concern is willing to give up command. Both these men are strong personalities. A recent meeting resulted in Herr Rathenau giving way and in the Allgemeine agreeing to consider the plan for a certain identification of interests.

BUSINESS.

The Ontario agency of the Metaphone Company, 16 Yonge Street Arcade, Toronto, desires to secure agencies for all kinds of electrical novelties and supplies.

The National Carbon Company has just completed a very thorough canvass of all central lighting stations in the United States in towns having population of 10,000 or more, and the result, with regard to the use of its Columbia enclosed-arc carbons, is striking. It appears that 440 of these plants out of a possible 486, are burning Columbia carbons exclusively. This, of course, does not include the thousands of smaller central and private stations, which are quite generally using Columbia carbons and which are now being canvassed by the company in order to get absolute facts. This remarkable record speaks eloquently of the company's product and business methods.

The E. J. Noblett Company, 898-902 Thirty-fifth Street, Chicago, manufacturer of electrical woodwork, etc., is making a specialty of special insulator pins for high-voltage transmission lines. The Noblett company is one of the leading producers of insulator pins, cross-arms and brackets, and supplies many of the largest consumers in the United States.

The extent of the large Corliss-engine business conducted by the Westinghouse Machine Company, through Westinghouse, Church, Kerr & Co., is well brought out by the fact that within the short period, less than five years during which the Westinghouse Machine Company has taken up the manufacture of large Corliss engines, a total of over 160,000 horsepower in engines has been sold, comprising four distinct types—vertical three-cylinder compound, vertical cross-compound, horizontal cross-compound and horizontal tandem-compound. The equipments now in service include such plants as the New York Edison, Brooklyn Edison, Third Avenue Railway, in New York, Boston elevated railway, etc.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 2, 1903.

729,523. Safety Guard for Trolley Wires at Railroad Crossings. Charles D. Austin, Amsterdam, N. Y. Application filed April 10, 1903.

An inverted trough-shaped safety guard is suspended parallel with the trolley wire at the crossing and has depending electrically conducting sides in electrical connection with the trolley wire to receive the current therefrom and transmit it to the trolley wheel in the event of the latter leaving the wire.

729,550. Battery Jar. George H. Condict, New York, N. Y., assignor to the Electric Vehicle Company, Jersey City, N. J., and New York, N. Y. Application filed December 16, 1898.

The jar which is rectangular and of uniform internal dimensions is constructed of insulating material and is adapted to contain an electrolyte. Its upper portion is tapered upon the outside so as to reduce the thickness and separate the edges of the jar from an adjacent body or bodies to allow escaping liquid to recede therefrom.

729,560. Signaling Jack for Multiple-telephone Exchanges. Lars M. Ericsson, Stockholm, Sweden, assignor to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. Application filed February 12, 1901.

This is a signaling device for indicating the engagement of a subscriber's line the moment the call is made. The device is adapted to cut out the signaling electromagnet by the movement of a spring-actuated slide having two arms carrying two insulating contacts so arranged as to make or break contact between two sets of springs. (See cut.)

729,614. Process of Treating Materials by Radiated Heat in Electric Furnaces. Carl G. P. de Laval, Stockholm, Sweden. Application filed March 19, 1902.

By this process of treating the material is so introduced into the electric-furnace chamber as to form a stack having its sloping side facing the source of heat, and controlling the temperature at the side, and the consequent rate of consumption of material, by mechanically decreasing the distance between the side and the source of heat.

729,620. Trolley Stand. William Magner, Lockport, N. Y. Application filed November 6, 1902.

The combination consists of a car-roof and a track comprising a pair of longitudinal rails mounted thereon, each of the rails consisting of an upright body portion having lower and upper webs extending outwardly therefrom and vertical flanges extending upwardly and downwardly from the webs.

729,640. Brake for Elevators. John P. McCurdy, Chicago, Ill., assignor to the J. W. Reedy Elevator Manufacturing Company, Chicago, Ill. Application filed June 9, 1902.

To the shaft of a motor, which is used in operating the elevator, is connected an electromagnetic brake which can be applied by means of current induced in the armature coils of the motor by the momentum of the armature when the circuit for operating the motor is opened.

729,655. Winding of Revolving Magnets. Charles A. Parsons, Newcastle-upon-Tyne, England. Application filed October 7, 1902.

In dynamo-electric machines having revolving field magnets are arranged bridge pieces of non-magnetic material fitted between the poles of the magnet to carry the windings. The bridge pieces are perforated with holes suitable for the winding to pass through and have further perforations for the purpose of ventilation.

729,657. Trolley Catcher. William E. Pettee, Newton, Mass.; Clara M. Pettee, adminisratrix of said William E. Pettee, deceased. Application filed February 21, 1901.

The device consists of a pole-catching mechanism adapted to be set in operation by a sudden pull upon the trolley cord and serving to pull down on the pole when the wheel jumps the trolley wire.

729,662. Electric Ignition Generator. Benjamin P. Remy, Anderson, Ind., assignor to the Remy Electric Company, Anderson, Ind. Application filed April 17, 1902.

The device described is for automatically maintaining a dynamo or magneto machine in proper relation to the driving mechanism.

729,664. Electric Motor. Edgar G. Richards, Madison, Wis., assignor to the Northern Electrical Manufacturing Company, Madison, Wis. Application filed June 30, 1897.

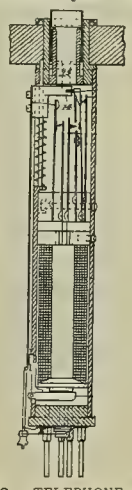
A self-contained electric motor having a countershaft geared to its armature shaft, and means for angularly shifting the countershaft to different positions around the armature shaft is described.

729,703. Means for Indicating the Impact of Bodies at a Distance. Juan Urrutia y Motta, Getafe, near Madrid, Spain. Application filed October 28, 1901.

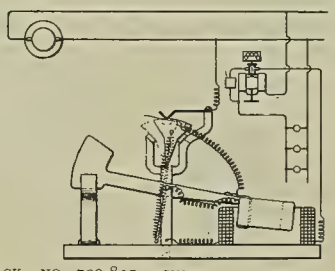
An oscillatory target-plate is adapted to vibrate back and forth when struck, and to return to its normal position. Means are adjustably located in the path of oscillation adapted to produce a temporary contact when the plate abuts thereon, an indicator being operated by the temporary contact.

729,709. Loaded Electric Circuit. Howard S. Warren, Everett, and George A. Campbell, Newton, Mass., assignors to the American Telephone and Telegraph Company. Application filed March 19, 1902.

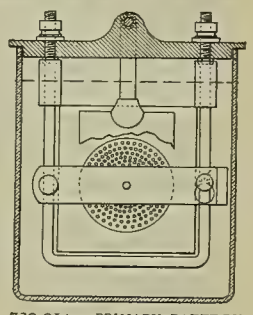
One claim reads: A localized or station taper for loaded electric circuits comprises a series of gradually varying impedance elements composed of inductance coils and condensers adapted to be interposed in the circuit between the loaded line portion thereof and the station instruments.



NO. 729,560.—TELEPHONE SIGNALING JACK.



NO. 729,811.—SYSTEM OF METERING



NO. 730,014.—PRIMARY BATTERY.

729,716. Means for Electrically Operating Countershafts. Norman C. Bassett, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1902.

In combination with an electric motor are a countershaft, a driving-pulley on the shaft provided with two concentric faces and a pinion on the motor-shaft adapted to engage with the faces. A rocking frame in which the countershaft is journaled has an arm on the frame, and springs for holding the arm normally in a central position. Two solenoids having a common axis are connected in series multiple with the motor, and a rod carrying the armatures for the solenoids is connected with the arm. Means are provided for causing the line current to pass through one or the other of the solenoids at will, whereby the direction of rotation of the countershaft can be reversed without reversing the motor.

729,729. Fusible Electric Cut-out. William P. Burke, Fethard, Ireland. Application filed February 24, 1903.

By this system are employed an insulating casing, two plugs adapted to slide in the casing, two tensional springs connected respectively to the plugs, a bridge piece, a fuse wire passing over the bridge piece, and means connecting the ends of the fuse wire to the plugs.

729,730. Incandescent Lamp. William R. Burrows, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 30, 1901.

Means for preserving the seal of an incandescent electric lamp are provided. Heat radiators of large superficial area compared to the leading-in wires surround each wire at a point below the filament joint and near the seal.

729,734. Braking System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 18, 1901.

In an electric braking system for a car or vehicle are arranged electrically actuated brakes at each end of the car, and a controller for supplying current to actuate the brakes. The controller is constructed and arranged to supply a larger current to the actuating winding of the brake at the front end of the car than to the corresponding winding of the brake at the rear end.

729,744. Snap Switch. Frank L. Fenn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 1, 1902.

The mechanism described consists of a stationary rack, a switch-blade and supporting means for the blade, a latch lever or levers connected to the supporting means, and adapted to engage the rack. An actuating spindle, a spring connecting the spindle and the supporting means, and a lever connected to the latch lever or levers and adapted to be actuated by the spindle are provided.

729,748. Alternating-current Transformer. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 2, 1903.

In this transformer are combined a core having a single magnetic circuit and sets of coils located on the core at a distance from each other. Each set of coils consists of three coils located one over the other, the middle one being adapted to a voltage which is a multiple of that for which the corresponding inside and outside coils are adapted. There are connections between all of the coils.

729,753. Subaqueous Magnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed January 10, 1901. Renewed November 5, 1902.

Description is given of a subaqueous magnetic separator provided with an electromagnet, the coil of which is encased in a water-tight jacket through which passes the magnet core. The magnet core has a covering plate.

729,762. Starting Rheostat. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 8, 1902.

The combination is for use with a switch having a retaining magnet, and consists of a thermostat whose temperature varies with the current, and a shunt around the magnet controlled by the thermostat.

729,771. Electric Heater. Thomas J. Johnston, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1899.

In this system of electric heating are a number of separate heaters, each containing coils of different current capacities. A switch is arranged to connect both heaters and coils in parallel or series to obtain various heating effects.

729,772. Push-button Switch. Edwin G. Kastenhuber, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 3, 1902.

A push-botton movable parallel to the axis of a rotary contact member is provided with means to transform the

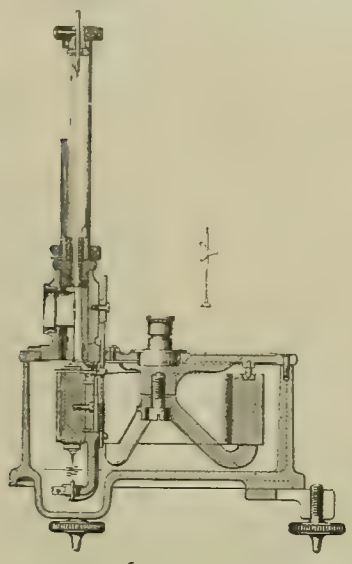
rectilinear motion of the button into rotary motion to move the contact member. A ratchet is arranged to permit a return rectilinear movement of the button without causing a corresponding movement of the contact member.

729,778. System of Electrical Distribution. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 18, 1899.

Three transformer windings are supplied with means for generating electromotive forces of the same phase in two of the windings and means for generating in the other winding an electromotive force bearing a quarter-phase relation to the electromotive forces in the first two windings. A six-phase alternating-current dynamo-electric machine is supplied with current from the windings.

729,795. Regulating Dynamo-electric Machines. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 24, 1902.

An alternator and a synchronously driven exciter are provided with means for conveying to the armature of the exciter a part of the current of the alternator. Means responsive to variations in speed of the alternator are also provided for causing a variation in phase of the current thus conveyed to the exciter relatively to the main current of the alternator.



NO. 730,061.—GALVANOMETER.

729,801. Telephone-exchange System. Charles B. Smith, New York, N. Y. Application filed June 25, 1901.

A telephone exchange system having a relay on one side of each of the subscribers' lines and jacks connected with the other side of the lines is described. A local circuit is controlled by the corresponding relay and includes a signaling instrument and contacts controlled by the springs of the jacks.

729,811. System of Electric Metering. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 21, 1898.

A consumption circuit, a meter-motor controlled thereby, and an electrically operated current-interrupter controlling the meter-motor and closing it at regularly recurring intervals during operation of a translating device in the consumption circuit are included in this system. (See cut on preceding page.)

729,812. System of Electrical Distribution. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 5, 1902.

In combination with constant-potential alternating-current supply mains is a series circuit adapted to contain a variable number of translating devices and a device of variable inductance through the instrumentality of which energy derived from the supply mains is utilized in the series circuit in the form of an electric current of substantially constant value.

729,826. Overhead Structure for Electric Railways. Ben Willard, New Orleans, La., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 25, 1899.

One claim reads: In combination with a supporting ear for the conducting wire are a fixed insulator and a ball-and-socket joint between the ear and the insulator.

729,827. Battery. David H. Wilson, Chicago, Ill. Application filed April 30, 1902.

An electrode for electric batteries comprising two cups or receptacles integral with each other and separated by a suitable space is described. An inner cup is surrounded by a complete free space and makes contact with the outer cup only at the bottom. Both of the cups have a comparatively smooth unbroken surface, so that they hold the liquid of the battery.

729,828. Lamp Receptacle. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 19, 1900.

The device comprises a base having transverse grooves and terminals lying across the grooves. A screw-threaded sheet-metal lamp-socket having flanges lies between one of the terminals and the base. A removable cover encircles the socket and extends over the grooves.

729,833. Solution for Primary Batteries. Harry S. Ammake, Camden, N. J. Application filed May 22, 1900.

In a primary electric battery of the porous-diaphragm type, an electrolyte on one side of the diaphragm comprising seven parts of sodium hydrate and 10 parts of water and an electrolyte on the other side of the diaphragm comprising five parts of sodium bichromate, nine parts of sulphuric acid and 10 parts of water.

729,857. Incandescent Electric-lamp Holder. Samuel S. Garvin, Austin, Ill., assignor to Marcus Phillips, Chicago, Ill. Application filed July 9, 1902.

The holder comprises a metal socket, contacts to which the conducting wires lead, and a combined shade, socket-covering sleeve and cap formed of glass in one piece.

729,862. Electric Heater. Joseph F. Hewitt and Charles W. Spatig, Allegheny, Pa. Application filed December 30, 1901.

An electric heater is described.

729,878. Brush-holder and Brush for Dynamo-electric Machines. Robert Lundell, New York, N. Y. Application filed November 26, 1902.

A brush-holder having two sets of brushes of different resistance located after one another on the periphery of a commutator is described. Means are provided for pressing the brushes against the commutator and against the main supporting portion of the holder, the main supporting portion being located between the brushes.

729,879. Field Magnet for Dynamo-electric Machines or Electric Motors. Robert Lundell, New York, N. Y. Application filed December 26, 1902.

A description is given of a dynamo-electric machine or electric motor having a laminated yoke and laminated pole-pieces held in contact therewith by means exterior to the laminations of the yoke.

729,882. Electric Traction. Auguste Mégroz, Clarens, Switzerland. Application filed November 25, 1902.

In this system is a current-supplying conduit laid above the surface of the roadway, the conduit consisting essentially of two parallel metal-feeding conductors and an insulating covering on and extending the entire length of each of the conductors. The insulating material covers only the upper and outer exposed surfaces of the conductor and leaves the inner surface of the latter bare or naked for contact with the current-collecting device, whereby the attendants of the railway and others are protected by the covering from contact with the conductor.

729,906. Electric Lamp. George Stein, New York, N. Y. Application filed August 12, 1902.

Two tubular metal sections are arranged with a lamp removably placed in one of the sections, and a metal tube in the section in which the lamp is arranged. A pin extends from one pole of the lamp filament into the tube and a pin or rod is arranged in the other section and is adapted to removably engage in the tube. Electrical connections are made with the rod and the section containing the lamp.

729,952. Electric Burglar Alarm for Vaults, Safes or the Like. Charles O. Miller, Estherville, Iowa. Application filed March 29, 1902.

In a burglar alarm for vaults and the like are combined an electric circuit including a gong on the outside of the vault, a compressed-air jacket for the vault, and a shield for the gong. A valve controls an escape-vent in the jacket, and an arm is carried by the shield. A stem on the valve is arranged to be engaged by the arm in the outward movement of the shield.

729,957. Trolley. Miles McBride, Braddock, Pa. Application filed April 3, 1903.

A trolley connection for electric vehicles is combined with a trolley wire mounted on insulated supports whereby the upper side of the wire presents an even and uniform surface. Mounted on either side of the trolley-pole and on suitable pivots are two trolley wheels. The pole has a downward tendency, whereby one or the other of the wheels is caused to be in positive contact with the trolley wire.

730,013. Means for Starting Electromotors with Rotating Fields. Paul J. M. Girault, Paris, France. Application filed August 26, 1901.

A system whereby a sufficient starting torque is produced in the motor without introducing resistances in the armature and without the use of currents of exaggerated intensity is described.

730,014. Primary Battery. James W. Gladstone, West Orange, N. J. Application filed December 17, 1902.

In combination with an oxide plate electrode is a sustaining frame or hanger consisting of vertical rods or bars rigidly and permanently united at their bottom to form a U-shaped frame or hanger. A hinged clamping bar or cross-piece is mounted on one of the vertical rods or bars and is adapted to bear against one of the plane or flat surfaces of the plate. (See cut on preceding page.)

730,056. Sparking Igniter for Explosive Engines. Charles A. Stickney, St. Paul, Minn. Application filed April 11, 1900.

This igniter comprises a cylinder having a recess in one of its walls, and a rock-shaft extending into the recess carrying a terminal arm. A fixed insulated terminal bolt extends into the recess. A spring is arranged for closing the terminals, and an auxiliary spring plunger impinges against a lever carried by the rock-shaft to hold the terminals normally apart. A spring trip carried by a rod is adapted to depress the spring plunger as it is revolved forward by the rod and to spring from engagement with the plunger when reversed.

730,058. Conductor. George E. Tinker, New York, N. Y. Application filed January 9, 1903.

In a third-rail system a support is provided for a number of transversely disposed brackets, each of the brackets having an opening in one of its vertical walls, the opening being in alinement with each other. A conductor passes through the brackets and a non-conducting sheathing incloses the brackets and forms a complete tube which is split longitudinally in registry with the openings in the sides of the brakets.

730,061. Reflecting Galvanometer. Edward Weston, Newark, N. J. Application filed July 9, 1902.

The field-magnet is secured directly to the lid or cover of the instrument and in a fixed or definite relation thereto. A detachable "movement" consists of a suspended mirror and coil and a magnetizable core and supports therefor, so secured in the lid or cover that the axes of the magnetizable core, the movable coil and the support for the latter are coincident when the instrument is leveled. (See cut.)

730,069. Electric Lamp. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 28, 1901.

A cut-out for electric-lamp heaters is described and comprises a substantially vertical magnet, a non-conducting slotted bar supported thereby and a circuit-making and-breaking armature loosely suspended from the slotted bar and provided at its lower end with a contact piece having a universal-joint connection therewith.

730,098. Electric Self-playing Piano Attachment. George H. Davis, New York, N. Y. Application filed December 23, 1898.

This sound-actuating device consists of a number of solenoids and a cross-beam provided with means for supporting and embracing the coils of the solenoids throughout their length. A weighted iron core is movable in each solenoid, the action of the solenoid moving the core in opposition to the weight of the core. Means are attached to each core for operating the sound-actuating devices. Contact-making-and-breaking devices are in circuit with the solenoids.

730,101. Vocal Guard for Telephones. William J. Dunihue, Jamestown, N. Y., assignor of two-thirds to Wallace B. Curtis, Jamestown, N. Y., and Jay C. D. Curtiss, Rochester, N. Y. Application filed June 9, 1902.

A voice guard for use with telephones consisting of a flaring hollow body distinct from the telephone to be held against the face, the body being adapted to have its small end passed over and inclose the mouthpiece of the telephone. A sound-muffling ring is interposed between the small end and the mouthpiece and a diaphragm of non-conducted material is carried by the small end to embrace the mouthpiece.

730,108. Method of Starting and Regulating the Speed of Induction Motors. Paul J. M. Girault, Paris, France. Application filed October 3, 1901.

The method of starting and regulating the speed of induction motors is made up of a number of component motors having polyphase induced-field windings connected in series. The inducing field of only one of the component motors is supplied with current at the moment of starting, the inducing field of the other component motor being at such time in an open circuit. The inducing field is so arranged as to exercise on the common induced circuits a concordant action when the motor is working at its normal speed, and afterward, as the speed of the motor increases, increasing the excitation of the inducing field of the second component motor from zero to its normal value.

730,116. Trolley Pole. George W. Hamilton, Philadelphia, Pa., assignor to Burnham, Williams & Co., Philadelphia, Pa. Application filed March 23, 1903.

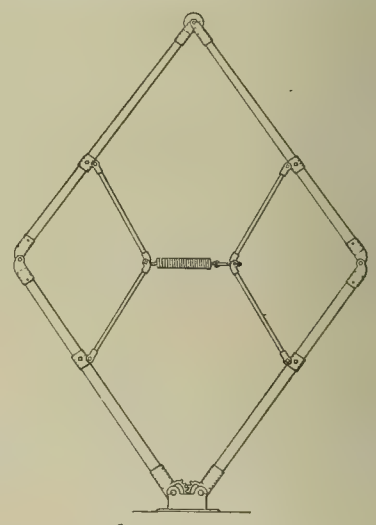
A jointed trolley pole having two sets of arms pivoted together, two sets of links connected to the arms, and a spring connecting the two sets of links. (See cut.)

730,181. Electric Automatic Overflow Alarm. Robert J. Walker, Holland, Mich. Application filed May 21, 1902.

An electric automatic overflow alarm for use on tanks and the like is patented.

730,211. Lightning Arrester for Electrical Plants. Georg Honsberg, Nuremberg, Germany, assignor to Elektricitäts-Aktiengesellschaft, formerly Schuckert & Co., Nuremberg, Germany. Application filed December 16, 1902.

This arrester has two conducting electrodes and one or more porous intervening cylinders filled with a conducting liquid. The surfaces of the electrodes and the intervening cylinder or cylinders are out of mechanical contact with each other so as to constitute air-gaps.



NO. 730,116.—JOINTED TROLLEY POLE.

730,214. Transformer. Maurice Leblanc, Paris, France. Application filed January 4, 1901.

By the method described a body of magnetic material subjected to periodic magnetomotive forces tending to produce a complex rotary magnetic flux is provided with a magnetic shield against a component or components of such flux.

730,215. Method of Shaping Rotary Fluxes and Operating Transformers. Maurice Leblanc, Paris, France, assignor to George Westinghouse, Pittsburg, Pa. Original application filed January 4, 1901. Divided and this application filed April 5, 1902.

Various methods of shaping rotary complex magnetic fluxes by suppressing a predetermined component or components of the same are described.

730,216. Electric Lamp. Henry N. Potter, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 27, 1900.

This is a Nernst lamp patent. An automatic heater cut-out has a pivoted circuit-making-and-breaking member and a spring that bears against the member in each of its positions and thus prevents vibrations.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXII. CHICAGO, JUNE 20, 1903 No. 25

Seattle Independent Telephone Company.

By J. I. Dieringer.

June, 1901, marked the birth of the Independent telephone movement in the city of Seattle, Wash. The company, known as the Independent Telephone Company at that time, started constructing its plant, this being done so quietly that very few of the citizens realized the magnitude of its work, which, as it stands to-day, is superior in many respects to any system ever built in a city the size of Seattle.

The main building and offices of the company are located on Fourth Avenue, between Spring and Seneca Streets. The edifice is fireproof, and is constructed on scientific principles. It was the first structure of its class to be built on the North Pacific Coast. The walls are of stone and brick, with floors of expanded metal and concrete, as are also the partition walls, which are on steel channels plastered with cement. The only wood used in the entire building is for a light seven-eighths-inch flooring on top of the concrete, and for the door-frames and window sills.

The two sub-exchanges, situated at Twentieth Avenue and Columbia Street and First and Mercer Streets North, are duplicates in miniature of the main exchange, and may be operated as independent plants. By this arrangement it will be noted that nothing short of the destruction of the entire plant could put the patrons of the company entirely out of the service.

At the outset the company's plant was rather a primitive affair, being equipped with a now obsolete type of switchboard. This was a 360-line board with transfer trunks and a very small power plant. During this stage the number of subscribers at no time exceeded 350, but nevertheless the service was entirely acceptable. The actual beginning of the company's growth was coincident with the installation of the Stromberg-Carlson Telephone Manufacturing Company's full multiple-line, lamp-signal, common-battery board. Thirty men have been engaged in the setting up of this board since April, 1902.

The power plant embraces two sets of Roth Brothers' machines for charging batteries. The motors are of the most modern type, turning at 950 revolutions per minute, wound for 220 volts and of 17-horsepower capacity. The dynamos have a capacity of 200 amperes at 60 volts. The power ringer runs at 1,200 revolutions per minute on the 220-volt direct current. There is also a battery ringer running on a 40-volt circuit from the storage battery. In addition, there are two sets of Chloride accumulators with a 750-ampere-hour discharge rate. The power switches and apparatus for operating the plant are all mounted on a marble switchboard, presenting a fine appearance. Everything on the exchange is fused on this board, in addition to being fused at various points of convenience on racks.

The main terminal rack is provided with the latest type Sterling arresters for 4,000 lines' capacity. All lines are fused at the relay rack in strips of 20, in order to preclude the possibility of more than that number of lines being out of service at any one time, and also to render less difficult the task of locating trouble on dead lines, one-ampere fuses being employed.

All the battery leads are composed of No. 20 Okonite wire run in separate cables, so as to obviate serious difficulty in the event of burnouts. All jumpers on the intermediate rack are run straight, in order to bring the lines in in their proper positions, thus simplifying the operators' work, and enabling them to render satisfactory service.

The switchboard consists of 16 sections of highly finished solid oak, with steel frames, having an ultimate capacity of 10,000 lines when completed and equipped. Each section embodies three operative positions. At present there are 40 main-line positions in service, together with eight trunk positions.

These positions are fully equipped with 15 pairs of cords, each having double supervising lamp signals and selective ringing keys, also order wires to sub-stations and several interior points, as monitor's desk, chief operator, trouble clerk, information bureau and general manager. All the positions have a selective ringing key for ringing four-party lines, this being the maximum number of subscribers on any one line. There is capacity for six trunk positions, of which two are fully equipped with 24 incoming trunk lines each. All cords are provided with the requisite apparatus for securing a busy line, so that double connections are not among the probabilities.

The Twentieth Avenue sub-exchange is a story-and-a-half building, and has a three-section board of the same design as the main switchboard, with 3,100 capacity, of which 1,000 lines are already in operation, together with 24 trunk lines. The Queen Anne exchange has a capacity of 3,000 lines, with 600 now in service, aside from 24 trunk lines.

The whole system was, originally, somewhat of an experiment. But the men behind it have abundant capital. Now that proper support has been given

SEATTLE INDEPENDENT TELEPHONE EXCHANGE.—MAIN SWITCHBOARD.

them, they are proceeding to install a system which will be at least the equal of the telephone-exchange apparatus of any city in the United States of or near the size of Seattle.

Telephone competition in Seattle is very spirited, but it cannot be said that either the Bell or the Independent company is making very radical concessions or wide departure from established rates. The Independent company has laid special stress, to date, on the local business, and has not given equal attention to long-distance affairs. Now that a substantial footing has been gained, the need for an out-of-town connection is becoming more and more apparent with the growing clientele. The construction of circuits to the following-named places is now under consideration: Port Townsend, Whatcom, Everett, Ballard, Green Lake, West Seattle (for which there has already been ordered a three-mile, 50-pair submarine cable), and Tacoma, all of which will have the best apparatus which the market affords. Subsequently the lines will extend to Portland and intermediate towns. A 60-line toll board has been ordered, and is now under construction in Chicago. It will probably go forward within the ensuing 60 days. This will be sufficient to conduct all the business growing out of the connections enumerated above for some time to come.

In the aggregate there has been strung 130,000 pounds of No. 14 copper wire in and around Seattle, which is equivalent to approximately 2,000 miles of lines. There has also been laid about 35 miles of underground cable in the business district.

The telephone census of September, 1902, showed 1,697 Independent telephones in operation in Seattle.

SEATTLE INDEPENDENT TELEPHONE EXCHANGE. A SUB-STATION.

A consistent and steady increase has been in daily evidence, until, at this writing, the 5,000 mark is being pressed closely.

It may be said in passing that this company, through its general manager, S. B. Claypool, has, in the opinion of the writer, negotiated one of the largest contracts ever let at one time in the history of the telephone business on the Pacific Coast—that of the Washington Hotel, which has just been equipped with 100 main lines, quite an extraordinary private equipment for this coast, if not in the large eastern cities.

The company is leaving nothing undone that will enable it to add to the excellency and rapidity of its service. Every move made by it so far indicates permanency, notwithstanding the large number of reports to the contrary that are constantly being circulated.

The writer has Mr. Hodgeman, superintendent of equipment, and late of the Stromberg-Carlson company, to thank for much of the data herein given.

Main Building.

Generating Plant at Main Exchange.

SEATTLE INDEPENDENT TELEPHONE EXCHANGE.

The Equipping of Telephone Exchanges.

By H. P. Clausen.

In equipping a telephone exchange with apparatus we have to consider:

First—The ultimate capacity to which it is expected a given exchange equipment may require to be extended within approximately five years from the date of installation.

Second—Whether the ultimate capacity, when considered in connection with the immediate installation, is sufficiently large to warrant the immediate installation of auxiliary apparatus which may be required when the ultimate capacity is reached, but may not be required with the immediate installation. This refers particularly to power provisions.

Third—The question of the system to be adopted should receive attention and result in deciding for a magneto call, centralized calling or common-battery system, and whether the switching provisions shall be of the direct-reach, trunking or multiple type.

Considering the first provision, this question will be answered in part by whatever decision may be reached with respect to the third provision, and after this has been determined, we have the second requirement to decide.

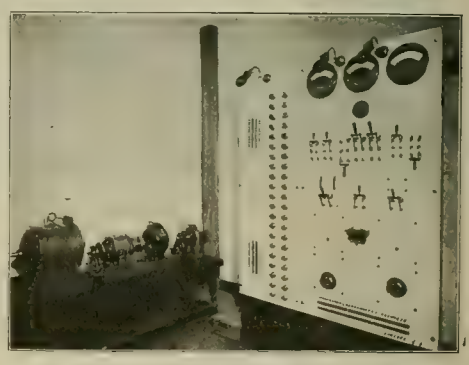
In order to get at the proposition in an approximately correct manner, let us take it for granted that we have the requirement to provide telephone service to not more than 300 subscribers, this representing the ultimate capacity. In consideration of the low ultimate capacity provided for, it is, of course, out of the question to install anything but the most economical arrangement, and in view of the fact that no trunking provisions or multiple jacks need be installed, the first aim should be to reduce as much as possible the amount of auxiliary apparatus in the exchange. This refers particularly to such arrangements as storage batteries, charging of storage batteries, etc. Obviously, the plain magneto-call type of switchboard would meet this requirement in the cheapest way, but, owing to the strong objections usually made by telephone users to being required to turn a crank to get "Central" and turning it again when signaling for a disconnection, it almost becomes necessary for the exchange manager to provide automatic signaling. In view of the fact, however, that automatic signaling systems call for some provisions of supplying signaling current at the central office (the subscriber's telephone not being provided with magneto generator) we are required to consider the matter of power provisions. If the switchboard were made common battery, the power provisions would have to be much more complete than if the installation were arranged only for the automatic signaling system. Therefore, we have, next to the magneto service, the centralized calling system available, giving us all of the advantages (as viewed from the subscriber's point of view) that may be had from a full common-battery system.

The battery power which is required at the central office for a 300-line centralized calling switchboard may be derived from a suitable number of primary batteries. Any battery capable of giving, say, 200 or 300 ampere-hours of current would be suitable and run the exchange for a reasonable length of time. As an auxiliary, it is not necessary to provide a duplicate of the battery having the large current output, but in view of the fact that the batteries are required to be recharged, some auxiliary power provisions must be provided, and, in the writer's experience, an auxiliary set in the form of the ordinary 10 or 12-ampere-hour dry battery meets all the requirements, as the battery readily keeps up the service until the regular batteries may be recharged.

It is needless to mention that lamp-signal supervision and lamp-line signals are out of the question for such small exchanges, unless the current necessary for lighting the lamps can be obtained directly from storage batteries. The target signal requires much less current, both for supervision and initial-call service.

In case the 300-line exchange equipment must be built on a common-battery plan, then it becomes necessary to provide some source of current supply which is more reliable than the primary battery. This is not saying that the primary batteries cannot be used for an exchange equipment, but when provided they should generally be supplied in duplicate, and, assuming that the exchange is operated on a 20-volt basis, this would give us 50 cells of primary battery for the duplicate equipment, and would represent a first cost of approximately $150, or 50 cents a line for the 300-capacity switchboard, while an installation of 10 60-ampere-hour storage cells would not cost much more than one-half, or amount to 25 cents a line, and would leave us $75 to purchase a battery-charging machine, which would not be too low an estimate under ordinary circumstances.

Of course, it may be suggested that expensive power switchboards, measuring instruments, etc., would run this price up considerably. However, this may be met by stating that even if a voltmeter and ammeter are installed, together with the necessary switching apparatus, the cost of this apparatus would not add more than $50 to the entire installation, but it must not be understood that this $50 item includes anything more than the bare switching and measuring instruments.



SEATTLE INDEPENDENT TELEPHONE EXCHANGE.—GENERATING PLANT IN SUB-STATION.

Therefore, in summing up the small-exchange requirements, we have, first, the lowest-cost equipment—the magneto board—and, second, the centralized calling equipment, the price of which is higher than the magneto board, owing to the provisions of the centralized battery and double supervision, while the most expensive arrangement is, of course, found in the common-battery system, where we are required to furnish (or at least it would appear to be the best plan) a storage-battery equipment with the necessary charging machinery.

In either of the systems considered we are, of course, required to furnish the usual auxiliary ap-

pliances, such as ringing machines, transmitter batteries, etc.

Now, when we come to consider an exchange equipment having an ultimate capacity for 1,200 lines and an immediate installation of 500 lines, then the economical advantages of the magneto board almost disappear as compared to the centralized calling and common-battery, but the installation price of the centralized calling exchange is somewhat lower than that of the common battery. Even when considering the current requirements in an exchange having immediate installation of 1,200 lines, the advantage of the magneto board as to first cost does not remain an advantage when considering automatic signaling service, for in the magneto board we cannot very well expect an operator to take care of more than 100 subscribers, while in the automatic signaling board, whether it be of the centralized calling or common-battery type, we may safely expect an operator to take care of 160, and in some cases even 200 subscribers. This advantage being present, it is obvious that the reduction in the number of operators' positions which might be made in the centralized calling equipment almost pays for the difference in cost between magneto and the automatic switchboard, for if in the magneto we are required to install six positions, this will mean a total of 72 interconnecting equipments, clearing-out signals, etc., and six operators' telephone equipments, as well as switchboard cabinets and 40 trunking circuits, while in the automatic signaling switchboard, with 200 lines per position, we are required to install only three operators' equipments, switchboard cabinets and eight trunking circuits. The number of interconnecting equipments and clearing-out signals remains the same as in the magneto board.

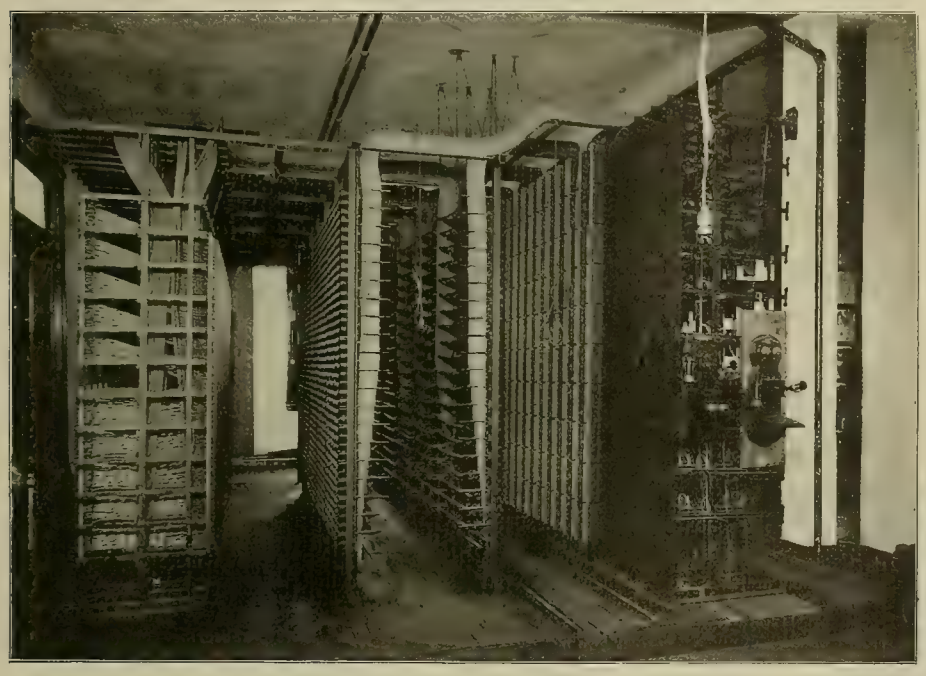
From the above it will be observed that not only do we find in the centralized calling equipment a saving in the number of operators' positions, but we have the important item of operating expense, as in the automatic signaling systems we find that the operators can do almost again as much work as in the magneto service. And that is not all; we also have the trunking circuits to consider. These are reduced in number, and the number of direct-reach connections made by the operators is proportionately increased.

As for the power provisions, primary batteries are, of course, not to be considered as the main source of power, though they may well be used as an auxiliary. The main source should consist of a set of storage batteries, and for a 1,200-line ultimate-capacity exchange equipment with, say, 600 lines installed, the battery should be approximately of the 250-ampere-hour capacity, and, owing to the immediate capacity of the board already being one-half of the ultimate, no saving is seen in the installation of only one-half of the necessary storage-battery plates. If a saving must be made, then let it be done in the direction of installing a battery capacity sufficient for giving service to the exchange equipment, even when it reaches within 20 per cent. of the ultimate capacity, for it is only in rare cases that when the ultimate capacity of the exchange is twice the immediate capacity that the ultimate is reached wihout some change taking place in either the switchboard installation or power provisions. To this point, however, the average exchange manager does not seem to give any consideration. He takes it for granted that when the storage batteries are equipped for a fixed immediate capacity, that he will obtain as good service from this battery equipment when additional plates are installed. He does not seem to understand that the storage batteries, as well as other portions of a telephone-exchange equipment, are liable to slight abuse in their use, and that such abuse when added up after several years of service, cannot be wiped out by adding additional plates. At its best, the battery would be "second-hand," and the amount of additional current required for keeping up the battery for a year's time would cost more than the interest on the cost of a renewal of the original plates would amount to. This, of course, is true only of the small exchanges, where expert attendants are not always in charge.

It is thought that within the next three or four years exchange managers will observe some interesting developments in the behavior of their batteries which are now working apparently satisfactorily, and to which it is expected to add additional plates with the idea of producing a battery of a certain capacity. Probably the result will be an "indicated" capacity.

As respects the switchboard equipment for a 1,200-line ultimate-capacity exchange, the increase of the rapidity in operation and service in general would indicate that lamp signals should be used throughout. The target signal is not prominent enough for securing the best result, and in view of the fact that we are required to maintain a storage-battery equipment anyway, we might as well obtain the additional advantage to be had from using lamp signals.

As respects the question of multiple provisions, it is not thought that for an exchange with the ultimate indicated, the multiple arrangement should be recommended, chiefly on account of the additional complications introduced in the switchboard and the difficulty of maintaining the switchboard equipment in good service conditions by the usually only ordinary help which the manager of so small an exchange can afford to employ.



SEATTLE INDEPENDENT TELEPHONE EXCHANGE.—TERMINAL ROOM.

In the trunking style of the switchboard we have the plain trunk circuit for connecting together the different operators' positions, while in the multiple switchboard we have the complicated arrangement of multiple jacks—not exactly complicated on account of providing the multiple jacks, but for the fact that the apparatus required to be installed in connection with the multiple arrangement calls for a careful switchboard man. In the plain standard trunking boards, even though they be of the centralized calling type, the line circuits come directly from the cross-connecting boards to the line-signal relays, usually mounted in the switchboard cabinet itself, while in the multiple arrangement we are required to provide some junction point for the multiple cables and the answering-jack cables and line-signal relay cables; but the most important point of all which we have to consider is the provisions which must be made for clearing the line signal when an operator goes in on the multiple of a certain circuit.

The simplest plan, and it is at the same time the worst plan, would be to connect the subscriber's line clear through the board through the jacks in series, and when an operator places the plug into, say, the multiple, it would lift off everything on the circuit upon that particular jack, including, of course, the line-signal relays. However, the disadvantages of a series-jack arrangement, when considered in connection with a multiple switchboard, even with a low ultimate capacity of 1,200 lines, are so obvious that it is almost useless to consider the series arrangement for anything outside of trunking work. Admitting the series jack as objectionable, we have to consider the multiple-equipment additional arrangement, usually in the form of a relay, which, when an operator places a plug into the spring jack and closes an auxiliary contact, causes this relay to cut off the line signal from the circuit.

It is not thought necessary to go into details as to connections established when cut-off relays are used for clearing the line signal, but it introduces the feature of the busy-test arrangement, which must be provided upon the operator's cord circuits.

In the writer's suggestions in this matter, it is not his intention to belittle the advantages of a multiple system over a trunking system, but the purpose of the discussion is to arrive at some conclusion as to whether the trunking system or the multiple system is the more economical to install when the ultimate exchange capacity is never expected to grow above 1,200 lines.

As respects the advantages of a common-battery system over the centralized calling system when installed in a 1,200-ultimate-capacity exchange, they should be about equal, but it is not thought that when common-battery operation is intended the trunking system need be considered, for when we come to common-battery operation, then we are required to employ switchboard help of a class that is well able to take care of the multiple complications, for it would be out of the question to employ a class of help in a common-battery exchange which might be employed with good results in a centralized calling equipment.

Thus, in a 1,200-ultimate-exchange equipment, the magneto board is not considered as at all suitable. The centralized calling board is undoubtedly more easily taken care of when not in its multiple form, but when the centralized calling board is placed upon the multiple basis, then we have only to add a slight additional expense to the original cost of the exchange equipment, and produce the full common-battery system, as in both the centralized calling and common-battery systems we are required to furnish power provisions, and the switchboard provisions being equal, we have only to increase the power capacity. This increase is more than offset by the advantages given in the general operation, particularly upon a point not before mentioned, i. e., the subscriber's telephone equipment. In order to make himself clear on this point, the writer might mention that in operating a centralized calling system, the subscriber's telephone equipment cannot well be operated without a third wire, or what introduces a still more objectionable source of trouble, a ground circuit, for as it would not be good practice to obtain supervision from the subscriber's circuit by connecting his telephone across the line, chiefly on account of the current lost during the time the subscribers may be in conversation with each other, one side of the telephone circuit is normally closed through the signal bell, and it is through this leg to ground that supervision is had. It is understood, of course, that when the subscriber removes the receiver from the switch-hook the signal is automatically sent in, owing to current passing through his telephone equipment, and when the operator plugs in on the circuit, she finds that the supervisory remains extinguished as long as this condition prevails, but when the subscriber replaces the receiver to the switch-hook, the supervisory burns and the relay controlling the supervisory lamp is only de-energized by removing the plug from the spring jack, or by the subscriber again removing his telephone from the switch-hook and clearing the ground.

The difficulties introduced by the system operated on the above plan occur, of course, through the difference in ground potentials, etc. At any rate, a change from a centralized calling system employing a ground at the subscriber's station to a common-battery system without such a ground always results in a marked reduction in the subscriber's circuit trouble.

Our next consideration must be given to large exchanges having capacities from 3,000 to 5,000 lines and immediate installation of, say, 50 per cent. of their ultimate.

Let us say, for example, that we have to install a 3,000-line board with an immediate installation of 1,500 lines. In this connection we need not consider battery. As far as centralized calling systems are concerned, it need only be stated that no one at the present time would consider for a moment the installation of a 1,500-immediate and 3,000-ultimate switchboard equipment on the centralized calling plan. Common-battery multiple is the universal choice, and for good reasons, as practice has shown that the common-battery switchboard can be handled to a better advantage than we can ever expect to secure from the centralized calling systems. One important item is the absence of the local battery at the subscriber's telephone.

In the matter of selection of switchboards considerable latitude is presented by the different manufacturers of this class of apparatus. In many exchanges very satisfactory service is secured from both two and three-wire systems (this refers to the multiple-jack circuit), and we are even promised one-wire systems.

As respects the construction of a 1,500-capacity exchange with 3,000-ultimate, we have as a first consideration the style of board to be adopted. It is important, while considering this subject, to suggest that not always is the matter of current consumption given due consideration. This is shown to be a fact by the different kinds of systems which are handling

large exchanges successfully, there being a difference of several hundred per cent. in the current consumption in several of the installations. However, this is an economical question which will have to [illegible] out in the future.

Now, as respects power equipments for large exchanges, we find that the installation of the power plant required to operate a 1,500-line exchange is considerably less than one required to handle 3,000 lines. And again, power-plant specifications are only too often drawn up without any consideration for expense. Thus, let us take, for example, the following specification and compare it with another: "There should be furnished duplicate sets of battery-charging dynamotors and storage batteries, while the ringing equipment shall be provided for two sets of duplicate equipments. One set of duplicate machinery arranged for a primary voltage of (20 or 40 volts), and the remaining set of machinery to be arranged for primary current (of, say, 220 volts). All of the machinery and the storage-battery equipments to be arranged for an immediate capacity of 3,000 lines."

The above requirements, it will be observed, call for duplicate charging machinery, and to this we cannot make any strong objection. Another requirement is duplicate storage batteries, and if it be understood that the furnishing of this duplicate equipment of storage batteries, together with the necessary auxiliary apparatus, represents an expense of almost $1 a line in the immediate installation of 1,500 lines, it is easy to understand the saving which might be effected by reducing the number of storage-battery equipments to a single installation, for we have already the duplicate charging machinery as a reserve, and it is scarcely seen where the extra battery equipment will be of any advantage, and before the exchange reaches the full ultimate capacity, one or the other of the batteries will have been renewed, and it is this probability which prompts the writer to suggest that the immediate installation of a storage battery should be within approximately 20 per cent. of the expected ultimate capacity of the exchange. In order to produce, what on first thought might appear an economical provision, the extreme specifications are drawn up somewhat on the following lines: "There shall be provided one battery-charging dynamotor, one 3,000-line capacity, 1,500 lines installed storage-battery equipment, and one ringing generator."

From the above it will be observed that only one charging machine is provided, and without any means to permit of charging the storage battery in case of injury to the machinery, a breakdown in any portion of the charging equipment would cripple the exchange.

As respects the battery equipment, the immediate installation of the exchange being 1,500 lines and the battery being arranged for 1,500 lines, the very first increase in capacity, which may be expected to take place inside of a year, and sometimes six months after the original installation is put into service, will make it necessary to add additional plates to the storage batteries.

Now, it is to be remembered that the original storage-battery installation has already given service for six months or a year; that the plates are not in as fit condition for service as they were in when first put into commission (it seems to be a very difficult matter to convince the average telephone manager that his storage-battery installation will not last forever), and that if the greatest care is not exercised while adding new plates, irreparable damage will be done, and often result in requiring a complete renewal of plates. For these reasons and for several others which it is not necessary to discuss, the writer makes the twice-repeated statement that the immediate installation of a storage-battery equipment should be somewhere midway between the immediate and ultimate installation. This does not, however, contemplate that the ultimate tank capacity of the storage battery should be lower than specified.

In the first power specification it will be observed that four ringing machines were specified—two, that tery, and two from the outside source of current supply. This certainly is extravagant, for what conditions can we conceive of in which one of the lower-voltage as well as one of the higher-voltage ringing machines would be out of service, owing to some breakdown? Duplicate machines, one for the outside current supply and another for the storage-battery current supply, should be sufficient.

As respects the second specification, only one ringing machine is specified, with no provisions to take care of a breakdown. This, of course, is going to the other extreme, and it is needless to say that some auxiliary should be provided. This auxiliary should be of such capacity that it will at least handle the service successfully; and, as a good rule, this machine should obtain its source of current supply from the main storage-battery equipment.

In concluding this article, therefore, we have arrived at the following:

For exchanges up to, say, 300 lines capacity, the magneto board is the most economical. For exchanges expected to reach a 1,200 ultimate, we have the centralized calling trunking board on an equally desirable basis with the common-battery multiple. For 3,000-line-capacity exchanges we have, of course, only the common-battery multiple to consider, but are required to give special study to the power proposition.

Divided Multiple Switchboards.[1]

By W. Aitken.

The designing of an efficient telephone system for one of the great centers of industry requires much careful consideration, as the subject bristles with difficulties. Before putting my suggestions before you it will be advisable to consider briefly the methods that have already been put forward. The general practice has been to divide the area to be telephoned into sections, to place in each section an exchange, to connect the various exchanges together by direct junction wires where the traffic is considerable, and to connect the various exchanges or groups of exchanges also to one or more junction centrals, through which connections are obtained to small exchanges, where the traffic is not sufficient to warrant direct junctions being run, so that complete intercommunication may be established. Fig. 1 shows such an arrangement. The weak spot of such a system is the multiplicity of junction calls. Only a small proportion of the total calls can be dealt with direct by one operator. In the larger exchanges 50 per cent. of the calls may be local, but in the majority of cases the percentage will be much smaller, in some cases only five or 10 per cent. Fifty to 95 per cent. of the calls have, therefore, to be handled by two—in some cases three—operators. The service is not, therefore, ideal. The call has to be passed from exchange to exchange, and a junction call takes about twice as long to complete as a local one. The subscriber's number has to be received by more than one operator. There is also the possibility of delay and inefficient transmission because of the complications of the junction circuits and their consequent liability to go out of order. In practice it is found that for an efficient service where there are a considerable number of exchanges, for every 100 subscribers' lines 20 junction lines are required, 10 per cent. for incoming work and 10 per cent. for outgoing work. In addition, the junction circuit is much more complicated than a subscriber's circuit; its apparatus is more intricate and requires more expert handling.

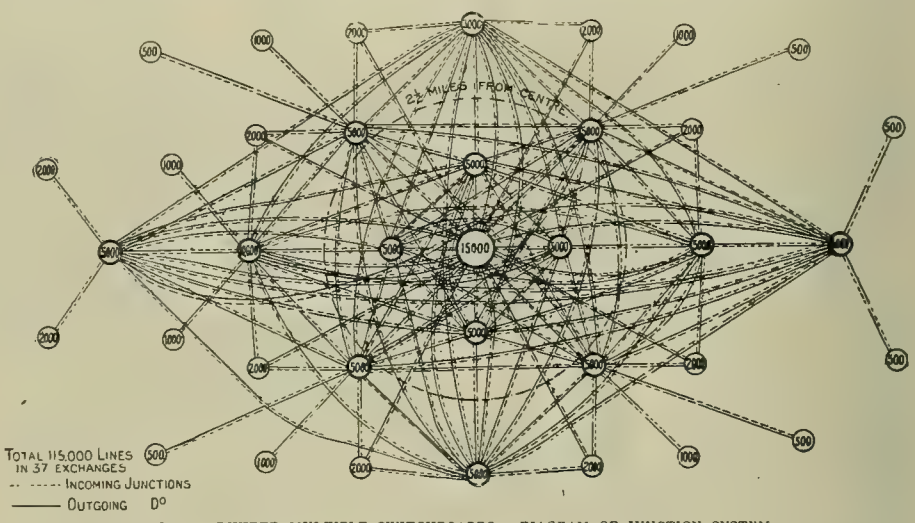


FIG. 1. DIVIDED MULTIPLE SWITCHBOARDS.—DIAGRAM OF JUNCTION SYSTEM.

Let us consider a concrete case, dealing with an area served by two large exchanges. Such a condition could hardly exist in practice. There would almost certainly be lines to smaller and more distant exchanges. In large systems it is usual to reckon the number of junctions necessary at 20 per cent. of the number of subscribers' lines in an exchange. In considering the following hypothetical case, I have calculated on 15 per cent. being necessary for working between two large exchanges. Between two exchanges of 10,000 lines each 15 per cent. of junction lines would be required, 7½ for incoming work to one exchange and 7½ to the other, or 1,500 metallic-circuit lines. To accommodate the incoming junctions 20 switchboards (10 in each exchange) would be necessary with 25 lines per operator and three operators' positions per board. Sixty operators and six supervisors are, therefore, required to work the incoming junction lines in the two exchanges, and as each subscriber's operator has a large proportion of connections for the other exchange, she cannot attend to so many calls as she could do if all the work were local. On each junction switchboard the complete multiple of 10,000 subscribers' lines must be repeated, and on every subscriber's section 1,125 spring jacks must be multipled for outgoing work to the other exchange, these being multipled three times on two sections to place them well within the reach of the operators. The provision of junctions between exchanges is a difficult one, for to provide an ideal service the number of circuits must be sufficient to carry the maximum number of calls at the busiest half hour of the busiest day, and necessarily many of these junction circuits would be lying idle the greater part of the time.

In the earlier days of telephony there was not much need for the divided board, as the great cities were efficiently telephoned with switchboards having a capacity of from 6,000 to 15,000 lines. When necessary, a number of these were fitted and connected by junction lines. Even to-day the system I advocate is worthy of consideration practically only in the world's capitals, where it may be expected that the number of telephone subscribers may reach something like 100,000. Underground work is essential with the divided board, owing to earths, etc., giving false calls, and it is only of late years that facilities could be obtained for work of such a nature, and even to-day way-leave facilities are not always obtainable. It is only in recent years also that satisfactory conduits for large capacities have been introduced, and that hermetically sealed lead-covered, air-space paper cables containing a large number of conductors were manufactured. The system I am about to describe to you is just beyond the experimental stage, and I think the time is now ripe for it to receive careful attention.

Such a system must, of necessity, be an underground metallic-circuit system. The average length of subscribers' lines would be greater with a divided system than with the junction system, as a larger area would be served from a central, but against this must be placed the great reduction in the number of long-junction circuits with their elaborate switchboard equipment. In my opinion, it is only by adopting a divided multiple switchboard system of working in which the exchange is divided into several sections, the subscriber having the power to call any one of the sections at will, the large cities of the world may be more efficiently telephoned.

By a divided multiple exchange, I mean an exchange divided into two or more groups, each group having a multiple of a proportion only of the total subscribers' lines, each subscriber having the power of calling each of the groups at will and obtaining connection with the subscribers multipled thereon without the intervention of a second operator. The advocates of the divided multiple-board system believe in centralization and the abolition of junction lines as far as possible. The multiple of each switchboard or division is made as large as can be conveniently reached by the operator, and where those who favor the divided system differ from the advocates of the junction system is in that they ask the co-operation of the subscriber by giving him the selecting of the group of switchboards on which the line wanted is connected. Two or three push buttons or switches are fitted in combination with the ordinary subscriber's instrument, one, say, labeled 1 to 10,000, the second 10,001 to 20,000, and the third 20,001 to 30,000, or in other suitable divisions. In addition to taking the telephone from the switch hook the subscriber has to press the button of the group in which is the number required; he then gets the connection direct instead of as in the junction system, the first operator having to ask the second to assist her in completing the connection in a large proportion of the calls.

The central exchange on a divided system consists really of two or more great multiple switchboards, serving a large area, and its total capacity may be from 30,000 to 60,000 lines, according to the size of the units and number of divisions. Instead, however, of having junction lines between the exchanges, the subscriber's line is branched to each division and has a calling signal and answering jack on each, so that it can be connected to each of the multiples of the several divisions, his own line being multipled on one of the divisions, so that other lines may be connected to it. The subscriber can, therefore, greatly expedite the rate of operating for a great proportion of his calls, and at the same time he enables the operator to perform more work, as a second operator more rarely intervenes. A proportion of junction working will still exist to the exchanges more distant from the center, but in most instances it will be possible to so design a system that 75 per cent. of the possible junction

1. Abstract (from the London Electrician) of a paper read before the (British) Institution of Electrical Engineers, April 30, 1903.

working will be eliminated. I have, therefore, based my estimates on this figure.

Fig. 1 shows a large populous area telephoned on the junction system, the total number of subscribers being 115,000 in 37 exchanges. The largest exchange has a capacity for 15,000 lines, or 13 per cent. of the total. In the two largest exchanges there is 22 per cent., and in three 26 per cent. Even if the three exchanges were each of 15,000 lines, they would only contain 39 per cent. of the whole. Fig. 2 shows the same area telephoned on the divided multiple system for the same number of lines in 15 exchanges. The largest exchange has 45,000 lines and the next 30,000 lines. In the former there is 39 per cent., in the two 65 per cent., and in three 83 per cent. of the total. The lines on the diagrams indicate direction only, and not the number of circuits necessary. I may be accused, with a good deal of justice, of comparing a theoretically good divided system (Fig. 2) with an imperfect junction system (Fig. 1), but with the latter system local conditions and limitations, such as rivers, public parks, low-class residential neighborhood, etc., form natural boundaries beyond which for the sake of economical working it is not desirable to extend, and, therefore, single exchanges of the maximum size are not always possible or essential, whereas this does not apply to the same extent to the former.

Milo G. Kellogg of Chicago was, I believe, the first to design and advocate a divided multiple-board system, and a number of exchanges are now working in America on this plan. Usually two divisions have been adopted, but in one or more cases a four-division board has been installed. In these pioneer exchanges the system was complicated by polarized relays and indicators on the switchboards, and at the subscribers' offices by commutated magneto-generators. In at least one case the magneto-generators were replaced by the primary speaking battery, acting through an induction coil, giving a "kick" when the circuit was made and broken, sufficient to energize the calling signal. (See Fig. 3.) Suitable switches connected the current-generating apparatus to line in the proper direction to actuate the signaling apparatus in the division required.

In one circuit a positive and a negative polarized indicator are in series across the loop, and two similar indicators in series are connected as a tap to earth on one wire of the metallic circuit. (See Fig. 4.) In another case a positive and a negative polarized indicator are in series and tapped to earth, two off each line. (See Fig. 5.) Four-division exchanges are thus obtained.

With the development of the central or common-battery system of telephone-exchange working and the popularizing of the telephone, the need for a simpler way of working great central exchanges became more urgent, and when considering this question I was struck with the idea of working a divided system from a central battery. I had previously designed two circuits which led naturally up to this, one in February, 1898, with a retaining electromagnet at the subscriber's instrument, which allowed a momentary depression of a key (thereby mechanically completing the circuit of the central battery through the calling relay to earth) to give a permanent signal to the operator (Fig. 6), and another in June, 1899, in which I removed the electromagnet from the subscriber's instrument and provided a local retaining circuit on the relay at the exchange, utilizing the ordinary line relay coil for this purpose (Fig. 7). The latter I preferred to use for my divided-board system, as it simplified the apparatus at the sub-station.

In this system non-polarized relays are used, energized from a central battery when any one of the simple switches at the sub-station instrument is depressed. The caller can thus select any one of two or three groups of multiple switchboards required. A greater number of combinations could, no doubt, be obtained by step-by-step movements, but at the expense of simplicity. In a two-division exchange having two groups of multiple switchboards, two simple single make-and-break relays are necessary at the central and two earthing or grounding switches at the sub-station. In a three-division exchange two double (or one triple and one double) make-and-break relays are used in connection with the two wires of the metallic circuit, and in connection with them are three calling lamps, one on each of three groups of multiple switchboards.

Any of the well-known forms of instruments may be used in conjunction with these systems, it being only necessary to fit in combination therewith a simple two or three-way switch, as required, one position earthing the A line, another earthing the B line, and the third earthing the A and B lines simultaneously (the latter in the three-division only). The switch lever or plunger is put momentarily in one of these positions to give a permanent signal to the attendant at the corresponding switchboard.

With a two-division system, shown in skeleton on Fig. 8, and the line-circuit in more detail on Fig. 9, two switchboards (A_2) (B_2), Fig. 8, of suitable size are provided and one-half the total capacity is multiplied on one line of boards and half on the other. Each subscriber's instrument has two push-buttons (A_1) (B_1), one for earthing the (A) and the other for earthing the (B) line.

Each line, after passing through the usual test board or main distributing frame (TB), Fig. 9, is connected to a special double intermediate distributing frame (IDB). To a central set of soldering tabs the two test-board wires are connected, and from the same set a triple wire per circuit is carried to the multiple jacks (MJ), of one line of boards. From a parallel strip of tabs on one side of the central line tabs a quadruple wire per circuit is carried to the answering jack (AJ_1) and calling lamp (CL_1) on the same line of boards and from a parallel line of tabs on the other side of the central-line tabs another quadruple wire per circuit is carried to an answering jack (AJ_2) and calling lamp (CL_2) on the second line of board. A quad-cross-connecting wire connects the central-line tabs and the tabs on both sides. All wires from the intermediate frames are made up in cables, but the wires between tabs are made in loose quads to allow of ready alteration with the object of changing the local position of any subscriber so as to equalize the work per operator, as in this arrangement it is necessary to allow distribution on each line of boards. Each quad is made up of the two line wires, the test wire and a lamp wire. The test wire also has a connection through the cut-off relay coil to earth. Each line wire has a connection through a tongue and contact of the cut-off relay (COR) and its line relay coil (LR_1) or (LR_2), to battery and earh. Each tongue of the cut-off relay (COR) has also a connection to the tongue of the line relay associated with it, the under contact of each line relay being connected to earth.

The answering jacks and calling lamps are arranged in the usual way, with pilot relay (PR), and lamp (PL), night-bell (NB), etc., as shown at Fig. 9. The calling lamp has also a connection to the line side of the relay coil, so that it is in parallel with that coil. The action is as follows:

When a subscriber depresses key (A_1), Fig. 8, there

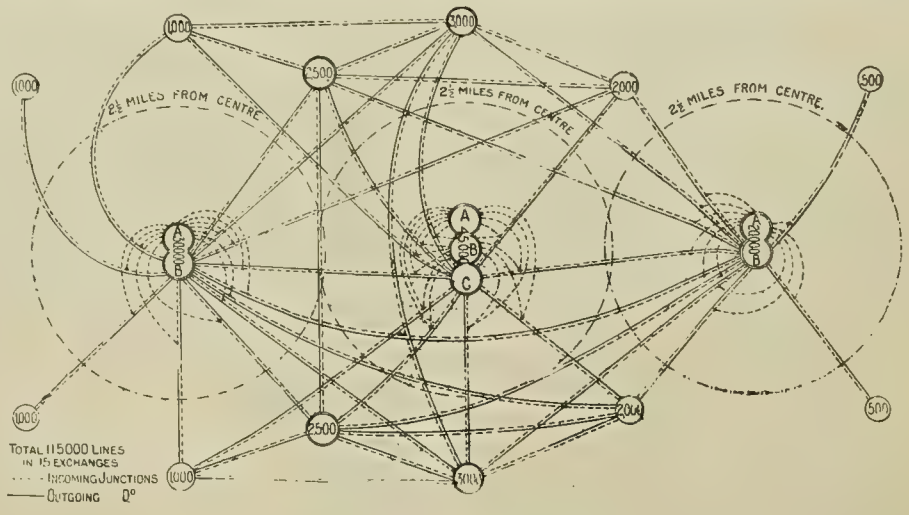


FIG. 2. DIVIDED MULTIPLE SWITCHBOARDS.

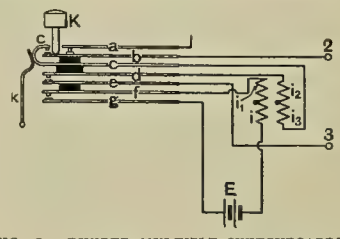


FIG. 3. DIVIDED MULTIPLE SWITCHBOARDS.

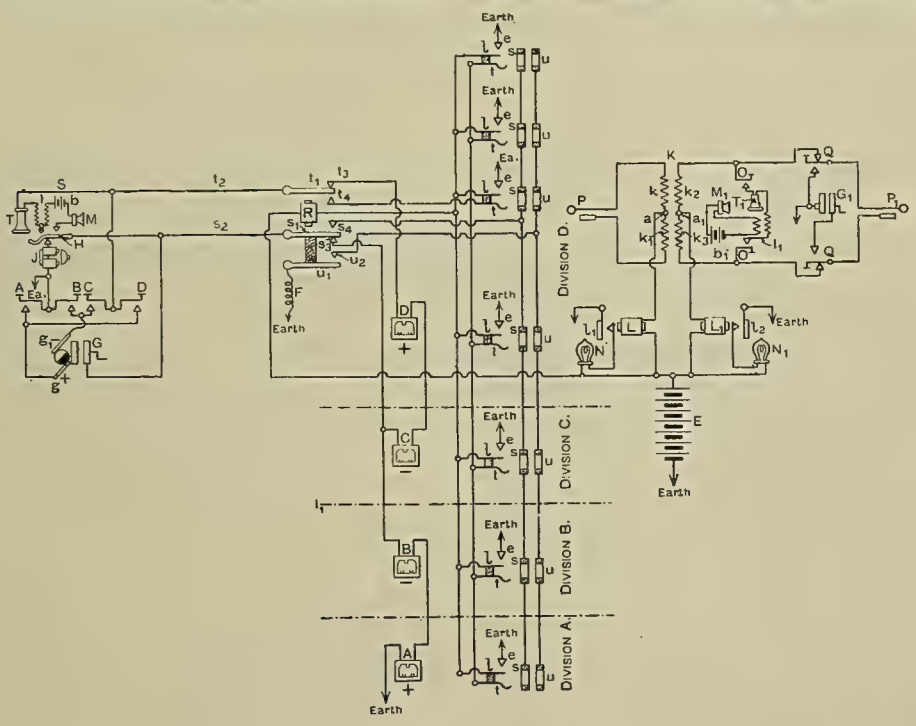


FIG. 4. DIVIDED MULTIPLE SWITCHBOARDS.

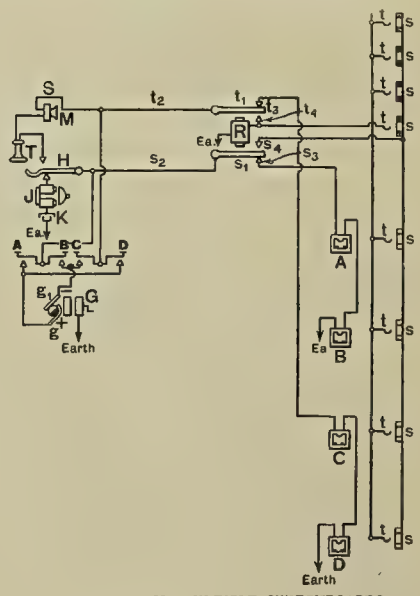


FIG. 5. DIVIDED MULTIPLE SWITCHBOARDS.

is a circuit from the earthed central battery through line coil of relay (k) (with lamp (j) in parallel) associated with that line, through one contact and tongue of cut-off relay (h), through the (A) wire to earth at key (A^1). The line relay (k) is therefore energized and the lamp (j) glows. There is then a local circuit from earthed central battery through line coil (k) and lamp (j) in parallel, through contact and tongue of cut-off relay (h), through tongue and contact of line relay (k) to earth, and the lamp, therefore, continues to glow after the key (A_1) is released until the operator answers. This is done by inserting a plug (q), of a connection set into the answering jack (C_2). Another local circuit is then established from earthed central battery (i), through the shunted lamp (p), on the third conductor of the cord to sleeve of plug (q), bush of jack (C_2), over test wire, through cut-off relay coil (h) to earth. The cut-off relay (h)

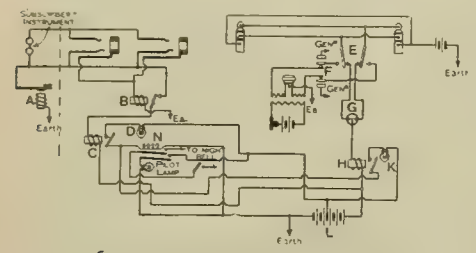


FIG. 6. DIVIDED MULTIPLE SWITCHBOARDS.

is therefore energized and the line relay circuit broken by the tongue leaving the outer contact, so that the calling lamp ceases to glow. The subscriber may then be connected with any other on that multiple. Should the (B_1) key be depressed, the other line relay and lamp will be energized, the retaining circuit be broken by the cut-off relay being energized by a connecting set used by an operator at the second line of boards, and a connection completed thereon.

Each operator may have 300 answering jacks and calling lamps under her control, but will only attend to half the total number of calls from each subscriber. As there are fewer junction lines between exchanges on the divided system, the outgoing junction work will be less and each local operator will, therefore, be able to attend to a greater number of lines. Presumably on the junction system about 50 per cent. of the calls would be for the second exchange, and as a junction call takes twice as long to complete as a local one, if most of the work is made local, as on the divided system, the operator will be able to attend to approximately 50 per cent. more lines, so that instead of 66⅔ subscribers' sections being necessary on the junction system at 100 lines per operator, only 44⅓ sections would be necessary on the divided system.

There will also be a very considerable saving in

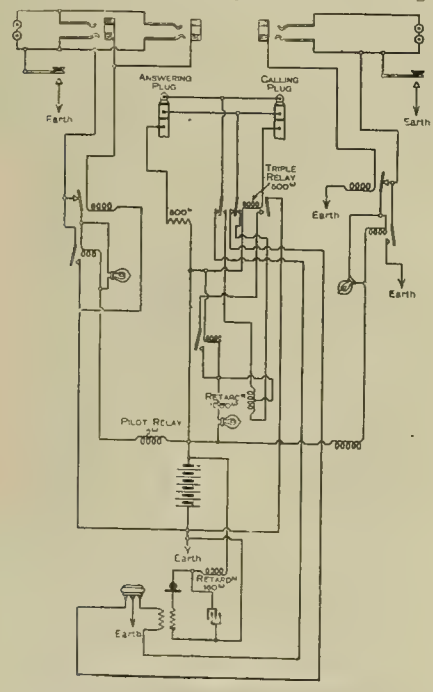


FIG. 7. DIVIDED MULTIPLE SWITCHBOARDS.

floor space, and consequently rent or value of premises, as the length of the unnecessary junction and subscribers' sections would be about 270 lineal feet, made up of 20 junction sections and 22 subscribers' sections, each about six feet six inches long.

If three 10,000-line exchanges were opened on the junction system, then possibly treble the number of junction lines, multiple junction sections and operators would be necessary, as 1,500 lines are required between (A) and (B), 1,500 between (B) and (C), and 1,500 between (A) and (C), and the subscribers' (or local) operators can each attend to a still smaller number of calls, because a still greater proportion of their work is over junction lines, and each local operator would then be able to attend to a smaller number of lines, say, 90 instead of 100. The number of switchboards and number of operators would therefore be increased, while there would be no increase on the three-division system.

With a three-division system, at the central exchange three independent multiple switchboards are fitted, one-third of the total number of lines being multipled on each. Each subscriber's line is multipled on one of the three, but has an answering jack and calling lamp (or other indicator) on each. An operator may therefore have 450 calling lamps and answering jacks to attend to—150 in connection with the lines multipled on that group of switchboards and 150 each in connection with the other two groups, so that the subscribers can call and be connected to the other lines that are multipled thereon.

At the sub-station three push-buttons are fitted, and, according to the number required, the subscriber presses the (A_1) (B_1) or (C_1) key. When the (A_1) or (B_1) key is depressed the (A) or (B) calling lamp glows, as described for the two-division arrangement, and when the (C_1) key is depressed both lines are earthed and both line relays are energized, the circuit of the (A) and (B) line lamps is cut, and the lamp associated with the third, or (C), group of boards glows. When an answering plug is inserted the cut-off relay is energized, and

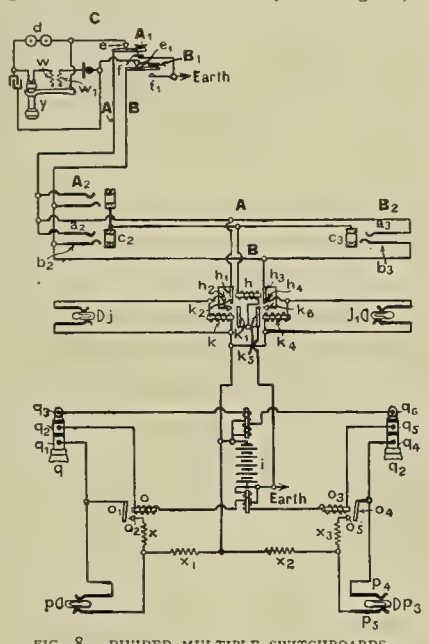


FIG. 8. DIVIDED MULTIPLE SWITCHBOARDS.

the local retaining circuits are broken and the (C) lamp ceases to glow.

The foregoing arrangement can be used practically with any cord circuit. It may be used in conjunction with the ring-through system, in which one subscriber rings the bell of the subscriber wanted, or the operator may do the ringing. In the former case a generator is supplied with each instrument; in the latter case this is not necessary.

In the ring-through system with relay and lamp which was designed to replace the now practically obsolete call-wire system, I preferably use a cord circuit without listening key, as shown on Fig. 7.

The operator's telephone is normally in circuit through the back contacts of a triple relay in the third conductor of the calling cord. The operator is, therefore, ready to answer immediately she inserts the answering plug, but when the connection is completed by the insertion of the second plug her telephone is automatically cut out, as a local circuit is completed from earthed battery, through coil of triple relay, through sleeve of plug, bush of jack, over test wire, through coil of cut-off relay to earth. This combination, it is believed, will form the simplest manually operated switchboard known. The operating is as follows: (a) When the lamp glows operator inserts answering plug; (b) tests line wanted, and, if free, inserts plug into jack of line wanted; (c) when clearing lamp glows she withdraws plugs. Such a system, up to the present, has only been proposed with central-battery signaling, a primary battery at the subscriber's being used for speaking.

I would propose forming one huge central exchange of from 30,000 to 60,000 lines in the heart of each great city, this exchange serving an area of about 14 square miles; this, of course, would vary with the density of the population and the prospective number of renters. With an underground system, and cables containing from 250 to 300 pairs each, such an arrangement is perfectly feasible. Four main conduits should radiate from the central building, each containing from 50 to 80 ducts, these branching out, as required, up to a distance of from two to 2½ miles from the exchange. Outside this area, say at 3½ miles distance from the central, subsidiary exchange should be formed. When these exchanges are of considerable size they would have direct junction lines to the central and incoming junction sections on each of the three multiples of the central exchange; where, however, the junction lines were few the operator would call the multiple required at the central by pressing the corresponding key in the same way as a subscriber.

The outgoing junctions for these subsidiary exchanges would only be multipled over one group of boards at the central, say, the (C) group, so that subscribers would call, say, numbers 1 to 16,000 by depressing the (A) key, 16,001 to 32,000 by depressing the (B) key, and 32,001 to 45,000 and all subsidiary exchanges by depressing the (C) key. These numbers of lines can perfectly well be placed within the reach of the operators by using for the (A) and (B) multiples, six-foot three-inch frames having nine panels of strips of 20 spring jacks measuring 8¼ inches by three-eighths inches. Eighteen blocks of 100 jacks give a height of about two feet 9¾ inches. The answering jacks and calling lamps and number pegs, in strips of 20, with space sufficient for 533 lines per operator (this being about equal to 177 lines on a simple multiple, as each operator only attends to one-third of the total number of subscribers' calls on a three-division system) would occupy a height of about 11¼ inches, so that the height of the upper row of spring jacks above the keyboard would be about three feet nine inches. The (C) line of boards could either be made to accommodate a slightly smaller number of subscribers' lines, so as to leave room for the outgoing junctions, or the section could be still further increased in length.

For a 45,000-line three-division exchange, reckoning that each operator can attend to an average of 150 lines per multiple board, or a total of 450 lines, the (A) and (B) groups would each consist of 107 multiple sections; while reckoning that each operator at the (C) group could attend to 100 lines only owing to the amount of junction work, 130 sections would be necessary. Each group of switchboards (and possibly also separate intermediate and main distributing frames) should preferably be in a separate fireproof room in practically separate buildings, so that in case of fire the fireproof doors could be closed and so confine the breakdown to one group.

The premises should, therefore, consist of one central building with flanking wings. In the basement

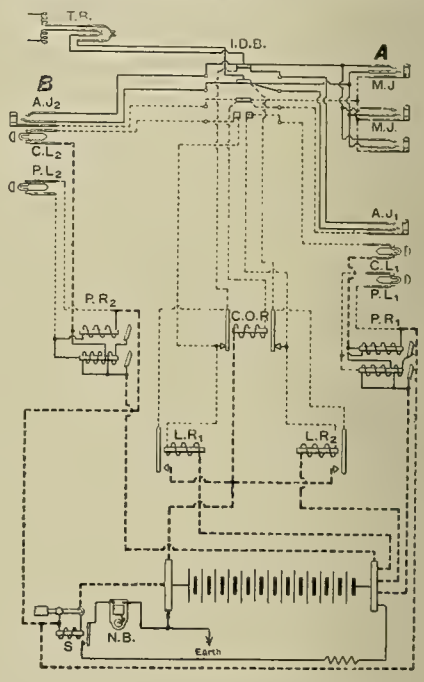


FIG. 9. DIVIDED MULTIPLE SWITCHBOARDS.

of the central building one main distributing frame should be fitted, arranged radially in four sections of 12,000 or 15,000 in the shape of a Greek cross, the four conduits opening out at the ends. On the ground floor should be similarly arranged the intermediate distributing board and relay racks, the former having two or three distributing fields, as it may be necessary for equalizing purposes to cross-connect the lines on one group of boards and not on the other. In the central building might be the (C) switch room, the (A) and (B) switch rooms being in the right and left wings respectively. Preferably the groups or divisions of the exchange should grow uniformly, as will be made clear by the following example. If it is desired to convert a 9,000-line ordinary exchange into a two-division exchange, and it is necessary to begin the second group with a capacity of 2,000 lines, then while it is only necessary to provide 2,000 extensions of answering jacks and lamps on the 9,000-line frame, for which there is plenty of room, the 9,000 lines require lamps and jack extensions on the sections built for 2,000, and each operator would have an abnormal number of lamps and jacks from the first line in front of her, and these would require to be redistributed when further extensions were made.

I think it must be granted, from what I have said, that, from an operating point of view, a great boon would be obtained by the introduction of the divided

multiple-board system. Also that the made-up or speaking circuits would be much simpler.

As far as I can see the principal objection that can be urged against it is that the system depends for its efficient working upon the co-operation of the subscribers. We have been told that "men are mostly fools." Must this be taken literally? I think, at any rate, not sufficiently fools to spoil a divided system by wilfully or carelessly calling on the wrong group or division of the exchange.

International Electrical Congress.

The International Congress on Electricity will be held during the week beginning September 12, 1904. On the recommendation of the director of congresses (Howard J. Rogers) President Francis has appointed the following committee on organization to promote the congress, issue the invitations and prepare the official programme:

President—Elihu Thomson, Swampscott, Mass.

Vice-presidents—Professor H. S. Carhart, University of Michigan; C. F. Scott, Pittsburg, Pa.; W. E. Goldsborough, St. Louis; Dr. W. S. Stratton, Washington, D. C.

General secretary—Dr. A. E. Kennelly, Harvard University.

Treasurer—W. D. Weaver, New York city.

Advisory committee—B. J. Arnold, Chicago; B. A. Behrend, Cincinnati; C. S. Bradley, New York; J. J. Carty, New York; A. H. Cowles, Cleveland; Professor F. B. Crocker, New York; Dr. L. Duncan, Boston; H. L. Doherty, Denver; R. A. Fessenden, Norfolk; W. J. Hammer, New York; C. Hering, Philadelphia; Dr. L. B. Stillwell, New York; C. P. Matthews, Purdue University; R. D. Mershon, New York; K. B. Miller, Chicago; Dr. W. J. Morton, New York; Dr. E. L. Nichols, Cornell University; Professor R. B. Owens, McGill University (Montreal); Dr. F. A. C. Perrine, Pittsfield, Mass.; Professor M. I. Pupin, New York; Professor J. W. Richards, Lehigh University; Professor H. J. Ryan, Cornell University; William Stanley, Great Barrington, Mass.; Professor C. P. Steinmetz, Union College, and A. J. Wurts, Pittsburg.

The duties of the organizing committee will be to prepare a programme for the International Congress of Electricity, to name the participants therein, to secure the ways and means for the conduct of the congress, and to promote general interest in the congress.

The American Institute of Electrical Engineers, the American Electrochemical Society and the National Electric Light Association have thus far decided to hold meetings in St. Louis in conjunction with the International Congress of Electricity during the week of September 12-17, 1904. That week immediately precedes the week of the Congress of Arts and Sciences, which will be a notable gathering of scientists eminent in all departments of human knowledge, who will gather from all parts of the world, electricity being represented by two distinguished men. The electrical congress is fortunately placed with reference to the Congress of Arts and Sciences, inasmuch as it will give those who desire an opportunity to stay over and join in the latter congress. It is said that advices from abroad indicate that from four to five hundred foreign electrical engineers will be in attendance at the congress.

Commencement at Boston "Tech."

Commencement exercises were held last week at the Massachusetts Institute of Technology in Boston. At the alumni reception addresses were made by President Pritchett, Frederick P. Fish of the American Telephone and Telegraph Company and Dr. Louis Duncan, head of the Institute's electrical department. The graduating class entered the Institute with 329 members, and 191 were graduated with the degree of bachelor of science. The degree of master of science was conferred on seven persons. Of the graduates, 39 were in the electrical engineering course, 27 in the civil and topographical engineering course, 37 in the mechanical engineering course, 27 in the mining engineering and metallurgy course, 15 in the architectural course, 13 in the chemistry course, 10 in the chemical engineering course, 12 in the naval architectural course, four each in the physics and sanitary engineering courses, and one each in the courses in biology, geology and general studies. Some of the theses read were as follows:

Stephen Russell Bartlett, B. A. (mechanical engineering), "A Twenty-four-hour Duty Test on a 10,000,000-gallon Leavitt Pumping Engine at New Bedford." (With P. J. Kearny.)

Ralph Benjamin Yerxa (mining engineering), "A Laboratory Study of the Different Stages in the Refining of Copper." (With C. F. Green.)

William Chaille Martin, M. S. (chemistry), "The Cathodic Reduction of Gold Telluride Ores."

James Winfield Welsh, A. B. (electrical engineering), "The Unbalancing of Scott Transformers." (With C. H. Porter.)

Elizabeth Langdon Williams (physics), "An Analytical Study of the Fresnel Wave Surface."

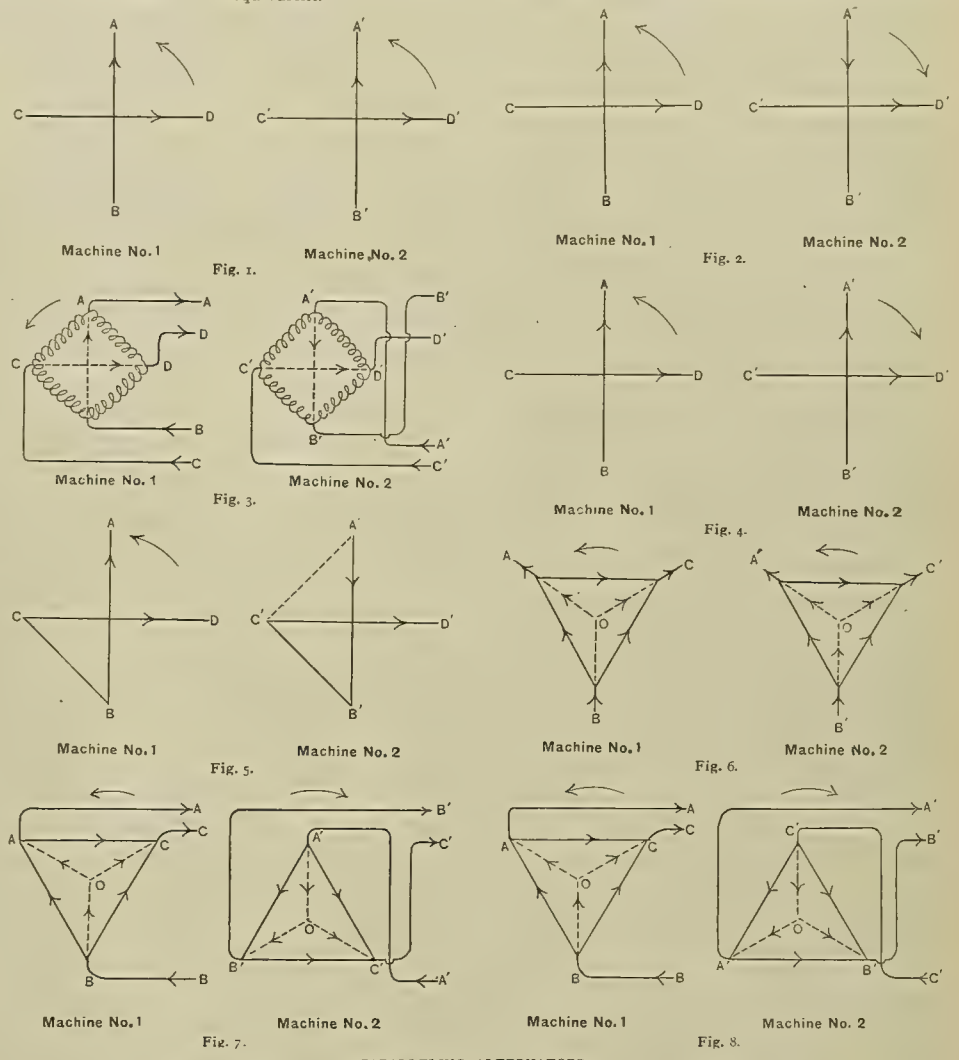
Paralleling Alternators.

By F. Hardie Jeannin.

There is a point in connection with the operation of alternators in parallel that is not so generally known and understood as to prohibit wider publication.

The following conditions are prerequisites to successful paralleling:

1. The frequencies must be identical.
2. The phases in parallel must be counterparts.
3. The voltages of the phases in parallel must be equal.
4. The power for each machine must be proportional to the load if the machines properly divide the load.
5. The machines must be of the same class; that is, a simple and composite machine cannot be properly operated in parallel.
6. There must be enough flexibility between the two generators to permit an effective operation of a synchronizing current between the two machines.
7. The direction of rotation of the machines must be the same or its equivalent.



PARALLELING ALTERNATORS.

It is the last condition I shall consider here.

Taking the case of two quarter-phase machines first, as shown by Fig. 1, where the armature windings are represented topographically by vectors (AB) and (CD) for machine No. 1, and (A'B') and (C'D') for machine No. 2. The arrow heads show the direction of the potentials, and they will always point upward when the rotation is as indicated by the arrows. (CD) and (C'D') are just commencing to diverge from the horizontal, and hence the arrow heads still point upward, the potentials having at the horizontal datum line reversed.

Now, it is obvious by examining the diagrams for the two machines that, since they are running in the same direction, they will be properly connected together for operating in parallel when terminals (A) and (A') are connected to bus-bar No. 1, (B) and (B') to bus-bar No. 3, (C) and (C') to bus-bar No. 2, and (D) and (D') to bus-bar No. 4.

However, suppose generator No. 2 should be running in the reverse direction with respect to Machine No. 1, as shown by Fig. 2. Then for a like position of armature coils with respect to the field poles, the direction of the potentials will differ by 180°; that is, the arrowheads will be reversed, and will consequently point downward at all times. The potential, then, in (A'B') will be opposite to that in (AB), and the potential will be in the same direction in (C'D') as that in (CD), with respect to the bus-bars. The direction of the potentials is seen to be from (C') to (D'), because the arrowheads must for machine No. 2 point downward, and (C'D') is just leaving the horizontal in the direction indicated by the arrow. Therefore, (CD) and (C'D') are in proper relation for synchronizing, while (AB) and (A'B') are 180° apart. Consequently, either (AB) or (A'B') must be reversed with respect to the bus-bars. Fig. 3 shows the leads from (A'B') reversed as mentioned, in which case the two machines will be properly connected to the bus-bar for parallel operation.

If the correction were attempted by throwing the two machines together when the relation between the armature coils and the field poles is 180° different from machine No. 2, Fig. 2, the result would be as shown by Fig. 4, the arrowheads pointing upward, indicating a position 180° apart from No. 2 of Fig. 2, which manifestly does not accomplish the desired results.

It is to be observed, by comparing Figs. 2 and 4, that it is immaterial on which phase the leads are reversed; they may be either of (A'B') or (C'D').

If the generators are wound three-wire, quarter-phase, the common connection will have to be changed as indicated by the dotted line (A'C') in Fig. 5 (No. 2).

Care must be exercised to connect the synchronizing transformers between any two leads connecting to the same bus-bars, and not to like generator leads.

With three-phase machines it is necessary to reverse any two leads only. Fig. 6 shows two delta-wound generators running in the same direction, in which case like terminals are connected to the same bus-bars. This is true of Y-connected, or of a combination of Δ and Y-connected machines, so long as they rotate in the same direction.

Should machine No. 2, Fig. 6, rotate oppositely to machine No. 1, the two lower arrowheads would be reversed for the position shown, but which is no longer the synchronizing position of that machine, which must now have two of its leads reversed.

With leads (A′) and (B′) reversed, the machine will take up a position as indicated by No. 2 in Fig. 7. If (B′) and (C′) were reversed, the position would be as shown by No. 2 in Fig. 8, and if (A′) and (C′) were reversed, it would be as shown by No. 2 in Fig. 9.

Therefore, from Figs. 7, 8 and 9 we conclude that it makes no difference which two leads are reversed, and it is only necessary to be careful that the synchronizing transformers are connected between the leads that go to like bus-bars.

In the deltas of Figs. 6, 7, 8 and 9, I have inscribed dotted vectors (AO), (BO) and (CO), etc., indicating Y-wound machines, from which it is readily seen that what has been said in regard to

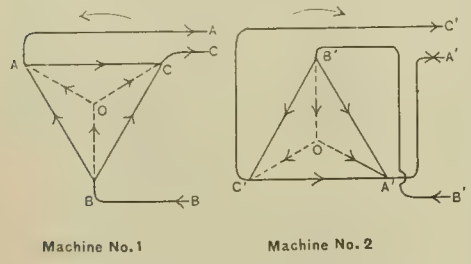


FIG. 9. PARALLELING ALTERNATORS.

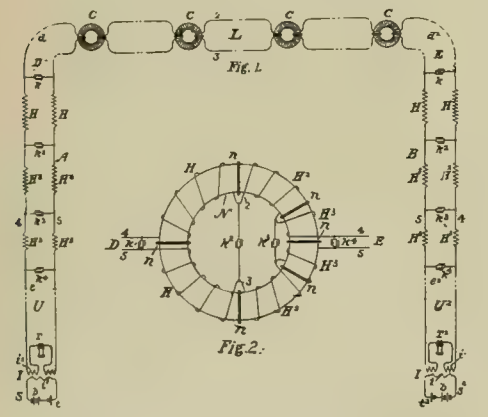
delta-wound machines applies equally to Y-wound generators. This is so by reason of points (A) (B) and (C) being coincident in Δ and Y-wound generators of like voltage.

In composite machines where the compounding is done by means of a current transformer having three primary and one secondary winding, any two leads cannot be reversed as above stated for separately excited generators, owing to the fact that one primary coil is reversed with respect to the other two. Therefore, the two leads that are reversed must always include the lead connecting to the reversed primary of the compounding current transformers. This can be done by trial, if not convenient to trace out the connections.

Tapering System of Impedance Coils for Telephone Circuits.

A recent invention by Howard S. Warren of Everett, Mass., and George A. Campbell of Newton, Mass., appears to be of considerable value in telephone work. Like a number of other recent telephone inventors, Messrs. Warren and Campbell have been studying the load-coil improvement. Their apparatus, which is the subject of a recent patent, has to do with electric circuits loaded with inductance coils for the prevention of adverse capacity effects, and is especially effective in reducing what is known as "reflection," which varying currents experience when passing from one part of the circuit to another of different characteristics.

These wave reflections, experience has demonstrated, take place with a decided loss of energy.



TAPERING SYSTEM OF IMPEDANCE COILS FOR TELEPHONE CIRCUITS.

In the operation of telephone circuits, the telephone instruments of a subscriber's station are not usually united directly to a heavily-loaded circuit, but are connected through the unloaded subscriber's line, and perhaps still further through a trunk line. In such a case the abrupt transition of the current waves from the high impedance of the loaded portion to the low impedance of the unloaded portion of the circuit takes place with considerable loss of efficiency due to wave reflection. The invention under consideration provides means of avoiding this difficulty.

The system provides for the introduction into the circuit, between the portions of high and low impedance, a series of impedance coils, gradually reducing in impedance from the loaded side to the unloaded subscriber's portion of the circuit. In conjunction with the impedance coils are condensers connected across the line in multiple. The inductance of the coils and the capacities of the condensers are so arranged and proportioned as to provide a succession of sections or elements of gradually changing impedance.

Fig. 1 is a diagram representing a long loaded circuit connecting at each end with an unloaded portion of the circuit by means of an artificial tapering apparatus such as has been indicated. In this drawing (L) represents the loaded part of the circuit, (2) and (3) being the two sides of the line. (S) and (S^2) are the telephone sets at the subscribers' stations. Connecting these stations to the loaded circuit are the subscribers' lnies (U) (U^2). The cut plainly shows the manner in which the tapering apparatus is connected. (H) (H^2) (H^3) are the inductance coils, (k) (k^2) (k^3) (k^4) the condensers. The impedance of these inductance and capacity limbs of the circuit, should be so proportioned that the drops in impedance between all of the pairs shall form a gradually decreasing series from the high value at (L) as a maximum to the value at (S) as a minimum. Fig. 1 shows but three such steps, but of course it is to be understood that the number of such steps is to be limited only by the conditions of the circuit.

For example, suppose that the impedance of the main line is 3,000 ohms, and that the tapering apparatus is to contain six sections. The impedance values of the sections will then preferably be, beginning on the end nearest the main line, 2,400, 1,800, 1,425, 1,100, 850 and 650 ohms, respectively, diminishing in a substantially geometrical ratio. Care must be taken that each pair of impedance coils on the two sides of the limbs (U) (U^2) are balanced.

Fig. 1 represents the impedance coils as placed at different distances along the limb (U) of the circuit, but this is not a necessary arrangement. The coils may be wound upon a single core instead of upon separate cores, as shown in Fig. 2, thus forming a very condensed piece of apparatus. In fact, this construction is of considerable advantage since the iron losses in this case are less than when a large number of cores are used.

The inventors say that by experiment it has been proved that the sum of the several reflection losses in such a tapering system is small in comparison with the losses which occur when no such system is used, or where no competent substitute is in the circuit, such as a terminal transformer. Experiment has also shown, they add, that the practical advantage attending the employment of the taper is perceptibly greater than that obtained from the use of the best terminal transformer thus far designed. Since the employment of such terminal transformer has been found to hamper the simultaneous use of telephone circuits for other uses, such as telegraphy, a further advantage, therefore, in the use of the new invention is that the transformer may be done away with entirely, thus dispensing with one of the obstacles encountered in using a single line for both telephony and telegraphy.

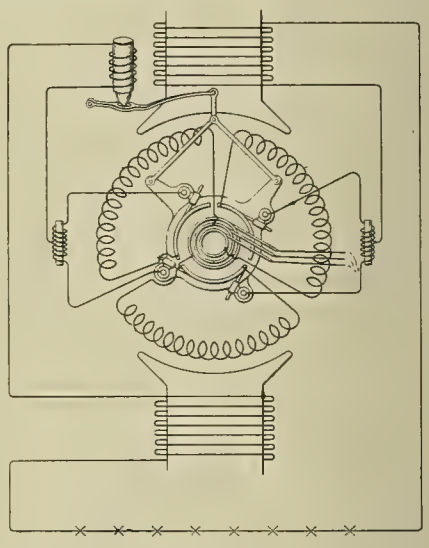
Examination for a Degree by Telephone.

The recent floods and consequent suspension of traffic from St. Louis to eastern points is responsible for an innovation in the methods of taking examinations. Mr. Percival E. Fansler, a post-graduate student of Purdue University of Lafayette, Ind., who is now located in St. Louis, had submitted his thesis and waited only to take the prescribed examination for the degree of electrical engineer. Arrangements had been made with the university authorities by which the examination was set for Monday morning (June 8th). High water had undermined the approach of the Eads Bridge, making it impossible for passenger trains to go either into or out of the city, and as a last resort a telegram was sent to the university authorities asking for permission to take the examination over the long-distance telephone. This was granted, and arrangements were made at Lafayette whereby the members of the examining committee were all connected to the long-distance line. For nearly an hour Mr. Fansler was plied with questions, after which the committee made a favorable report to the president, and on Wednesday the degree of electrical engineer was conferred by the president and faculty. This is probably the first time a long-distance telephone has ever been used for such purposes, and the matter was looked upon by the university authorities as an example of the aggressiveness its graduates are showing in the engineering field.

Constant-current Rotary Converter.

Richard Fleming of Swampscott, Mass., has devised a new type of constant-current rotary converter. The principal object of the invention is to accomplish the conversion of constant-potential alternating current into direct current of constant volume. This converter differs in some respects radically from the usual type of converter for this purpose. For instance, the armature winding, instead of being continuous, is of the open-coil variety, each coil of the winding being connected at one end to a segment of the commutator, the other ends of the windings being connected, respectively, to collector rings, through which the windings receive alternating current from a suitable source of supply, though this feature is not inherently essential in the practice of the invention. Another point of distinction is that the brushes which bear upon the commutator, instead of being fixed during normal operation, are moved back and forth in order to vary the electromotive force impressed upon the direct-current circuit, and thereby maintain in it a constant value of current.

The accompanying diagram represents clearly the essential parts of the machine. The poles are two in number. The armature which co-operates with these field poles is provided with three equally spaced armature coils. The spacing of the coils gives rise to induced electromotive forces having a three-phase relation to each other, making the converter suitable for the transformation of a three-phase alternating



CONSTANT-CURRENT ROTARY CONVERTER.

current. Each armature winding has one end connected to a collector ring and the other to one of the three commutator segments, these segments being separated by an air gap.

There are two sets of brushes, mounted on two rocker arms, which can be shifted automatically upon the commutator to obtain constant current regulation. The inventor does not confine himself to any particular device for doing this. The toggle joint shown in the drawing is merely a suggestion of one suitable appliance. In order to prevent too large a flow of current between brushes, an induction coil is connected between each set, as shown, and to the middle point of this induction coil is tapped a constant-current main.

In exciting the field of the converter the direct current in the consumption circuit may be passed through the field winding. If desired, however, a separate source of excitation may be employed. In starting the converter the brushes are separated so that the distance between any two is less than the arc spanned by one commutator segment. The armature windings are thus connected so as to form a closed circuit, and if supplied with alternating current through the collector rings will cause the converter to start into operation, the starting of the converter being the same in principle as the starting of the ordinary rotary converter. After the machine is up to speed and the load thrown on, the further operation of the machine is automatic.

The Railway Exchange Building, now under construction at the corner of Jackson Street and Michigan Avenue, in Chicago, will be a handsome 17-story structure. It is being erected by a number of railroads for the purpose of establishing a permanent location for their general offices and will be large enough to accommodate the interested companies, besides yielding some revenue. The area covered is 171 square feet. The building will be of the most modern design and will cost about $2,200,000.

Independent Telephone Association's Convention in Chicago Next Week.

For the third time in its career the Independent Telephone Association of the United States is preparing to meet in Chicago, the occasion being the seventh annual convention, which will be held at the Auditorium Hotel on June 24th and 25th. The first convention of the association was held in Detroit, Mich., in 1897. Since that time wonderful strides have been made in the Independent field, and the organization has grown in importance. It is intended to make next week's convention the largest and best of all the annual gatherings, although it will be difficult to exceed the records of

JAMES M. THOMAS, PRESIDENT INDEPENDENT TELEPHONE ASSOCIATION.

several former conventions, notably those of '99, 1900 and 1901. However, Secretary J. B. Ware of Buffalo and the local committee are working hard to make a record-breaker, and reports from out-of-town telephone men indicate a large attendance.

Aside from the excellent programme, which is given below, the Chicago committee of arrangements, consisting of J. G. Ihmsen, H. D. Critchfield, W. Forman Collins, Henry Shafer, A. E. Barker, C. W. Stiger, H. B. McMeal and J. R. Dare, has provided a number of entertainment features, principal of which is a trip to San Souci Park on Wednesday evening, June 24th, at which popular summer garden a special programme has been arranged for the amusement of the visitors.

The officers of the Independent Telephone Association of the United States are: President, James M. Thomas, New York, N. Y.; first vice-president, Hugh Dougherty, Bluffton, Ind.; second vice-president, C. E. Stinson, Rochester, N. Y.; third vice-

JOSEPH B. WARE, SECRETARY INDEPENDENT TELEPHONE ASSOCIATION.

president, W. H. Durin, Cedar Rapids, Iowa; secretary and treasurer, Joseph B. Ware, Buffalo, N. Y.; first assistant secretary, C. E. Wilson, Philadelphia, Pa.; second assistant secretary, Ed. L. Barber, Wauseon, Ohio; third assistant secretary, T. B. Lee, Pittsburg, Pa. The advisory board consists of James M. Thomas, Hugh Dougherty, H. D. Critchfield of Chicago, E. B. Fisher of Grand Rapids, Mich., S. E. Wayland of Scranton, Pa., S. P. Sheerin of Indianapolis, E. E. Webster of Minneapolis and H. C. Young of Columbia, Pa.

Following is the programme that has been arranged:

WEDNESDAY AFTERNOON (JUNE 24TH).

2 p. m.—Address of welcome by Hon. Carter H. Harrison, mayor of Chicago.

Response by Hon. S. P. Sheerin of Indianapolis, Ind.

Annual address of President James M. Thomas.

Roll-call of states for 10-minute reports.

"Advantages of Association." Paper by Hon. C. E. Hull, Salem, Ill., president Interstate Telephone Association.

"The Telephone and the Technical School." Paper by J. C. Kelsey, professor of telephony in Purdue University, Lafayette, Ind.

"Independent Telephone Development in the South." Paper by C. E. Stinson, president Memphis Telephone Company, Memphis, Tenn.

"Western Telephone Development." Paper by J. S. Bellamy, Knoxville, Iowa.

WEDNESDAY EVENING.

6 p. m.—Concert in Auditorium Hotel.

8 p. m.—Special train to San Souci Park. (A special programme of entertainment will be given at the park.)

THURSDAY.

10 a. m.—"Patent Litigation." Committee report by Hon. Hugh Dougherty, Bluffton, Ind., chairman.

"The Value of Good Work." Paper by C. E. Tarte, general manager Citizens' Telephone Company, Grand Rapids, Mich.

"Eastern Telephone Development." Paper by F. A. Demarest, general manager Interstate Telephone and Telegraph Company, Trenton, N. J.

"Present and Future." Paper by Frank L. Beam of Columbus, Ohio.

General business.

Election of officers.

An important feature of the convention will be the report of the committee on patent litigation, of which Hon. Hugh Dougherty of Bluffton, Ind., is chairman.

J. G. Ihmsen, chairman of the local committee of arrangements, announces that special hotel and railroad rates have been secured, and it is hoped that the attendance will equal, if not surpass, any of the previous conventions, which have been held as follows: 1897, Detroit; 1898, Chicago; 1899, Chicago; 1900, Cleveland; 1901, Buffalo; 1902, Philadelphia.

Boston Edison Improvements.

On June 9th the Massachusetts Railroad Commissioners held a hearing on the petition for authority to issue 20,000 new shares of stock at $200 a share, presented by the Edison Electric Illuminating Company of Boston. There was no opposition. Charles L. Edgar, president of the company, stated that on December 31, 1902, the company had notes payable amounting to $683,000, and that appropriations for the year brought the gross debt up to $780,000. The balance due on capital stock was $384,000, leaving a net debt of $396,000. The budget for 1903 amounts to $2,510,000, plus five per cent. for contingencies, or $2,635,500. Of this amount the new L Street station in South Boston will cost $1,347,000 and the coal plant on the harbor will cost $103,000. The year's expenditure for tubes and cables is estimated at $328,326.

The following are the prices paid for suburban electric companies: Milton Light and Power Company, $71,000; Dedham Electric Company, $135,000; Blue Hill Electric Company, $76,000; Natick Gas and Electric Company, $188,000; Framingham Electric Company, $134,000; Woburn Light, Heat and Power Company, $269,000; Somerville Electric Light Company, $627,000; Needham Company, $30,000; Chelsea Gas Light Company, $287,000; Newton and Watertown Electric Company, $412,000; total, $2,229,000. These companies' stock amounts to $723,000, bonds $239,000, other debts $330,000, a total of $1,292,000, which the Edison company will meet by part of the proceeds of the new stock.

The net debt on December 31, 1902, the budget for 1903, and the cost of the companies amount to $5,260,000. Deducting undivided profits amounting to $300,000 and unissued capital stock amounting to $1,730,000, leaves a debt of $3,230,000. New lamps, service, meters, a new unit in the power station, and general extensions in 1904 are estimated as costing $1,610,000. This would make the debt $4,490,000 on December 31, 1904. Of this amount the company wishes to fund $4,000,000 in the additional stock for which it asks authority to issue. The Edison company paid $125 a share or about 25 per cent. of the valuation for the Newton and Watertown company and $300 per share or about 50 per cent. of the valuation of the Chelsea company.

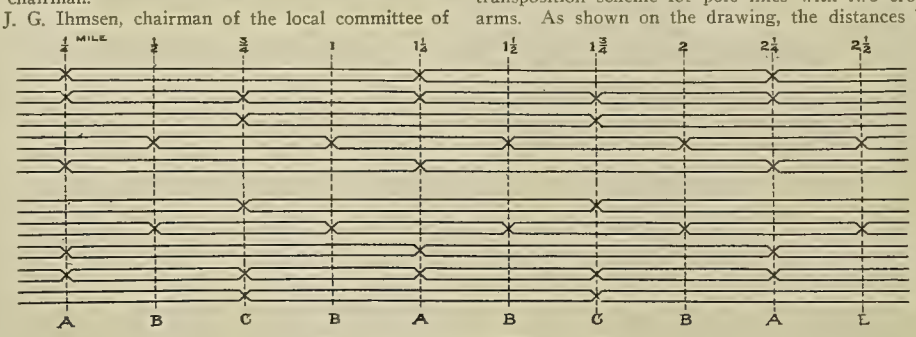
Transposition of Telephone Lines.

A Georgia correspondent of the Western Electrician submits the following "trouble" statement: "We have a two-arm, 10-pair, No. 14 B. & S. gauge copper line between our main and sub-exchange. During the day we get the familiar noise from the motor of the trolley line, and at night the buzzing noise from alternating-current circuit. We can detect slight cross-talk on our tests, but this is not of a serious nature. The lines are metallic and free from grounds. Will you kindly suggest a good scheme for transposing these lines?"

ANSWER.

While the inquiry does not specify what the distance is between the main and branch exchanges, the fact that cross-talk is present would appear to indicate that it must be considerably over one mile. In the absence of any information in relation to the circuit arrangement in the main and branch exchanges—i. e., in respect to the connections to the switchboard circuits—it might be stated that if the wires are not transposed the noises of the trolley and electric-light circuits will be present as well as the cross-talk.

The accompanying diagram shows the standard transposition scheme for pole lines with two cross-arms. As shown on the drawing, the distances be-



TRANSPOSITION OF TELEPHONE LINES.

tween the transposition points are marked in steps of one-quarter miles. If this scheme is followed out correctly and the distance strictly adhered to, then the circuits of the Georgia inquirer should become quiet after the transpositions have been effected. This is with the assumption, of course, that the exchange terminals of the trunk circuits are not in any way so transposed as to throw the line out of balance or ground one of the wires of a pair.

International Telegraph Conference.

The ninth International Telegraph Conference is now in session in London, England. The first session was held on May 26th and meetings will be held daily throughout the month of June. Nearly every civilized nation of the earth was represented at the opening. The United States sent no delegate, but was represented by Gen. A. W. Greely, chief signal officer of the army, who went of his own volition, having no vote in the convention.

The proceedings, which are held in private, were opened by Hon. Austen Chamberlain, postmaster-general of Great Britain, who welcomed the delegates. Mr. J. C. Lamb, principal delegate of Great Britain, was chosen president of the conference, and Mr. John Ardron and Mr. P. Benton, vice-presidents.

One of the chief propositions before the convention is that a new international vocabulary of about 4,200 words be adopted. General Greely is opposed to this proposal and did all in his power to have it shelved, which will no doubt be done. In speaking of the new vocabulary General Greely said that it would mean the complete revising of all American cable codes, and every other cable code as well, which would mean a waste of a great deal of time, as well as of money. One thing which the convention brought about, and which the general thought was of great benefit, was a rule that in future groups of five letters may be counted as one word; for instance, formerly "U. S. A." would count as three words, now it will count as one.

The entertainment feature of the programme is prominent. Many dinners, excursions and parties are given daily. The principal entertainment feature so far was the dinner given at the Hotel Cecil by the submarine telegraph companies, for which 450 invitations were sent out. The cable companies were admitted to conference in 1871. The application of the Marconi people for admission to the conference was denied on the ground that it did not do an international commercial business. To carry out the plans as now arranged the conference will be in session until July 1st.

The city of Derby, England, has decided to substitute electricity for its present inferior horse-railway system. The sum of $440,000 has been appropriated for the purpose as a beginning. The length of road now contemplated exceeds six miles. The overhead trolley will be used.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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DATES AHEAD.

Independent Telephone Association of the United States of America, Chicago, June 24th and 25th.

American Society of Mechanical Engineers, Saratoga, Springs, N. Y., June 22d to 26th.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

International Association of Municipal Electricians, Hotel Rudolf, Atlantic City, N. J., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

IT IS gratifying to note that the effort to provide for an International Electrical Congress to be held in St. Louis next year in connection with the exposition has advanced to such a stage that an organization committee has been appointed. This action means, undoubtedly, that the congress will be held; and that the gathering will advance the interests of electrical science and be a great success in every way cannot be doubted. The organization committee is a strong one and embraces many well-known names. Its duties will be to make the arrangements for the congress, to decide on the programme and membership, to awaken interest in the project and to provide the necessary ways and means. Professor Thomson and his colleagues will doubtless experience no great difficulty in executing this commission (unless in the matter of naming participants in the congress), and we wish them all success in executing their pleasurable task.

WE recommend to our telephone readers a careful perusal of the article by Mr. H. P. Clausen on "The Equipping of Telephone Exchanges," published in this issue. The writer considers three sizes of telephone exchanges—300, 1,200 and 3,000 lines' capacity—and shows what, in his judgment, is the most economical equipment for each installation. This is, of course, a question of fundamental importance to all persons contemplating the establishment or extension of a telephone exchange, and to the non-technical man—and, indeed, to not a few technical men as well—it constitutes a perplexing problem. Mr. Clausen is a specialist in the intricacies of telephone-exchange design, which he has studied with enthusiasm for years; and in the article in question he states his conclusions clearly, giving fully the reasons which actuate him in making his recommendations. The result is an article of real value from an expert who states his opinions honestly and unequivocally.

DIVIDED telephone switchboards have met with much opposition in this country, but it is interesting to note that the subject seems to be attracting attention in England at the present time. Not particularly as representing our own views, but as an interesting contribution to the literature of telephone engineering, we print in this issue a long abstract of a paper recently read before the Institution of Electrical Engineers in Great Britain on "Divided Multiple Switchboards." This paper was written by Mr. W. Aitken, and the author advocates the divided board with considerable ingenuity and force. Mr. Aitken has designed some improvements on the divided-board system as known in this country, and, although his arguments may not convince the advocates of the well established trunking system, he is entitled to a respectful hearing, for the large central exchange divided into sections has certainly some decided advantages to recommend it, although most American engineers will contend that practical disadvantages of operation outweigh them.

DEEP-SEA cable-laying is a comparatively new branch of industry for Germany, but results of considerable significance have been attained in the comparatively short time in which the Fatherland has turned its attention to this important aspect of international relationship. During the last seven years Germany has laid 7,375 miles of cable at a cost of over $7,000,000. The new era began with the laying of a line to Vigo, Spain, a distance of about 1,300 miles. In 1898 a cable, 73 miles in length, was laid between Sassnitz and Trelleborg, and in 1899 German Southwest Africa was connected with the international telegraph system by a cable 154 miles long. In 1900 the first German-American cable between Emden and New York, via the Azores—a distance of 4,813 miles—was laid. The construction of a second transatlantic cable between Emden and New York, via the Azores, has been commenced, and it will, it is expected, be completed before the expiration of the next year. These facts are contained in a recent report of Richard Guenther, United States consul-general at Frankfort, who further states that the growth of German interests, both military and commercial, will in the future require the building of more cables by Germany, independent of foreign nations. The United States has lagged behind European nations in the building and laying of long submarine cables, although, as in the case of Germany—but not to so great an extent—something has been done of late years. Although the Spanish war showed that it was possession rather than ownership of the cables that was important in wartime, it may nevertheless be questioned whether we might not, with advantage, take a leaf out of Germany's book in the matter of the extension of home-made cables. For instance, it would be gratifying if the American Pacific cable, now being laid by an American company, was a product of the United States and not of Great Britain.

ONE thing that stands to the credit of the Independents in the telephone field is the high class of workmanship and material put into their later exchanges. The case of the Seattle plant, described and illustrated in this issue, is in point. The pictures and text show an entirely modern, carefully designed and well constructed telephone installation, such as would be a credit to any company, whether Bell or Opposition. The Independents have certainly done great things in stirring up and enlarging the telephone field. In addition, they have, of late, furnished some very excellent examples of telephone construction. No one conversant with the telephone situation can deny, we think, that the Independent telephone interests have played a prominent and worthy part in bringing the telephone service of the United States to its present stage of efficiency. And this influence has been not only direct, by establishing thousands of new exchanges, by improvement of apparatus and by new inventions, but it has also indirectly been of great service in applying a sharp stimulus to the Bell companies, by which their service, also, has been greatly improved. Two telephone systems in one city may be a nuisance—perhaps; but certainly, viewing the matter in its broadest aspect, the Independent activity has been of great value to the art of telephony as practiced in this country.

CHICAGO is the favored meeting place for telephone conventions. It has had every meeting of the young but vigorous Interstate association, and next week will entertain the national association, or the Independent Telephone Association of the United States of America, to give it its full title, for the third time. This should be an important meeting. The gathering of last year in Philadelphia was not a wholly satisfactory one in attendance and interest, and it is hoped this year that the meeting will equal or excel those of 1901 and former years, which were certainly as enthusiastic and well attended as one could wish. The fact is not to be disguised that the formation of the Interstate association weakened the national organization to some extent. The newer association is a compact body representing the states where the Independent movement has its chief strength and it represents, generally, enthusiasm and new blood. On the other hand, the national body has done important work in defending patent litigation and has the rights of the pioneer in the field. There has been some talk of a combination of the two societies, but whether this will come to anything remains to be seen. It is to be remembered that by an express constitutional provision the Interstate association is pledged "to cooperate with and assist the Independent Telephone Association of the United States of America in its undertakings in the general Independent telephone interests." Many telephone men are interested in both organizations, and Mr. Ware, the efficient secretary of the national association, is a member of the executive committee of the younger society. Whether any steps toward amalgamation will be taken is perhaps doubtful, although the subject will undoubtedly be discussed, but perhaps not in the open convention.

The programme is a short one, and there should be ample time for technical and business discussions. The report of the patent-litigation committee will be awaited with interest, and perhaps some action leading to the more extensive building of toll lines will be taken. The Wisconsin state association has abandoned its summer convention because of dates conflicting with next week's Chicago convention, and the Minnesota association has voted to send a delegation. These indications seem to show that a large attendance, particularly of western telephone men, may be expected.

Canadian Electrical Association.

The thirteenth annual convention of the Canadian Electrical Association was held on June 10th to 12th in the new King Edward Hotel, Toronto, said to be one of the finest hotels on the continent.

In the absence of Mayor Urquhart, Aldermen Starr and Ward welcomed the delegates to the city.

Under the able secretaryship of C. H. Mortimer the membership has increased very rapidly during the last year, until now it numbers 375. In addition to a very large attendance of members, many visiting electricians and supply men were registered from the United States, among whom were J. F. Thorne, Westinghouse company, Pittsburg; H. B. Kirkland, American Circular Loom Company, New York city; R. J. Russell, Wagner Electric Manufacturing Company, St. Louis, Mo.; Frank G. Bolles, Bullock Manufacturing Company, Cincinnati, Ohio; P. H. Hover, New York Insulated Wire Company, New York city; A. P. Munning, Cutler-Hammer Manufacturing Company, New York city; Charles F. Scott, Westinghouse Electric and Manufacturing Company, Pittsburg; Robert T. E. Lozier, Bullock company, Cincinnati, and others.

The chair was occupied by B. F. Reesor, manager Electric Light and Power Company, Lindsay, Ont., the popular president of the association. In delivering the annual address he said that during the year that had passed the question of long-distance power transmission had engrossed the minds of capitalists to a greater degree, perhaps, than at any previous period in the history of the country. Rapid strides had been made in development in this direction, and at the present time some very extensive plants were contemplated and under construction, notably around the Niagara Peninsula, and, when completed, Canada could boast of having some of the largest and best-equipped electrical installations in the world. He called attention to the fact, and asked the members not to lose sight of it, that the tide of municipal ownership was in full flow, and there were municipal councils and individuals with whom it had become somewhat of a craze, or, in other words, a case of "municipalities gone mad." During this great unrest the members should not forget that vested interests were at stake and must be taken care of. Millions of money in Canada had been invested in lighting and power development by individuals and companies, which had been sanctioned, and in many cases induced, by the very corporations and municipal bodies who were looking with longing and covetous eyes and clamoring for a business that had been carried from an experimental stage until it had become, to all appearances, a factor of considerable importance in every-day commercial life.

An invitation was received from the mayor of St. Louis, and also from the Business Men's League of that city, inviting the association to hold its convention there next year during the Louisiana Purchase Exposition, when an International Electrical Congress would be held during the month of September.

John Yule, manager of the Guelph Light and Power Company, presented the report of the committee on legislation, in which it was stated that the underlying principles of the Conmee bill were considered and admitted to be a reasonable protection to those who had developed the lighting business to its present proportions. There was a danger, however, that in the future some amendments might be made to the act which would endanger this position, unless carefully watched, and might seriously affect the values of the members' properties. An amendment which had been discussed in the Legislature was one under which municipalities could compel companies to sell to them or give the right of expropriation to the municipalities. Thus far the committee had been successful in opposing any such amendments, and it asked for a better financial support, as its work was not being overestimated when it was stated that millions of dollars had been saved to the electric-lighting companies.

O. Higman of Ottawa presented the report of the committee on arc-light rating, stating that, owing to the transition stage in which arc lighting is at present, it would not be desirable to bring in a report recommending a standard for arc lighting; the movement has been first from the old open-arc light to the enclosed and the alternating, and now there was the Nernst lamp as a disturbing element; and it would be quite impossible to lay down hard and fast lines as to what shall constitute an arc light. The original intention of the government in this matter had been to induce the companies to abandon the old method of making their contracts in terms of candlepower. Frequently the department had been called upon to settle disputes between municipalities and electric-lighting companies, and with the method of making contracts above referred to it was quite impossible to do anything in the premises.

Charles F. Scott of the Westinghouse Electric and Manufacturing Company, Pittsburg, retiring president of the American Institute of Electrical Engineers, read a paper on "The Training of the High-tension Engineer," which had been prepared by Paul M. Lincoln of Pittsburg, which Mr. Scott supplemented with much useful information. Prof. R. B. Owens of McGill University, Montreal, discussed this paper from the college standpoint, and while he agreed with Mr. Scott that the school of experience was the one in which the engineer must receive his education, still it was acknowledged that the college graduate who had been thoroughly grounded in the principle, made, as a rule, the best engineer, and the electrical manufacturing companies were giving the preference to these men. He spoke of the willingness of the manufacturing companies to impart practical information to any graduate or engineer who would take the trouble to visit their works.

A very practical paper was read by R. T. E. Lozier of Cincinnati, Ohio, on the subject of "Variable-speed Motors and Their Relation to New Shop Methods," in which he laid considerable stress upon the adaptability of the individual motor and the collateral advantages to be derived from it in connection with the other features of new shop methods, and said that the individually applied motor went a long way toward enabling the new shop methods to place in the hands of the employer a means of discounting the demand of the labor union for shorter time and higher wages, which means consisted of working his men and his tools at a far higher rate of efficiency, the ultimate result of which was a much greater output, despite the increase in pay-roll and the shortening of the hours worked. This paper was discussed fully and ably by many of those present.

"Some Points Relating to Submarine Electric Power Cables" was the subject of a paper by Mr. G. U. G. Holman of Quebec, in which he fully detailed the work of construction and the difficulties encountered afterward in connection with a submarine power cable belonging to the Canadian Electric Light Company which supplies 1,000 horsepower to the Quebec Light and Power Company in the city of Quebec, the cable being laid on the bed of the St. Lawrence River, the terminal-cable bells being approximately 3,400 feet apart. Mr. Holman good-naturedly answered many questions which were asked of him by those interested.

R. J. Russell of St. Louis, Mo., who is connected with the Wagner Electric Manufacturing Company, presented a paper on "Single-phase Motors as a Means of Increasing Station Earnings" and stated that no large degree of success in the production of a single-phase motor had been attained until the present form of induction motor built by his company was placed upon the market. The paper gave a full description of this motor and the advantages to be derived from it.

A paper on "High-tension Transformers" was read by J. W. Farley of the Westinghouse company. It contained much valuable information.

The social features of the convention consisted of a tally-ho drive by courtesy of the Canadian General Electric Company; an excursion, by special steamer, and band concert, at Toronto Island; a visit by special cars to the works of the Canada Foundry Company, by courtesy of the company, and the annual banquet at the King Edward.

On Friday morning the election of officers and selection of the place for holding the next convention took place. Hamilton, Ont., was selected as the place of meeting for 1904. The following-named officers were elected:

President—J. J. Wright, Toronto.

First vice-president—K. B. Thornton, Montreal.

Second vice-president—A. A. Wright, M. P., Renfrew.

Secretary-treasurer—C. H. Mortimer, Toronto (re-elected).

Executive committee—John Yule, A. B. Smith, P. G. Gossler, A. A. Dion, Gordon Henderson, B. F. Reesor, C. K. Greene, C. B. Hunt, J. A. Kammerer and H. O. Fisk.

Votes of thanks were passed to those who had contributed to the success of the meeting, after which the association adjourned.

Electricity and Steam Contests on German Railways.

Tests are soon to be made of electricity and steam-propelled trains on the Prussian state railways between Hamburg, Hanover and Berlin. The leading locomotive builders and electrical firms in Germany have been invited by the state to submit designs and specifications for steam and electric locomotives or motor cars capable of a speed of 100 miles an hour with the light load of ordinary traffic.

The tests will be a continuation of the trials of high-speed electric trains on the Prussian standard-gauge military line from Berlin to Zossen, accounts of which have been published in the Western Electrician, and have been arranged on account of the decision to increase the speed of the trains between Hamburg, Hanover and Berlin. It must be borne in mind that the Berlin-Zossen line of 14 miles, over which exceptionally high speed has been attained, is practically straight, having no curves of less than a 6,560 feet radius, with no gradients. But German engineers are agreed that a speed of over 60 to 65 miles an hour is practically commercially impossible on the ordinary tracks, owing to the existing curves, and that the maximum of speed has been reached.

Steam Consumption of Turbines.

[From the Question Box of the National Electric Light Association.]

Question.

What is the steam consumption in pounds per horsepower-hour in steam-driven turbines operating against a back pressure of from five to seven pounds; initial pressure at the throttle, 150 pounds to 175 pounds?

Answers.

W. S. Barstow, New York city: Steam consumption is steam-driven turbines is not based upon pounds per horsepower-hour, as there is no way of indicating. The performance of the steam turbine in general is as good as that of the best type of engine for the same conditions.

H. T. Hartman, Philadelphia: The steam consumption in pounds per brake horsepower-hour, with steam-driven turbines operating against a back pressure of five pounds and with initial steam pressure of 150 pounds, was recently given us by a prominent manufacturer as between 34 and 36 pounds. Operating under these conditions, special arrangements have to be made to keep the oil in the bearings. With steam turbines it seems to be essential to maintain a high vacuum to obtain good efficiency.

Henry E. Longwell, Westinghouse Machine Company, Pittsburg: I do not know of any direct experiment that has ever been made to determine this point. We have a good knowledge of the steam consumption of turbines exhausting against atmospheric back pressure, and also of condensing turbines running under various conditions of vacuum. From the data obtained we can estimate with full confidence what results are to be expected under unusual conditions.

A turbo-generating set will transform from 50 per cent. to 52 per cent. of the total available energy of the steam into electrical energy. For example: A pound of dry saturated steam working between limits of 150 pounds initial pressure and a vacuum of 28 inches, has 322 British thermal units available for doing work. The heat equivalent of a horsepower-hour is 2,545 British thermal units, and consequently the steam consumption of a perfect engine would be 7.6 pounds per horsepower-hour. An actual engine converting 50 per cent. of the available energy into work would therefore require 15.2 pounds per electrical horsepower-hour, which agrees closely with actual tests.

A pound of dry saturated steam working between limits of 150 pounds initial pressure and atmospheric back pressure, has 173.5 British thermal units available for conversion into work. The ideal steam consumption is, therefore, 14.7 pounds per horsepower-hour. Assuming again, an efficiency of 50 per cent., the actual steam consumption would be 29.4 pounds per electrical horsepower-hour. As a matter of fact, as the difference of pressure between admission and exhaust grows less, the total efficiency improves slightly, and in the case of atmospheric exhaust the actual steam consumption is nearer 29 pounds. Making a similar calculation for seven pounds back pressure, the initial pressure remaining the same, we find 149 British thermal units available in each pound of steam, corresponding to an ideal consumption of 17 pounds and an actual consumption of not more than 34 pounds, with a strong probability that it will not exceed 33 pounds.

It must be understood that the results given above are only for turbines designed especially for the given conditions. It is impossible that a turbine designed to give the best results when running with a high vacuum should give reasonably good performance when exhausting against seven pounds back pressure. Conversely, a turbine designed for operating against seven pounds back pressure would give very indifferent results when run condensing. The case is exactly analogous to that of the compound engine. We can build an efficient condensing engine which is not at all adapted for exhausting against seven pounds back pressure, and we can build a very excellent engine for operating against seven pounds back pressure which would not have a very creditable record when run condensing. We could also build either a turbine or a compound engine of a sort of mongrel type that would be neither very good nor very bad under either extreme condition of operation.

I suspect that this question is prompted by some one who is interested in the problem of utilizing the exhaust steam from a central station, under a considerable back pressure, for steam heating in winter, and still being able in summer to operate condensing with the highest degree of economy. If this be the case, it might be pertinent to add that there is no type of engine, either reciprocating or turbine, that with the advent of the heating season can be easily and quickly altered into an efficient non-condensing machine and as readily put back into its original condition when the summer season is on. It is my belief that the turbine principle can be satisfactorily employed in the design of such an engine, and if the demand were sufficiently great to warrant the necessary development work, and if manufacturers could get a little ahead of the demand for turbines of standard design, there is every probability that such a machine would soon be an accomplished fact.

The buildings for the use of the National Bureau of Standards of Washington, D. C., are well advanced toward completion. The mechanical laboratory is nearly done, and considerable work has been done on the physical laboratory.

Water Purification by Ozone at Niagara Falls.

On Friday, June 12th, Mr. Otto, a French scientist, demonstrated most successfully the process of purifying water by the use of ozone. The demonstration took place in the plant of the Atmospheric Products Company, on the lands of the Niagara Falls Power Company, and was witnessed by officials of the cities of Lockport and Niagara Falls. The purposes of Mr. Otto's visit to this country were briefly set forth in the Western Electrician of May 16th.

The ozonizer used in the test was a cast-iron cylinder three feet long and about 18 inches in diameter. On the inside of this cylinder a shaft was set with circular fans or disks, each having a section removed to prevent the electric current from arcing. A current of 50,000 volts was turned into the ozonizer. The disks revolved at the rate of 30 revolutions per minute, and a series of brush discharges took place. Air was passed through the cylinder, and as it came in contact with the brush discharges the oxygen was burned or transformed into the peculiar molecular state called ozone. This ozone was discharged into two pipe lines which were connected with a brick sterilizing tower on the outside of the building. One of the ozone pipes entered the tower at the top and the other at the bottom. The unpurified water enters the sterilizing tower at the top, meeting the ozone in an emulsor or mixer, the contact causing a spray formation. When this contact of the ozone and water occurs there is a strange luminosity, and this is said to be an indication of violent oxidation by means of which, it is said, all the living germs in the water are destroyed, while the organic matter is partly burned up.

From this point and after this initial treatment the water flows slowly down through the sterilizing tower, which is partly filled with granite. As it percolates through the tons of granite it is met by an ascending stream of ozone, and all the organic life that escaped the first contact is removed or destroyed, the water being discharged at the base of the tower clear and practically pure, ready for domestic use. It is said that a plant of from 30 to 40 horsepower will treat 6,000 tons of water a day.

A very concentrated ozone is necessary in the case of very impure water. Mr. Otto admits that the purified water smells of ozone for the first few moments after leaving the sterilizing tower, but he asserts that the water itself does not contain even the slightest trace of ozone, the original taste being unaltered. He explains that ozone is but a particular molecular state of oxygen, and the use of it aerates water, proof of which is found by the action of the ozone in reducing the water to a spray in the emulsor at the top of the sterilizing tower.

It is stated that the foreign matter usually met with in water is air, carbon dioxide, salts of lime, magnesia and the alkalies, silica and organic matter. The ozone, as explained by the inventor of the process, removes only the objectionable animal life and organic matter and does not interfere with the very necessary mineral properties in the water.

The commissioner of health of Chicago has recommended that a plant to test the ozone process for the purification of water be installed and maintained in connection with the Rogers Park pumping station.

Damage Done to Electrical Properties by the Kansas City Flood.

One of the heaviest losers in the recent floods in Kansas City was the Metropolitan Street Railway Company of that city. Three of the bridges carried away were owned by this company. Both power houses, located upon opposite sides of the Kaw River, were rendered useless and will doubtless remain so for some weeks, as nearly all of the machinery was covered by the flood. A conservative estimate places the loss to this company at $1,000,000. The gas and electric-light service in Kansas City was shut off for two nights, and the street-railway service was interrupted for a considerable period.

Bert C. Haldeman, city electrician, and F. J. Fetter, insurance inspector, were determined that no fires should start in the flood districts on account of defects in electrical wiring. With a large corps of assistant inspectors they visited every building in the east and west bottoms. Wherever their testing apparatus showed that a circuit was not working properly, they removed the connections with the feed wires and posted the following warning: "The use of electric current in this building for light or power until permitted by joint certificate of the city electrician and insurance inspector, is prohibited. The use of the current for any floors, except those specially designated in the permit, will invalidate such permit, and subject all of the current entering the building to be cut off indefinitely."

After the wires were cut off at the first inspection the owners of the buildings were required to see that their wires and machinery were repaired. Then they are to notify the inspectors, who, if, upon examination, find the electrical apparatus in good condition, will issue the desired permit.

The currents will be turned on as fast as the inspectors can complete their work. At the end of last week it was stated that the first lights in the bottoms will be the arc lights in the Union Depot and two street lights. The next lights will be the street lights. Then will come the power currents necessary in the bottoms. It will be about 10 days before the machinery is ready for use, as most of it will have to be rebuilt after its soaking. Later still the incandescent lights will have been inspected and be ready for the current.

The telephone and telegraph companies were notified to take care of their fallen wires at once. There will be great danger to life and property should these wires remain in their present condition when the current is turned on through the electric-light wires, which they touch in many places.

WORLD'S FAIR NOTES.

Contracts Awarded.—Among the contracts recently awarded and approved by the executive committee are the following: With Smith & Eastman to extend the traveling crane in Machinery Building 240 feet, $4,442.53; with Westinghouse Electric and Manufacturing Company for switchboard at a net cost of $14,500; with Union Electric Light and Power Company of St. Louis to furnish the exposition power (minimum of 6,000 kilowatts and maximum of 7,500 kilowatts) at total minimum cost of $338,976. The contract with the American DeForest Wireless Telegraph Company for the erection of a wireless station on the World's Fair Grounds for communication with Chicago, Kansas City and other points, which had been made by the committee of concession, with the approval of the executive committee, was approved.

Electric Chairs.—The Electric Chair Company, recently incorporated in St. Louis, of which Mr. Gus B. Brecht is president, is now testing several automobile chairs with a view to furnishing service on the grounds and in the buildings of the exposition. This automobile chair, the invention of Semple S. Swift, is peculiarly adapted for exposition needs, its maximum speed being three miles per hour. It is driven by a small motor and is supplied with several cells of storage battery, sufficient to run it for about five hours. A very low fender, extending entirely around the front part of the chair, is so arranged that the slightest pressure on it will open the motor circuit and stop the chair at once. It is thus impossible to run over any object standing over six inches from the ground. The chair will seat two persons, side by side, one of whom may be a guide supplied to operate the chair and point out places of interest. The chair is steered with a lever, similar to that used on light automobiles, and is controlled entirely by one lever at the seat.

This automobile chair is only one of a large number of transportation devices offered to the Concessions Department. These include the roller chair which was used at the Chicago Exposition; also the ingenious electrically operated chair, so arranged that the occupant can drop a coin in the slot and thus make the machine capable of operation for a certain time. When this period has expired, by dropping another coin, it will be put into service again. A chair of this pattern will soon be sent to St. Louis for trial.

Lighting Test.—Chief Engineer Rustin has just completed a test of the lighting of the west half of the north front of the Education Building. Test lamps were inserted in all of the sockets on this portion of the building and current was turned on through the feeders which will supply the lamps with current during the exposition, these having been in place for some months. The test had a double purpose, first, to observe the effect of the lighting, and, second, to test the capacity of one of the engines installed in the temporary power house. Despite the fact that a considerable number of the lamps had not been turned home in their sockets, and were therefore dead, the effect was entirely satisfactory to Mr. Rustin, whose design it was. The "lamping" of the rest of the building will be finished at once and another test made when more power is available.

The power at present available is not sufficient to light adequately more than a quarter of the Education Building, as the present plant consists of but two engines, one of which supplies the arc-lamp circuits on the grounds, while the other is too small to carry more than a small portion of the lights on one of the big buildings.

Model Ticket Office.—One of the novel exhibits in the Transportation Building will be a railway-ticket office, in full operation, from which tickets to any part of the world, as well as sleeper and steamship tickets may be obtained. This office will be a great convenience to out-of-town visitors in many ways. It will have a bureau of information and baggage room and all the other important conveniences and special features of a first-class railway station. It will be circular in form and located in the center of the building. Mr. E. L. Masqueray, chief designer, is the architect.

Magic Whirlpool.—The "Magic Whirlpool" has just been approved as a concession by the executive committee. It consists of a giant annular waterfall, 60 feet in diameter and 40 feet high, of real water. The spectator is taken in a boat along the very brink of this fall, making two circuits of the ring over which the water pours; then suddenly the boat is drawn beneath the falls and plunges in a circular sweep to the bottom. The boat enters a tunnel in which are spectacular effects, which the designers call by such fantastic names as "The Spotted Rat," "The Menagerie," "Demon's Kindergarten," "Bridge of Sighs," "The Dance of the Phosphorescent Phantoms" and "The Haunted Castle." This tunnel leaves the boat on a circular platform, surrounded by water, where it receives a whirling motion, designed to give the spectator a sensation such as he would receive if he were whirled about in a seething maelstrom. The whirling motion is accompanied with flashes of lightning and rolls of thunder, the dropping of rain and the sighing of wind. After this terrifying experience the boat suddenly emerges with its load in the center of the basin into which the big waterfall plunges. Here an electric fountain that spouts real water to a height of 60 feet is installed, and around this the boat makes several circuits, landing finally close to the entrance to discharge its passengers.

Concessionaires give the name "ballyhoo" to the exhibition given outside in front of the show to entice the visitors within. The ballyhoo design for the "Magic Whirlpool" is noteworthy. The entire front of the installation will be open to the view of the public, and every person walking along Concession Street will be able to see the plunge of the big waterfall and the chute of the boats behind the water. The electric fountain will also be visible. The trip along the brink of the waterfall is made by means of a cable to which the boat is attached mechanically, but which the spectator does not see. The descent behind the falls is made by gravity. The trip through the tunnel is also accomplished by means of the cable. The whirling motion of the whirlpool is imparted by a belt, to a platform. The speed of the whirl can be regulated by the operator. The spectacular effects within the tunnel are produced as in the ordinary scenic railway or aquarama by the throwing of an electric switch by the boat in its passage. The entire length of the passage is about 2,000 feet. The boats are capable of seating six persons each. The building space needed is 100 by 300 feet.

The concessionaires are Robinson & Bayliss. Fawcett Robinson, the senior partner, is the designer of the annual parade of the Priests of Pallas, Kansas City's Veiled Prophet, and Edward M. Bayliss, the junior partner, is a St. Louisan who has conducted concessions at previous expositions, notably "The Land of the Midnight Sun," at Buffalo. The concessionaires picturesquely epitomize their production as "a tour of thrilling pleasure from the crest of beautiful waterfalls, encircling a sparkling fountain by curving canal, spiral chute and subterranean tunnel through the center of the great storm-girt whirlpool."

Chicago Party for Institute Convention.

The annual convention of the American Institute of Electrical Engineers will be held at Niagara Falls, N. Y., on June 29th to July 3d, and it is expected that a large party will go from Chicago and other western points to attend this meeting. The delegation will leave Chicago on Sunday, June 28th at 5:20 p. m., in a special car on the Michigan Central "New York State Special" train, arriving at Niagara Falls at 7:30 a. m. Monday morning. A rate of a fare and one-third for the round trip has been granted on all the roads.

Tickets will be on sale from June 27th to July 1st, and are good returning until July 7th. It is earnestly desired by the Chicago Branch that as many members as can possibly do so will attend this meeting, as it will be full of technical interest and will offer, at the same time, an opportunity for a visit to many points of technical and historical interest about the Falls. The Chicago transportation committee consists of Homer E. Niesz, 139 Adams Street, chairman; T. P. Gaylord and Van Rensselaer Lansingh.

To Determine the Absolute Value of the Ampere.

Preparations extending over six months in charge of Professors Carhart, Patterson and Guthe, at the University of Michigan, have been completed and an experiment of value to science, to determine the exact value of the ampere, will soon be tried. If the experiment is successful, the government will be asked to change the present law stating the value of the ampere, which is the amount of current that will deposit 1.118 milligrammes of silver a second from a specifically prepared solution of silver nitrate. This is the law also in European countries and is slightly in error. Scientists have several times attempted to correct the last figure. The Michigan professors have constructed an absolute dynamometer. It is not affected by heat, cold, moisture or gravitation. No instrument quite similar has ever been used before.

New York State Independent Telephone Associations Combine.

The adjourned annual meeting of the New York State Independent Telephone Association was held at Butterfield House, Utica, on June 10th. The association was called to order by the president, George R. Fuller of Rochester, who delivered the opening address. The president regretted that so little had been done to add to the membership and financial strength of the association since the meeting had been adjourned last year, and added: "There has been a feeling that we could not do vigorous, profitable work, until there had been a complete, harmonious fusion of all factions, and all honest, sincere friends of Independent telephone work in the Empire State had joined hands, and all interests had become cemented in one strong united organization. Since our organization in July last, exchanges have been opened and are being operated in Buffalo, Albany, Troy, Elmira, Binghamton, Jamestown, Ithaca, Canandaigua, Penn Yan, Lockport, Batavia, and dozens of smaller towns in the state, representing in all a million people or more. Add to these Niagara Falls, Medina, Albion, Brockport, Rochester, Geneva, Auburn, Syracuse and many other populous towns through the state to the very gates of the metropolis, where prosperous exchanges were in operation previous to a year ago, what power or unsavory methods of our special opponent can prevent our further progress, development, popularity and prosperity, and the rapid uniting of this vast population with Independent connecting lines?"

The address was closed by the submission of the question of the advisability of so amending the constitution as to admit to membership the manufacturers of telephone apparatus and supplies, possibly giving them a representation for the submission and discussion of papers referring to the welfare of the association and its members without the right to a vote.

It will be remembered that two rival state associations of Independent telephone men were formed at Rochester when the New York State association was organized. Soon after the conclusion of President Fuller's address a committee on membership was appointed, consisting of Messrs. Brush, Ferris, Davis, Edwards and Brailey. This committee advocated amalgamation with the "Buffalo association," and formal resolutions to carry out this idea were adopted.

The election of officers resulted as follows:

President—George R. Fuller, Rochester.

First vice-president—Howard Hendrickson, Albany.

Second vice-president—J. H. Scofield, New York city.

Secretary and treasurer—J. B. Ware, Buffalo.

Executive committee—H. H. Persons, Buffalo; B. G. Hubbell, Buffalo; S. B. Rawson, Niagara Falls; Edward Davis, Binghamton; T. H. Ferris, Utica; J. S. G. Edwards, Gloversville; J. S. Brailey, Jr., Herkimer, and C. O. Harris, Rochester.

Inspectors—C. H. Poole, Utica; C. O. Harris, Rochester.

Two papers were read—one by Charles O. Harris of Rochester upon the Independent growth in the state of New York, and the other by Mr. Potter on "Uniformity of Toll Circuits." Martin Carey, attorney for the Frontier Telephone Company of Buffalo, made a few remarks, followed by Senator H. H. Persons of Buffalo, vice-president and general manager of the same company. J. B. Ware of Buffalo also gave a short talk on the development of the telephone in the East.

It was decided to hold the annual meeting of the association on the first Thursday in June.

A reception was tendered the visitors by the Utica Home Telephone Company at the close of the meeting. Mr. Ferris extended the invitation, which was gladly accepted by nearly all present.

Among those in attendance were: S. A. Coe, Orleans County Rural Telephone Company, Lyndonville; Charles H. Poole, Utica Home Telephone Company, Utica; T. Harvey Ferris, Utica Home Telephone Company, Utica; W. D. Fuller, Norwood Telephone Company, Norwood; B. H. Brownell, Rural District Telephone Company, Morton Telephone Company, Buffalo; J. B. Ware, Inter Ocean Telephone Company, Buffalo; B. G. Hubbell, Consolidated Telephone Company, Inter Ocean Telephone and Telegraph Company, Geneva Telephone Company, Ithaca Telephone Company, Corning Telephone Company, Penn Yan Telephone Company, and other exchanges, Buffalo; F. H. Sudro, Citizens' Standard Home Telephone Company, New York city; J. F. Spockwell, Ontario Telephone Company, Oswego; J. A. Crawford, Franklin County Telephone Company and Racket River Telephone Company, Hamden; J. S. Edwards, Glen Telephone Company, Johnstown; E. C. Aiken, Auburn Telephone Company, Auburn; E. L. Barber, Rome Telephone Company, Rome; J. S. Brailey, Jr., the Herkimer County Telephone Company, Herkimer; H. H. Persons, Frontier Telephone Company, and Haines Telephone Company, Buffalo; Boyd McDowell, Elmira Telephone Company, Elmira; William C. Geer, Rensselaer Telephone and Telegraph Company, Troy; W. Lewis Burk, Saratoga Telephone and Telegraph Company, Saratoga Springs; F. M. Brush, Cohoes-Waterford Home Telephone Company, Elyria, Ohio; J. Fagen, County Telephone Company, Herkimer; J. H. Griswold, West Shore Telephone Company, Catskill; Howard Hendrickson, Albany Home Telephone Company, Albany; H. J. Prince, Jr., Watervliet-Green Island Telephone Company, Albany; S. M. Strong, Schenectady Home Telephone Company, Schenectady; F. E. Hicks, Granville Telephone Company, Granville; John A. Driscoll, Seneca-Gorham Telephone Company, Ontario County; D. Odell, Rome Home Telephone Company, Rome; J. B. Marquis, Jr., Marquis Telephone Line, Norwich; F. A. Smith, New Berlin Telephone Company, New Berlin; George G. Otis, Colonial Telephone Company; Newburgh; W. W. Capron, Oneonta Telephone Company, Oneonta; Sam B. Rawson, Independent Union Telephone Company, Elmira; J. H. Griswold, Dunkirk Home Telephone Company, Dunkirk; W. H. Kelley, Newark Telephone Exchange, Newark.

TELEPHONE MEN.

Walter G. Campbell of St. Paul, superintendent of equipment of the Twin City Telephone Company, died suddenly on June 6th of appendicitis.

V. W. Eaton has resigned as manager of the Minnesota Central Telephone Company at Wadena, Minn., and has accepted a position with a North Dakota company.

William W. Dean, the well-known telephone engineer, formerly of the Western Electric Company and later with the Kellogg Switchboard and Supply Company, has accepted a position as engineer with the Consolidated Fire Alarm Company of New York.

John Ainsworth of Zanesville, Ohio, will within a short time succeed Division Manager Bush at the Columbus office of the Central Union Telephone Company, the latter going to the Pacific Coast. Mr. Ainsworth has been the manager of the Zanesville office for some time.

Two telephone men are honored by appointment on the committee of organization for the International Congress of Electricity to be held in St. Louis in September, 1904—K. B. Miller of the Kellogg Switchboard and Supply Company of Chicago and J. J. Carty of the New York Telephone Company.

F. A. Focke, engineer for the Federal Telephone Company, Cleveland, has resigned his place with that company and accepted a position with L. W. Stanton. Mr. Focke's technical training, together with his practical experience in telephone engineering, makes him a valuable man for assisting in the multiple-cable distribution and construction, of which Mr. Stanton is making a specialty.

Frederick P. Fish, president of the American Telephone and Telegraph Company, has been chosen president of the Cleveland Telephone Company, to succeed John I. Sabin, resigned. The other officers are as follows: Vice-president, H. J. Pettingill; secretary, Charles A. Grant; treasurer, J. P. McKinstry; manager, Peter Yensen. It is said that the election of Mr. Fish to the presidency indicates that the American Telephone and Telegraph Company has acquired a controlling interest in the Cleveland company within the last year or so.

L. W. Stanton, consulting and constructing telephone engineer of Cleveland, Ohio, reports that he is working on a number of new installations. Mr. Stanton is making a specialty nf multiple-cable distribution and construction. In party-line work this system is said to be the only system in which the full value of party-line rate is realized. C. E. Kent, who is well known in telephone circles, having been identified with some of the larger Bell and Independent companies, is just completing the work on a new multiple-cable distribution for the addition to the Cambridge Telephone Company's plant. Mr. Kent is in the employment of Mr. Stanton, who has charge of the work.

Growth of the Telephone in England.

In a recent lecture on telephony, delivered in London, Mr. F. C. Raphael reviewed the history of the telephone and criticized in a brief and concise manner the growth of the movement in England from its inception. Speaking of the telephone the lecturer said that, although it was at first looked upon by the government as a toy, yet in 1879—only three years after the invention of the instrument—there were exchanges at London, Manchester, Liverpool and Glasgow. The government then brought its famous action against the companies, with the result that the telephone was declared to be a telegraph; and the telephone company has worked under a license and a heavy tax ever since. At the present time there are more than a quarter of a million subscribers and about 1,100 exchanges in Great Britain; this includes 65,000 subscribers in London, 55,000 of whom are on the National Telephone Company's system and 10,000 on the Postoffice system. Sixty-five thousand subscribers mean over two thousand million possible connections. The telephone exchange system of a large city must necessarily be more expensive per subscriber than a small one, and the lecturer pointed out the difficulties peculiar to London, illustrating this with load curves showing the longer business hours in New York, resulting in a broader and less peaky load curve than in London, with a smaller luncheon interval.

Having described, with the help of a sectional drawing, the construction of the most recent type of Ericsson hand telephone set, Mr. Raphael went on to explain the working of a telephone exchange on the automatic calling and clearing system, such as is used by the Postoffice in its new London telephone exchanges, mentioning incidentally that the Postoffice central exchange has now 7,560 subscribers, its ultimate capacity being 14,400. This part of the lecture was illustrated with numerous lantern slides and a model. Brief particulars as to the organization of the operating staff were also given, and overhead and underground line construction was briefly touched upon. Mr. Raphael then explained how subscribers could utilize their telephones for a number of purposes, of which the majority of subscribers were ignorant; as, for instance, telephoning telegrams, express letters, and even ordinary letters to postoffices. In the latter case, 30 words can be telephoned to a postoffice for transmission as an ordinary letter for an extra charge of one penny in addition to the ordinary charge for postage; and telephoned express letters are delivered at the ordinary express fee (threepence per mile) from the postoffice without extra charge. The lecture was concluded with a reference to the telegraphone, the speaker regretting that this instrument had not yet been developed to form a useful auxiliary to the telephone exchange system.

Fig. 1.

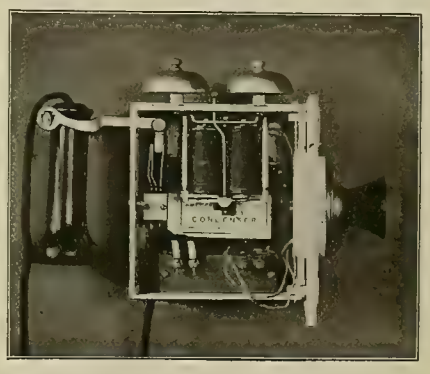


Fig. 2.

NEW HOTEL TELEPHONE.

New Hotel Telephone.

Illustrated herewith is the new hotel type of telephone developed by the American Electric Telephone Company of Chicago. The idea of installing branch telephone exchanges in hotels, with an instrument in each guest chamber, is spreading rapidly, and the telephone manufacturing companies are devising special instruments to meet this demand. The kind herewith illustrated is known as the Philadelphia type, as the name-plate shows. It has an iron casting, hinged in a new and substantial manner, and provided with patented lock-nut device by which the door remains closed and cannot be opened except by the inspector's special key. Fig. 1 is a general view of the instrument, and Fig. 2 is an interior view with door opened. The mechanism consists of 1,000-ohm silk-insulated ringer coils, a two-microfarad condenser, an "American Beauty" transmitter, a Bell style non-adjustable, hard-rubber receiver and a platinum-contact switchhook. The telephone is well made, compact and substantial and is a high-grade instrument.

Telephone News from the Northwest.

The Amo (Minn.) Telephone Company has been incorporated with a capital stock of $45,000.

Work has been started for the construction of a toll line from Ashland, Wis., to Duluth and Superior. It is to be an Independent line and will connect with the Ashland Home Telephone Company.

The Wisconsin Telephone Company and the American Telegraph and Telephone Company are jointly constructing a system of 12 copper circuits from Abbottsford to Ashland, Wis., a distance of about 150 miles.

The Consolidated Telephone Company is rebuilding its exchange at Grantsburg, Wis. The old switchboard of 100 connections is to be replaced by one of double that number. A long-distance line is under way to Frederic. Another line is being built from Stillwater, Minn., to Hudson, Wis., Glenwood, St. Croix Falls, Centuria, Luck and Frederic. From Grantsburg a line will be built to Shell Lake and Spooner, thence to Superior and connecting with Ashland. Connections will also be made at Glenwood with Chippewa Falls, Eau Claire and Menomonie.

The Board of County Commissioners in St. Paul has settled with the Northwestern Telephone Exchange Company for services on the basis of $848. The original bill was about $1,900, but the company offered to cut it in half. A demand was then made to cut off charges for out-of-town calls except where an actual outlay occurred, which was agreed to. A rate of $3.50 for each instrument in the county offices was made to the board.

The Duluth Telephone Company will rebuild its system in Duluth, Minn., and will place the wires underground in the central part of the city. H. B. Willard, who has been contracting agent for the company for 18 months, has been made city manager.

The Northwestern Telephone Exchange Company expects to occupy its new building in Grand Forks, N. D., about July 15th. The company has cut over a new board at Fargo, N. D., on the central energy system. The new exchange building is occupied.

The Wausaukee (Wis.) Telephone Company declared a dividend of six per cent. at its recent annual meeting.

The Norwood Telephone Company will build a line to Chaska, Minn., where it will connect with the line of the Twin City Telephone Company.

An Independent telephone company is being formed by farmers north and east of Ord, Neb.

Joseph A. Lattner of Worthington has sold the Epworth Telephone Company and the Union Telephone Company to the Interstate Telephone Company at Dubuque, Iowa, for $7,500.

The Iowa Telephone Company proposes to rebuild its system in Waterloo. The work will include a new exchange building, an underground system, a new switchboard, etc.

The Nichols Mutual Telephone Company of Nichols, Iowa, has been incorporated.

C. B. Holaday seeks a franchise at Lehigh, Iowa, for a local telephone exchange. The town will vote on the application June 30th.

The Hutchinson (Minn.) Telephone Company is making improvements and extensions to its system. R.

Indiana Telephone Items.

Indiana capitalists have secured control and are operating a telephone system in Bowling Green, Ky.

The Hoosier Telephone Company, recently incorporated with headquarters in Portland, to build a large system reaching out over 21 counties, has elected the following-named officers: President, J. A. M. Adair; vice-president, J. A. Long; treasurer, J. A. Jaqua. The franchise recently granted the company by the Portland council has been vetoed by the mayor. This was done at the instance of a majority of the councilmen who discovered that the document fixed no rate for service nor any time within which the plant should be installed. Another franchise ordinance will be passed making better terms for patrons and the city.

Thirty-five citizens of Nashville cut out the telephone wires from their residences and places of business, as the result of the fight which has been on for 60 days between the Morgan Telephone Company and the citizens. This action on the part of the citizens is due to the company refusing to give free service to Columbus, the county seat of Bartholomew County. The company will be ordered to remove its poles from the streets. The Charnichael Telephone Company will ask for right-of-way into Nashville agreeing to give free service to Columbus.

The Rural Telephone Company connecting Uniondale, Markle, Sheldon and Zanesville and having over 200 farmer patrons will enter the town of Ossian and make connections with a large number of business houses.

The striking linemen at Indianapolis, Anderson and Alexandria are still holding out. Steps were taken last week to organize a state association or federation of electrical workers. The members of the proposed federation say that the state association will come to the assistance of the striking linemen and that electricians will have greater strength and less trouble in enforcing their demands.

The Big Raccoon Telephone Company has filed articles of incorporation with the secretary of state. The capital stock is $4,000. The company proposes to construct and operate a telephone system throughout Vigo and Park counties. The principal office and exchange will be in Bridgeton. J. R. McMiller, James P. Jones, Robert M. Bell and John W. Seller are the incorporators. R.

Southern Telephone Developments.

The Atlanta Telephone and Telegraph Company, successor to the Standard Telephone Company, has filed a mortgage in Atlanta on all of its properties to cover a bond issue of $600,000 for improvements. The Atlanta company paid $750,000 for this property.

The Cumberland Telephone Company will erect an $8,000 addition to its Chattanooga, Tenn., plant and will put in a new $10,000 switchboard.

The Southern Bell Telephone Company is constructing a line from Raleigh, N. C., to Cheraw, S. C. A new exchange has just been completed at Selma, N. C., by the Bell company. The company is working to connect every important town in North Carolina.

A movement is on foot for the organization of a local telephone exchange at Tullahoma, Tenn. A meeting will be held soon to discuss the situation. The Cumberland company is already in the field.

In connection with the erection of a new three-story exchange at Charlotte, N. C., the Southern Bell Telephone Company will install an entirely new system, placing its wires underground. New switchboards have also been ordered. There are now 900 telephones in use.

The Marshville (N. C.) Telephone Company has been chartered with $10,000 capital. H. B. Marsh is among the stockholders.

Archibald Blackshear has been made permanent receiver of the Augusta (Ga.) Telephone and Electric Company. He is instructed to continue the operations of the company.

The sale of the Greensboro, N. C., telephone exchange to the Southern Bell Telephone Company has been consummated, and the latter company has taken charge. The consideration was $70,000. The deal includes the property of the American Telephone and Telegraph Company, which has been preparing to build a system to compete with the Greensboro exchange.

It is reported that the Home Telephone Company of Memphis, Tenn., will build a line from Jackson to Humboldt, Tenn.

The city of Columbus, Ga., has tabled an ordinance requiring all wires in the business district to go underground. Both telephone companies are voluntarily placing their wires underground in the business section.

The Cumberland Telephone Company has a force of men at work putting in a new telephone exchange at Gleason, Tenn. L.

Municipal Electricians' Convention.

The eighth annual convention of the International Association of Municipal Electricians will be held in the banquet hall of the Hotel Rudolf, Atlantic City, N. J., on September 2d to 4th. The executive committee is arranging special features to be presented at this meeting which will make it exceptionally interesting. A topical discussion on line construction is expected to bring out new ideas on this important question, and the Question Box will have its usual place on the programme. Following are the titles of papers that have been promised: "The Best Methods for Lighting Small Cities," "Classifying of Records of Electrical Departments and Standard Specifications for Supplies and Contracts," "Importance of the Fire and Police Telegraph Systems." Special rates have been secured at the hotel, which is one of the largest and most modern on the coast, and is a favorite seaside resort. Communications concerning the convention should be addressed to Frank P. Foster, secretary, Corning, N. Y.

Strikers Fined for Violating Injunction.

Sixteen strikers charged with violating the injunction recently secured by the Kellogg Switchboard and Supply Company were fined $10 each by Judge Holdom last week. By the injunction the strikers were restrained from picketing the company's plant at the corner of Green and Congress Streets, Chicago, or in any way interfering with the men who were at work in the shops. It is said that the union men secured legal advice and were encouraged by attorneys to the extent of ignoring the injunction so far as to approach the men who are still at work, in an effort to induce them to quit. For this violation the fines were imposed. Appeal was taken, and bonds of $250 were filed in each case. In his decision Judge Holdom said: "For a corporation to be compelled to contract with a union to have in its employ only union men is a species of slavery and unlawful."

A recent invention of Howard H. Tunis, Windsor Hills, Maryland, consists of a single-rail car system. The bearing rail is situated underneath the car. Parallel to this bearing rail and above it are two guide or balance rails. Arms pivoted to the top of the car project outwardly and press, by means of wheels, against the guide rails, thereby holding the car in a vertical position.

GENERAL TELEPHONE NEWS.

German Baptists, whose national conference was held at Wakarusa, Ind., recently, voted not to permit their members to use telephones in their homes.

The Sunset Telephone and Telegraph Company is said to be negotiating for a piece of property in Seattle, Wash., on which it will erect a $60,000 telephone exchange building.

The Montgomery County Telephone Company, Dayton, Ohio, has been incorporated with a capital stock of $200,000 by Harry C. Kiefaber, John T. Barlow, L. Rauh, E. C. Canby and J. D. Artz.

The New England Telephone and Telegraph Company is installing an underground conduit system in Pittsfield, Mass. The company expects to occupy its new central exchange in that city by July 1st.

The New Telephone Company of Rock Island, Ill., will increase its capital stock by $150,000. The present capital stock is $400,000. The increase is to be used for extending lines to the large cities of the middle West.

Charles J. N. Woodbury of the New England Telephone Company has bought an estate at Lynn, Mass., containing 19,787 square feet of land and a house of 15 rooms. Mr. Woodbury is to occupy it as a residence.

Communication is now being carried on between Dixon, Cal., and neighboring towns over barbed wire fences. A large switchboard is being installed in the town to provide for the rapidly growing demand for telephones.

The Independent Telephone Association of Florida has been organized at Jacksonville, Fla., for the purpose of bettering the facilities and conditions of all the Independent telephone exchanges in the state. W. B. Mitchell of Sanford, Fla., is secretary.

The Cincinnati and Suburban Telephone Association has acquired control of the property of the Harrison Telephone Company of Harrison, Ohio. The Harrison company owned lines in Dearborn and Franklin County, Ind., which are also included in the deal.

The Independent Telephone Company of Seattle, Wash., has asked the city of Ballard for a 50-year franchise to install a telephone system in that city. The company has agreed to furnish the city its telephones free, charging the residences $2.50 per month and business houses not more than $4.

Construction will soon begin in the rebuilding of the Rocky Mountain Bell telephone line from Wallace to Couer d'Alene City, Idaho. New wires and poles will be used and the undertaking will cost about $10,000. Contracts for poles have been let. The line will run along the old route through Fourth of July Canyon.

N. S. McKinsey of Susanville and A. R. Nelson of Spoonville, Cal., have applied for a patent upon a new selective ringing telephone system by which any person on a party line may ring up another on the same line without disturbing the remaining subscribers. Immediately upon taking down the receiver the calling subscriber obtains complete control of the line.

MANUFACTURERS AND DEALERS.

The Consolidated Telephone Company of Gridley, Ill., has purchased a switchboard and equipment from the Stromberg-Carlson Telephone Manufacturing Company of Chicago and Rochester, N. Y. The latter company has also recently sold switchboard and telephones to the Concord Telephone Company, Concord, Ill.

The International Telephone Manufacturing Company, Chicago, is said to be enjoying a constantly increasing demand for its portable desk telephones. These instruments are especially adapted for central-energy systems, being provided with one of the most positive sliding-contact switches ever invented and with far-reaching, clear and distinct tone transmitters and double-pole receivers, the latter having all parts concealed within the rubber shell. The entire set is artistically designed and rigidly constructed.

The recent statement to the effect that the Modern Electric Company of Burlington, Iowa, has been succeeded by the Modern Telephone Company is erroneous. The fact is that the latter, an operating company, is an offspring of the Modern Electric Company, which is strictly a telephone manufacturing company. The same officers control both companies. The Modern Telephone Company owns the franchise granted to the Modern Electric Company by the city of Burlington as the result of a special election. The Modern Electric Company has recently increased its capital and its business is growing rapidly.

A newspaper correspondent at Peking, China, says that the Italian legation has begun the installation of the Marconi system of wireless telegraph at Peking to communicate directly with ships in the Gulf of Pe-chi-li.

Large Steam-turbine Electrical Plant for Philadelphia Subway.

Perhaps the largest contract of the year for steam-turbine and electrical power machinery has just been closed by Westinghouse, Church, Kerr & Co. with the Philadelphia Rapid Transit Company, covering 15,000 kilowatts of steam turbines and approximately 50,000 kilowatts of electrical generating and converting machinery for equipping the new Rapid Transit subway and elevated system, now under construction in Philadelphia.

The most interesting feature of the equipment to be installed, is that steam turbines are to be used exclusively for power generation in the new central station now under construction. There will be three turbines installed, each of 5,000 kilowatts normal capacity, which will be of the type now being built by the Westinghouse Machine Company for large powers. The turbines will be direct connected to Westinghouse three-phase, 25-cycle generators, and the units will run at 750 revolutions per minute with 175 pounds of steam, 27½ inches vacuum and possibly 100 to 150 degrees of superheat. The three units will operate in multiple upon a common bus-bar, and power will be distributed directly at a potential of 13,000 volts from the station without the use of any intermediate transformers; for this purpose the generators are wound for high potential.

The new power station will be located upon the Delaware River, near the foot of Green Street, and is laid out for an ultimate capacity of 50,000 kilowatts, it being the idea of its designers to concentrate at this point the entire power generating equipment at present distributed among a number of smaller stations. The location of the new station upon the river bank secures excellent coaling facilities and an inexhaustible supply of water for condensing purposes.

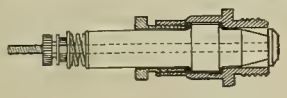
The present equipment will furnish power for the subway and some reserve power for the surface traction system pending the execution of proposed plans for centralizing the entire power system.

The contract also comprises a large amount of transforming and converting machinery, to be installed in the several sub-stations, which will be built at various locations in the district covered by the transit system. This machinery will be used for converting the high-tension alternating-current power received from the power station into low-potential direct current for use directly upon the third rail of the traction system. The first installation will comprise 14 1,000-kilowatt and two 500-kilowatt rotary converters. Each of the 1,000-kilowatt rotaries will be furnished with three 375-kilowatt step-down transformers, and each of the 500-kilowatt rotaries with three 175-kilowatt transformers of similar design. The electrical equipment will be built by the Westinghouse Electric and Manufacturing Company.

The new rapid-transit system now under construction will cover the entire business district of Philadelphia, and includes a two and four-track subway about 1¼ miles in length, extending from the Delaware River along Market Street, to a point near Twenty-third Street, a short distance from the Schuylkill River. At Broad Street an appropriate central terminal station will be erected. The enterprise is one of the most important in the history of American railway development, and the introduction of the steam turbine in such large sizes is another indication of the confidence shown in this comparatively new type of prime mover.

Roche's New Spark Plug.

A new gas-engine sparking plug without points has been designed by William Roche, 42 Vesey Street, New York city, and is shown in the accompanying cut. The central terminal is provided with a head at the inner end which comes in proximity to the edge of the steel shell, and the spark gap is of the form of an annular space all around the head. The insulating core consists of porcelain in a single piece and is packed with asbestos. A



ROCHE'S NEW SPARK PLUG.

coiled spring is placed around the central terminal under the washer at the outer end to prevent the porcelain from cracking when the engine is cooling, owing to the more rapid cooling of the metal than the porcelain. A chamber is formed between the porcelain, outer shell and head, and it is asserted that owing to the passage of gases into and out of this chamber during compression and expansion, respectively, no soot will deposit around the electrode and short-circuit the plug. The plugs are made with three-eighth-inch pipe, De Dion metric and one-half-inch pipe threads.

Intramural Railway at the World's Fair.

It has just been announced by Director of Works Taylor that the intramural railway which will carry visitors about the exposition grounds at St. Louis will be built by the Division of Works itself. Two contracts have already been let, one to the Southern Paving and Construction Company for the grading and the other to the Myers Construction Company for the bridge and trestle work. This work, together with the laying of the tracks, will be done under the supervision of the Department of Civil Engineering. As the amount of work required has not yet been determined, the contracts let were based on a unit figure. This places the exposition in a position to either operate the intramural road itself or to turn it over ready for operation to a concessionaire. Which course will be pursued has not yet been determined.

Since his last report Engineer Weston has materially changed his plans. The present specifications call for a double track throughout the entire length, except at the extreme western end, where the tracks will divide, running on either side of the athletic field. These tracks will loop on either side of the main avenue of the exposition, to avoid crossing it. The line, while operating within a short distance of every building of importance on the grounds, does not once break into the picture, and considerable ingenuity was exercised in thus skirting the grounds and yet serving all the large buildings.

The descent of Government Hill, upon which the United States Government Building will be located, has formed a considerable engineering problem. This hill has a slope of almost 80 degrees, but Chief Phillips of the Civil Department has solved this problem, obtaining less than a three per cent. grade by cutting from Government Hill and constructing a trestle about 1,000 feet in length, which will carry the road from the upper to the lower plateau. A considerable length of construction track already laid will be made use of, the only change necessary being to bond the rails. The civil-engineering department is at present building a stretch of construction track to facilitate the construction of the state buildings, and this track will be put to intramural use when the exposition opens. The intramural will at all points be so constructed as to carry heavy freight trains. This will make it possible to use the intramural tracks both for the bringing in of exhibits and for removing them after the exposition.

The intramural road will be run for the greater portion on the surface, being protected by an ornamental picket fence. The rugged character of the exposition grounds will necessitate five trestles, the longest being that mentioned from Government Hill. The deepest will be that across the ravine southwest of the Art Building. The grade nowhere will be over three per cent. These changes in the plans for the intramural road will greatly lessen the cost of construction, despite the fact that the road has been made double-track instead of single. The estimated cost of the work remaining to be done to complete the line is $253,000.

Sleeping Cars on Interurban Electric Railway.

Two sleeping cars are to be put in service on the electric road between Indianapolis, Ind., and Columbus, Ohio, by the Indianapolis and Eastern Company. The cars, which were built at the Harlan and Hollingsworth shops at Wilmington, Del., at a cost of $38,000 for the two, contain 20 berths each, or 10 compartments. They will be heated and lighted by electricity and are among the first of the kind ever built in this country. The cars are geared to run at a speed of 60 miles an hour, if desired. By the introduction of the cars a considerable saving is effected in the expense of travel from Indianapolis to Columbus. The price will be $2 a berth or $3 for a compartment. This, with the usual interurban fare, which is about half that of the steam roads, will make the sleeper service somewhat cheaper than the steam roads' regular day service.

Lavite.

The new insulating material lavite possesses several qualities which recommend it. It can be easily machined, it has great mechanical and disruptive strength, and also great ability to resist the action of chemicals or high temperatures. Its strength in cross-bending has been found to be from 6,000 to 12,000 pounds per square inch and in compression from 20,000 to 30,000 pounds per square inch. The break-down voltages required in a series of tests with this substance as a dielectric were from 200 to 250 volts per one one-thousandth of an inch, its disruptive strength being high in comparison with other materials such as fiber, wood, asbestos, etc. Aqua regia is the only solvent which will attack lavite, and it is unaffected by temperature up to a cherry-red heat. This substance is made by the D. M. Steward Manufacturing Company of Chattangooa, Tenn.

Chicago Street-railway Situation.

The franchise-extension problem will receive no attention from the City Council transportation committee until after the discussion of the validity of the 99-year act by the Union Traction Company's representatives before Judge Grosscup. Upon the judge's decision will depend the action of the council in the future. The terms on which the Chicago City Railway Company will agree to waive its claims under the 99-year provisions were presented to the council committee for its consideration. The main provisions embodied in the document are:

That the city shall have the right at the expiration of the franchise grant to either buy the tangible property of the company itself or authorize a new company to purchase it on the same terms the city could.

That the price to be paid shall be the fair cash value of the tangible property, exclusive of earning power and franchise rights, to be determined by a board of three appraisers.

That the city agrees, in case it neither purchases the property itself or causes a new company to purchase it, to make a new grant to the old company upon terms then to be agreed on, earning power or the value of franchises not to be included in the basis of the new grant.

That the company, in consideration of these obligations by the city, agrees to waive, in the acceptance of the ordinance, all claims under the 99-year act as well as all other franchises it may now hold through city ordinances.

Mayor Harrison says that the proposition is no waiver at all, and declared that he would demand an absolute waiver, preferring to litigate the 99-year claims before he would consent to a compromise as suggested by the Chicago company.

Plans for reconstructing the roadbed of the elevated roads are being discussed with a view to deadening the noise caused by passing trains, especially on the Union Loop. Some engineers say that the plan adopted in Berlin of laying the rails in concrete is practicable, but this opinion is not shared by some of the officials. The extension of the Lake Street elevated line to Maywood, Harlem, River Forest and ultimately to Fox Lake seems probable, although nothing definite has been done. Corporation Council Walker has given an opinion to the council in regard to compelling the elevated roads to carry children under the age of 12 years for half fare. The city has this power according to the opinion, and an effort will be made to effect the reduction.

The Supreme Court of Illinois, in a decision given in the mandamus proceeding instituted by the city of Chicago nearly two years ago to compel the West Chicago Street Railway Company to lower the Van Buren Street tunnel to give a clear depth of water of 21 feet, has sustained the city's claims in the case. The decision will be a great benefit to lake-shipping trade, and Mayor Harrison says the city will lose no time in exercising its right.

National Electrical Contractors' Association.

The city of Detroit is preparing to offer its hospitality to the National Electrical Contractors' Association of the United States, which will hold its convention at the Light Guard Armory, July 14th, 15th and 16th. This society, which is a federation of 15 state societies, includes in its membership the leading electrical contractors in these states and some from nearly every other state of the Union. In connection with the convention, an elaborate electrical exhibition is proposed, and there is already a large demand for floor space from prospective exhibitors. One company has offered to put on the most elaborate electric display ever seen in Detroit in the way of novelty if given the exclusive privilege. The committee was obliged to decline this offer, though with some reluctance. Frank J. Miner, chairman of the local committee, is doing everything he can to make the meeting a success. Among other things it is proposed to hold a banquet at one of the leading hotels.

Western Union-Pennsylvania Litigation.

The United States Circuit Court of Appeals has refused to modify its recent decree which held that the Pennsylvania railroad had a legal right to remove the poles and wires of the Western Union Telegraph Company from along the right-of-way of the railroad.

The Western Union Company sought to have the railroad company restrained until the United States Supreme Court had reviewed the action of the Court of Appeals in reversing the opinion of the United States Circuit Court of New Jersey, which granted the injunction against the railroad. The decree practically declares that the demolition of the telegraph company's poles and wire by the railroad company was legally justified.

A French botanist is said to have discovered a plant on the plains of the French Congo from the roots of which a fibrous rubber is obtained which may be of great commercial value. Specimens of the plant have been collected in seven different places included in the Lower Guinea and the Lower Congo. An English firm is employing agents to seek the plant in Northern Nigeria.

CORRESPONDENCE.

London Letter.

London, June 3.—The electrical equipment of the 30 odd miles of line of the Northeastern Railway Company is now assuming a more definite shape. As has been previously announced, electrical current for working these lines will be supplied by the Newcastle-on-Tyne Electric Supply Company, which was the first company to supply electricity "in bulk" in the United Kingdom. Originally it was anticipated that with the large amount of generating machinery which this company had erected in its Neptune Bank power station at Newcastle, the demand which would arise in connection with the Northeastern Railway Company's scheme of electrification could easily be satisfied, but so rapid has been the growth of the Newcastle Supply Company's system that the Neptune Bank power house is now fully loaded. Hence it has been decided to erect a generating station specially, in the first instance, for supplying the necessary electrical energy to the Northeastern Railway Company. The following particulars, therefore, of this proposed generating station, and of the scheme generally will be interesting. The generating sets in the new power house will be Parsons 3,500-kilowatt turbo-generators, supplied with steam by Babcock and Wilcox boilers at a pressure of 200 pounds per square inch. Three-phase current will be generated at 6,000 volts pressure and a periodicity of 40 cycles per second. From the power house current will be transmitted to five sub-stations, in which 14 rotary converters will be installed, each having a capacity of 800 kilowatts. From these sub-stations direct current at 600 volts will be supplied to the working conductor, which will be composed of specially high conductivity steel, weighing 80 pounds to the yard. The multiple-unit system of working has, of course, been adopted, and the British Thomson-Houston method of control will be installed. There will be four contact shoes on each motor car, of which there will be two on each train, with one trailer between. This will be the normal train, but, of course, it will be increased when needed. For the freight service, which will be catered for, electric locomotives will be employed. The bodies of the new motor cars are to be built by the railway company's own staff. The coaches will be carried on two four-wheeled bogie trucks, and each motor coach will be fitted with two G.E. 66 motors of 150 horsepower each, both motors being carried on one bogie truck.

At a meeting of the London County Council a few days ago it was proposed to construct 28 miles of additional tramway on the overhead-trolley system, and about 26 miles on the conduit system. The decision to adopt the overhead-trolley system over so large a mileage is being hailed with delight by the opponents of the conduit system.

In connection with the abandonment of the surface-contact tramways at Wolverhampton, the borough electrical engineer has been instructed to prepare a scheme of trolley tramways, and already provisional tenders have been accepted. A sub-committee has been appointed to settle up matters with the Lorain Steel Company.

A committee of the House of Commons and one of the House of Lords have been appointed to jointly consider the question of municipal ownership—a matter which has been receiving serious attention in many quarters in Great Britain lately.

W.

New York Notes.

New York, June 13.—The Independent Telephone Company has obtained from Supreme Court Justice Clark a writ directing Commissioner Monroe of the Department of Water Supply, Gas and Electricity, to show cause why a peremptory mandamus should not issue compelling him to grant to the company the permit to open the streets. The officers of the company state that they secured the necessary franchise under Article 5 of the New York state transportation laws. When, however, they applied to Commissioner Monroe for the necessary permit he refused it, on the ground that the new city charter had repealed the law and vested the granting of franchises in the board of aldermen. The company was organized and incorporated in 1899, with a capital of $100,000, with the privilege of increasing it to $20,000,000. It proposes to construct 100,000 telephones in Manhattan, to run a line over Long Island to Montauk Point, and north in this state to Rouse's Point, besides in the various boroughs comprising Greater New York. It proposes also to pay the city $1 for each telephone installed.

It has been announced that the Brooklyn Rapid Transit Company intends to make the extensions proposed by Chief Engineer William Barclay Parsons of the Rapid Transit Commission for the improvement of transit facilities in Brooklyn. The estimated cost of this work is $20,000,000. The plans provide for the connection of the Brooklyn and Williamsburg bridges by means of a subway in Manhattan, and for extensions of the surface and elevated lines in Brooklyn. They also provide for the removal of the elevated trains from the present bridge to give more room for the passage of trolley cars and trucks. A third track is also to be placed on all Brooklyn elevated lines.

The Long Acre Electric Light and Power Company which has applied for a franchise to lay wires, erect poles and other appliances for the maintenance of a public lighting plant in the Borough of Manhattan is to be given a hearing by the aldermanic committee on water, gas and electricity. This is the company organized and to be run in the interests of the big theatrical managers for the purpose of supplying the theaters which they control. W. W. Walters, one of the managers of the Garrick Theater, said that just as soon as the franchise was given the electric plant would be built at a probable cost of several million dollars. The company says that it will be able to supply electric light at one half the price now charged by the big lighting companies.

Miller R. Hutchinson, whose invention of the acousticon resulted in his being presented with a gold medal by Queen Alexandra of England, has invented a dry-storage battery which weighs but six ounces and can be carried in a vest pocket. The device is of special use to physicians and is adaptable for blasting work.

The Electrical Workers' Union was among those of the skilled trades which seceded from the Board of Building Trades this week. A new organization will be formed to be known as the United Board of Building Mechanics.

Chief Engineer Parsons of the Rapid Transit Commission states that unless Contractor McDonald has an absolutely clear field with no obstruction from labor or other troubles between now and January 1st all hope of having the rapid transit subway completed by that time will vanish. Portions of the subway are practically completed while others have scarcely been touched.

O.

New England News.

Boston, June 13.—The Norwich Street Railway Company has filed a notice of an increase of its capital with the Connecticut secretary of state. The company proposes to add $100,000 to its capitalization, making the total $350,000. The additional capital is needed for extensions. The company has outstanding bonds amounting to $350,000. It operates 17 miles of track and pays dividends of 4½ per cent. Only $11,000 worth of the capital stock is owned by residents of Connecticut, 53 of the 60 stockholders residing outside of that state.

Several buildings at the Charlestown Navy Yard are being equipped with steel shutters which will be operated by an electric motor of 15 horsepower.

Owing to the drouth the soil has become so dry that workmen are unable to tamp the road which the Connecticut Railway and Lighting Company is building between Ansonia and Seymour, Conn. The same trouble is experienced on the road which this company and the Fair Haven and Westville Railway Company are building between Derby and New Haven, Conn. This is greatly retarding the work of construction.

The Corbin Motor Vehicle Company has filed its certificate of incorporation with the Connecticut secretary of state. The company's capital amounts to $200,000, and it proposes to make and deal in motor vehicles, hardware and machinery. It is authorized to purchase the stock of other companies in the same line of business. The officers of the Corbin company are as follows: President, Philip Corbin; vice-president, Charles M. Jarvis; treasurer, Howard S. Hart; secretary and assistant treasurer, Paul P. Wilcox.

Governor Chamberlain of Connecticut has signed the resolution amending the charter of the Stafford Springs Street Railway Company. By the amendment the company can build electric railways from Stafford Springs to West Stafford, Stafford Hollow, Orcutville and Elithrope, Conn., and Wales, Mass. Originally the company had power to build an electric railway between Stafford Springs and Rockville, forming part of the proposed continuous line between Hartford, Conn., and Worcester, Mass. The company's offices are changed from Stafford Springs to Hartford.

In April the Quincy (Mass.) City Council instructed Mayor Bryant to endeavor to secure a contract with the Quincy Light and Power Company, by which the latter should light the streets at a reduction of 10 per cent. in the cost. The company refused to sign the contract and has shut off the current owing to the termination of the old contract.

The Eastern Connecticut Electric Power Company has perfected its organization by the election of the following-named officers: President, F. A. Jacobs of Danielson, president of the Worcester and Connecticut Eastern Street Railway Company; vice-president, R. L. Warner of Boston, of the Westinghouse Electric and Manufacturing Company; secretary and treasurer, Thomas C. Perkins of Hartford, Conn. The other directors are Edwin F. Greene of Lockwood, Greene & Co. of Boston, and Harrison B. Freeman, Jr., of Hartford, Conn. The company can issue stock amounting to $900,000 and can issue bonds amounting to $675,000. It proposes to develop water powers on the Quinnebaugh River in the towns of Plainfield and Canterbury, Conn., and to sell electric power to electric-railway, electric-lighting and manufacturing companies in Windham and New London Counties. Its charter allows it to distribute electric power in Massachusetts. Its water privileges have a capacity of 2,200 horsepower.

B.

Southern Developments.

Charlotte, N. C., June 13.—It is said that $750,000 has been set aside for the improvement of the electric-railway lines of Chattanooga, Tenn., and for the construction of an eight-mile line to Walden's Ridge, pending the consolidation of the three local companies, the Rapid Transit Company, the Chattanooga Electric Railway Company and the Chattanooga Light and Power Company.

The new electric railway from Birmingham, Ala., to Bessemer, 14 miles, will shortly be put in operation. The line has been satisfactorily tested.

The Fayetteville (N. C.) Gas and Electric Company has been incorporated with $33,000 authorized capital, to hold and operate the said property. W. A. McKinney of Washington, D. C., is the largest shareholder.

W. D. Manaw of Charlotte, N. C., has secured the contract for putting in a $10,000 electric-light plant at Lumberton in the same state.

It is said that plans for organizing a new electric-light and power company in Augusta, Ga., are nearing completion. The merchants interested believe they can furnish their own electricity at a saving over the present cost.

The Augusta (Ga.) Railway and Electric Company will enlarge its lighting system at Summerville, involving an expenditure of several thousand dollars.

In the difficulty between the Virginia Passenger and Power Company of Richmond, Va., and the American Association of Street Railway Employes, the company has given an answer to the effect that it cannot sign the agreement presented by the association.

Samuel Cohen and others have petitioned for a franchise to erect an Independent electric-lighting plant in Richmond, Va.

The town of Griffin, Ga., has voted $100,000 bonds for light, water and sewerage.

The Huntsville (Ala.) Railway, Light and Power Company has secured the contract for lighting the city for a period of five years at $75 per light per annum. The contract provides that a new lighting plant shall be erected by December 1st.

Ladshaw & Ladshaw of Spartanburg, S. C., have the contract for developing 20,000 horsepower on Roanoke River, near Weldon, N. C., for transmitting electric power to Norfolk, Va., 90 miles distant.

L.

Information from Indiana.

Indianapolis, June 15.—The organization and incorporation of the Indiana Union Traction Company last week marks the beginning of a stupendous street-railway undertaking. The organization involves the consolidation of the street-railway companies in the cities and towns of the northeastern part of the state through which the Union Traction Company interurban lines now run or will be run. The capital stock is $5,000,000. Horace C. Stillwell is president of the new company and the board of directors are well-known Union Traction Company directors and stockholders. The company's principal office will be in the Union Block, Anderson.

The merging of the Union Traction Company and the Indianapolis Northern Traction Company was completed at a meeting in Anderson last week. Hugh J. McGowan and A. L. Drum, both of Indianapolis, were elected directors to succeed Randall Morgan of Philadelphia and W. K. Schoepf of Cincinnati. Neither Morgan nor Schoepf has withdrawn his interest in the company. The new board now includes George F. McCulloch, Philip Malter, Hugh J. McGowan, A. L. Drum, W. C. Sampson, J. A. Van Osdal of Indiana and J. L. Jones of Philadelphia.

The Booneville council has granted a franchise to the Evansville, Booneville and Rockport Traction Company. Edward Henning and William Threlkeld, representatives of the company, say the franchise will be accepted and the road built at once.

The Louisville and Southern Indiana Traction Company will build a line from Jeffersonville to New Albany by way of Madison. The company stands ready to take up the contracts of the French Lick and West Baden Company and push the work. The Louisville and Southern Indiana has secured entrance to Louisville over the Big Four bridge.

A subsidy of $15,000 has been voted to the Logansport-Frankfort Traction Company by the citizens of Burlington Township, Carroll County. The line will connect Logansport, Darwin, Burlington, Michigantown and Frankfort, and run through a rich agricultural section which is wholly void of railroads.

Some of the interurban companies entering Indianapolis sell tickets to the farmers along their routes which they attach to baskets of produce or cans of milk, and when the car comes along the conductor picks up the can or basket and delivers it to the city. A basket or five-gallon can is carried for 10 cents. This does away with the necessity of the farmer accompanying his produce.

The commissioners of Marion County and the city of Indianapolis have granted a franchise to the Indianapolis Northern Traction Company through the county and into the city over the new College Avenue-Fall Creek bridge. In consideration of the grant the traction company will make the fills for

the approaches to the bridge estimated to cost $15,000.

The Fort Wayne and Southwestern Traction Company carried 51,000 passengers between Fort Wayne and Wabash during the month of May, an increase of 29,000 over May of last year. The average number of passengers per trip over the 49 miles was 50. The company is doing a big package freight business as well.

The Winona electric line running between Warsau and the Winona Assembly grounds was opened last week. The power house is located in the Assembly grounds and is also a lighting plant. The rolling stock and equipment is first class in every particular.

The specifications for the new electric-lighting contract for Indianapolis are completed and ready for advertisement. A contract for public and commercial lighting will be let jointly or separately. The limit of time has not yet been determined—it may be for 10 years or less.

The Bedford Electric Light and Power Company has issued $31,000 in preferred stock to make extensive improvements and install new machinery. F.

From the Buckeye State.

Cleveland, Ohio, June 15.—The Cincinnati, Georgetown and Portsmouth Railroad Company has let the contract for grading the extension of the road from Georgetown to West Union.

The Central Market Street Railway Company of Columbus has received five handsome new cars from the factory at Laconia, N. H., and has 15 more to come. This road is now cutting quite a figure in the local business in that city.

It is stated that the Cincinnati Electric Motor Company of Cincinnati will in a short time change its name to the Barriett Electric Company and will increase its capital stock from $50,000 to $100,000.

The City Council of Youngstown has refused to grant a franchise to the Pennsylvania and Mahoning Electric Railway Company to build a line on Mahoning Avenue and has ordered a lot of tracks already laid to be torn up.

The contract for building the line of the Michigan and Ohio Traction Company between Toledo and Ann Arbor has been awarded and work will be pushed as rapidly as possible. Senator Foraker, M. I. Wilcox of Toledo, and H. C. Clauss of Fremont, and a number of other well-known gentlemen are interested in the new company.

According to reports Manager F. J. Stout has resigned his position with the Lake Shore Electric and will go with a steam road. Mr. Stout was originally a steam road man.

The Cleveland Light and Power Company, Cleveland, has been incorporated, with a capital stock of $100,000, by Robert E. McKisson, Carrie Megger, W. E. Collins and others. Nothing can be learned of the intentions of the promoters.

Dr. J. F. Shrontz of Martinsburg is promoting an electric line between Newark and Mt. Vernon and reports good progress so far.

It is said the Pennsylvania Railroad Company is interesting itself in a traction route down the Ohio River from Allegheny, and that Edward B. Taylor, fourth vice-president, is looking after franchises and rights-of-way. It is thought that four electric roads recently incorporated in Pennsylvania are in the interests of the Pennsylvania Railroad Company.

The officers of the Columbus, Buckeye Lake and Newark Traction Company, elected a few days ago, are as follows: President, S. R. Anthony, Boston; vice-president, Philip Saltonstall, Boston; secretary, Frank W. Merrick, Columbus; treasurer, Chauncey Eldridge, Columbus. The same officers were elected for the Columbus, Newark and Zanesville Traction Company.

The people of Athens will vote on the issue of $15,000 in bonds for a municipal light plant on July 15th.

The Columbus, New Albany and Johnstown Traction Company has re-elected its old officers.

The Marysville Water and Light Company, Marysville, has increased its capital stock from $100,000 to $200,000.

The Cleveland and Sharon Traction Company has filed a mortgage for $2,000,000 to cover a bond issue of that amount. O. M. C.

Michigan.

Detroit, June 13.—The city of Charlotte has declared all the franchises granted for the construction of electric lines as forfeited, as work on the various lines was not commenced within the allotted time. As the Michigan Central Traction Company has already begun work on its line between Grandledge and Lansing, it is probable that when the grading is done up to the city limits the question of franchises will be considered.

The House of Representatives of the state Legislature promptly defeated a measure which was rushed through the Senate to make a radical change in the assessing of the electric lines. Under the present law, the rolling stock of the electric lines is assessed in the city in which are the principal offices, and the new bill proposed to have the rolling stock assessed in the townships through which the cars passed.

H. D. Walbridge of the firm of Hodenpyle, Walbridge & Co., New York, C. M. Clark of E. W. Clark & Co., Philadelphia, G. L. Estabrook of the same city, A. G. Hodenpyle of New York and Mr. Hopkins, general manager of the Columbus (Ohio) Street Railway, were in Saginaw this week inspecting the properties that these gentlemen propose to merge into a syndicate. The electric lines will be much improved and $720,000 spent in betterments.

Surveyors for the prospective Grand Rapids, Muskegon and Hart interurban road have just completed the survey from Muskegon, via Whitehall, Montague and Shelby, to Hart.

The Ohio and Michigan Traction Company, which will construct an electric line from Toledo to Ann Arbor, via Lamberton, Petersburg, Dundee and Azalia, has filed articles of incorporation. The incorporators held a meeting and elected the following-named officers: President John H. Clauss; treasurer, J. W. Pero; secretary and general manager, L. L. Austin; counsel, Willis Baldwin and James H. Southard. C. G. W.

Northwestern Notations.

Minneapolis, June 13.—The Duluth-Superior Traction Company, operating the street-car system of Duluth and Superior, Minn., has contracted with the Great Northern Power Company of Duluth for power to operate the street-railway system, to be furnished by or before July 1, 1904. The street-railway company will have a complete power plant of its own to serve for an emergency.

Congressman John Lind of Minneapolis has been granted a franchise at Excelsior, Minn., on Lake Minnetonka, to install an electric-light plant. The system will be extended to Tonka Bay and Cottagewood and eventually to other points on the lake.

The Des Moines City Railway Company of Des Moines, Iowa, is constructing a levee around its power plant to avoid a repetition of damage by floods. The levee will be of stone, brick, concrete and clay, and will be built four to six feet above the highest point reached by high water.

Ralph Maxwell has been granted a franchise at Lidgerwood, N. D., for an electric-lighting plant.

The Pound Construction Company of Chicago has begun work for the construction of the interurban line to run from Green Bay, Wis., to Kaukauna. A site has been secured at Wrightstown, where a station will be erected. The power plant will contain two rotary units of a capacity of 600 horsepower.

W. J. C. Kenyon of South Omaha, Neb., has completed arrangements for the construction of an immense power plant on the Platte River, near Fremont, Neb. The cost of the dam and the machinery is placed at $3,000,000. Surveys have been made for the work.

The council of Superior, Wis., has directed the legal department of the city to proceed with litigation to test the legality of the street-car franchise. It is claimed that the extension granted the Duluth-Superior Traction Company two years ago is illegal. The company is equipping the larger cars with air brakes.

The Sheboygan and Calumet Railway and Electric Company of Sheboygan, Wis., has been incorporated with $500,000 capital. The company proposes to build a line from Sheboygan to Chilton, where it will connect with the line to be built from Fond du Lac to Manitowoc.

The Triumph Electric Company of Cincinnati secured the contract for the electric machinery for the municipal electric-light plant to be installed for Fertile, Minn.

The council of South Stillwater, Minn., has granted a franchise to the Twin City Rapid Transit Company to extend its tracks from Stillwater to South Stillwater.

The People's Light Company of Davenport, Iowa, has completed extensive additions of machinery to its Brady Street plant and will furnish power to operate the lines of the Tri-City Street Railway Company. The improvements to the power plant have cost about $60,000.

The Western Iowa Interurban Railway Company has elected officers and directed to have a corps of engineers proceed at once with the survey for the line from Des Moines to Council Bluffs.

W. P. Walsh has been granted a franchise at Reinbeck, Iowa, for an electric-lighting plant.

The inside wiremen of St. Paul are on a strike. They demanded an increase in wages from 31¼ cents an hour to 37½ cents. The men claim to have presented the demand for an increase on May 1st and to have repeated it on June 3d without receiving an answer either time.

The Creston and Mt. Ayr electric railway will survey at once from Creston, Iowa, to Arispe, from where it will later be extended to Mt. Ayr.

The Fowler Electric Company of Morris, Minn., has been granted a franchise for an electric-light plant at Sisseton, S. D. R.

Among the Rockies.

Butte, Mont., June 10.—The Sand Point (Idaho) Electric Company has filed articles of incorporation with a capitalization of $25,000. The directors are T. C. Marshall, R. G. Rowland and M. R. Rutherford. The company is formed for the purpose of putting in an electric-light system at Sand Point.

Articles of incorporation for the People's Electric Light and Power Company of Bozeman, Mont., have been filed with the county clerk. The directors are F. L. Benepe, George Handers and M. S. L. Logan. The capital stock is $50,000.

The Gardiner (Mont.) Water and Electric Light Company has been granted permission to erect poles, string wires and lay water mains in the town of Gardiner. The Gardiner River will furnish power to operate the plant. It is expected to have the lighting system in operation by July 1st. H.

Salt Lake City, Utah, June 10.—A proposition to issue bonds to the amount of $20,000 will be submitted on June 15th to the citizens of Springville, Utah, the money so raised to be used for the installation of an electric-light and power plant.

The La Sal Mountain Telephone and Electric Company is the name of an incorporation recently organized at Moab, Utah. The object of the company is to build a power plant and operate electric-light and telephone systems. The officers are as follows: President, Harry Gree; vice-president, John Walsh; treasurer, V. P. Martin; secretary and manager, J. M. Corbin.

A franchise for the operation of street-railway and electric-lighting plants has been granted by the City Council of Trinidad, Colo., to Frank P. Read of St. Louis. A plant will be installed at an approximate expense of $500,000. G.

On the Pacific Slope.

San Francisco, Cal., June 11.—Articles of incorporation have been filed by the Kaweah River Power Company with a capital of $2,500,000. The incorporators, headed by Leon M. Hall, electrical engineer of Oakland, Cal., are backed by eastern capitalists who propose to install an electric power plant on the Lemon Cove Ranch. Twenty thousand horsepower can be developed at this point for transmission 150 miles south at 60,000 volts. The new company has a valuable market for electricity for light, heat and power purposes. Electric pumping for irrigation, and the operation of electric railways and mining works are also included in the service which it is proposed to give.

The Portland General Electric Company is making extensive improvements to its plant in Portland, Ore. About $250,000 will be expended in the purchase of machinery for installation at the North Portland station.

The Council of Riverside, Cal., has granted a franchise to H. E. Huntington to construct and operate an electric railroad along certain streets in Riverside.

The Los Angeles Railway Company of Los Angeles, Cal., will construct another large sub-station on the Plaza at a cost of $300,000. This company already has two sub-stations nearing completion, one near Agricultural Park and the other near Westlake Park. The Pacific Electric Railway Company has completed a large station at Eastlake Park and extensive storage batteries are being installed in all of the stations.

The Mt. Whitney Electric Company of Visalia, Cal., will extend its power line from Lemon Cove to Antelope Heights, a distance of nine miles. The company will erect a new sub-station at the Heights and electric power will be transmitted throughout that part of the country.

Articles of incorporation have been filed by the Dunsmuir Water, Light and Power Company, with a capital of $100,000. The incorporators of the company are J. B. Dougherty, Charles Gill, C. O. Clarke, J. M. Campbell and A. Andrew. The principal place of business of the company is Dunsmuir, Cal.

F. F. Graves & Co. have been granted a franchise for the construction and operation of telephone, telegraph, messenger, burglar and fire-alarm systems in South Pasadena, Cal. A.

PERSONAL.

As might be expected, it is officially denied that there is the slightest foundation for the newspaper report that Colonel R. C. Clowry is to resign the presidency of the Western Union.

Forest D. Varnum, inspector of electric wires for the city of St. Paul, Minn., has been appointed a member of the state board of electrical examiners, succeeding Charles L. Pillsbury, resigned.

E. B. Gunn, superintendent of the Richmond (Ind.) Street and Interurban Company's lines, has resigned. He will, it is said, accept a similar position with the interurban systems that center at Columbus, Ohio.

The chief premium given by the Institution of Electrical Engineers in connection with papers read before it during the session just closed has been awarded to Dr. J. A. Fleming, F. R. S., for his paper on "The Photometry of Electric Lamps."

President J. L. Wolf of the Elgin, Aurora and Southern Traction Company and of the Aurora, Elgin and Chicago Railway Company has decided to remove from Aurora to Chicago, where he can better attend to the interests of the companies.

Mr. Lucien Serraillier, who represents Great Britain's World's Fair Commission in St. Louis, has received a list of the commission's committees. The committee on machinery and electricity consists of Col. Sir Herbert Jekyll, R. E., K. C. M. G. (chairman); Sir James Kitson, Bart., M. P.; William H. Maw, Esq., M. I. C. E.; Sir William H.

Preece, K. C. B.; Alexander Siemens, Esq., M. I. C. E.; J. W. Swan, Esq., M. A., F. R. S., and J. H. Cundall (secretary). This committee will undoubtedly be divided to form two committees

Professor Albert Kingsbury has resigned the position of professor of applied mechanics at the Worcester Polytechnic Institute to accept a position as mechanical engineer with the Westinghouse Electric and Manufacturing Company at Pittsburg, Pa.

W. W. Churchill of New York, vice-president and chief engineer of the Westinghouse, Church, Kerr Company, was in Detroit recently, and in company with Alex Dow and W. S. Austin made an inspection of the new Edison Company's plant at Delray.

At the recent annual meeting of the electric lighting commission of Detroit E. H. McCurdy was elected president and Bernard Ginsburg vice-president. The salaries of secretary and electrician were increased from $1,500 to $1,650, and Capt. Wm. M. Daly was reappointed general superintendent.

At the recent commencement exercises at Columbia University the honorary degree of doctor of laws was conferred upon Peter Cooper Hewitt of New York. This graceful recognition of the work done by Mr. Hewitt in developing the mercury-vapor lamp and converter will be appreciated by his friends.

President H. H. Vreeland of the Interurban Street Railway Company of New York city will go to London in July, and, in response to an invitation received from Secretary Lyden McCassey of the Royal Commission on London Traffic, will testify before that commission as an expert in urban railroading.

Charles R. Henry, president of the Indianapolis and Cincinnati Traction Company; George F. McCulloch, president of the Union Traction Company, and Hugh J. McGowan, president of the Indianapolis Terminal Company, have purchased homes in Indianapolis, the three residences costing in the aggregate $210,000.

The board of regents of the University of Wisconsin has elected Professor M. E. Cooley of the University of Michigan to be dean of the College of Engineering, to fill the place of the late Professor J. B. Johnson. In event of the non-acceptance of Professor Cooley, the present acting dean, Professor Turneaure, will remain in charge of the College of Engineering.

The Courier Journal of Louisville, Ky., recently contained the following announcement: "Mrs. Ida Foree Bolling announces the engagement of her daughter, Miss Alice G. Bolling, to Mr. Eugene H. Abadie of St. Louis." Mr. Abadie has been one of the leading young electrical business men in St. Louis, and was recently appointed vice-president and general manager of the Elblight Company of America. For a number of years Mr. Abadie has been also one of St. Louis' leading society men, a member of the University and Merchants' clubs of St. Louis. The news of his engagement to one of Kentucky's fair daughters will be pleasantly received by his friends. Miss Bolling is a young lady of charming personality and is one of the belles of Louisville. Mr. Abadie is to be congratulated.

Alphonse Fteley, an engineer of prominence both in the United States and Europe, died at his home at Park Hill, Yonkers, N. Y., on June 11th. He was born in France in 1837 and was a graduate of the Polytechnic School of Paris. He occupied a number of engineering offices in Europe until 1865 when he came to the United States. Up to three years ago Mr. Fteley was the consulting engineer of the Panama Canal Company, and nine years before this declared himself as favoring the Panama Canal as the best way of cutting through the isthmus. He had held many prominent engineering positions, principally in Boston and New York, at the time of his death being consulting engineer of the Metropolitan Water and Sewer Board of New York. Mr. Fteley was a member of the Century Club and of the American Society of Civil Engineers.

ELECTRIC RAILWAYS.

The Council of Wrightsville, Pa., has passed an ordinance giving the York and Wrightsville Traction Company of York, Pa., the right to lay tracks on specified streets of the borough. This is the first movement toward the building of the proposed electric railway from York to the Susquehanna River. The new line will pass through the villages of Stony Brook, Hellam and Stoners. From Wrightsville an extension will be built to Wild Cat Falls.

The Rapid Transit Company of Philadelphia will abandon the use of the open trolley car after this summer. Experiment has shown that the large aisle cars are more desirable, so these will supplant the open cross-seat trolleys. The increased number of accidents in summer resulting from the use of the open cars and the consequential long list of damage suits have made the transit-company managers determine to make the change. Then, too, it is believed that the new style is more satisfactory to the public.

A. B. DuPont, vice-president of the St. Louis Transit Company, has recently executed a contract with the Electric Storage Battery Company of Philadelphia for the installation of a 3,000-kilowatt storage battery, to be used in a rotary sub-station with rotaries having a capacity of 6,000 kilowatts. The battery will regulate on the fluctuations and assist in caring for the morning and evening peaks. The sub-station is in the center of the city, and this installation is one of the extensions being made for the purpose of caring for the increase of traffic. It is interesting to note that this contract represents the largest individual installation of storage batteries in the world for railway service.

SOCIETIES AND SCHOOLS.

At the annual meeting of the New York Electrical Society on June 10th the officers who had been previously nominated, as mentioned in last week's Western Electrician, were elected. The reports read showed the society to be in prosperous condition.

A large tower clock having four dials 12 feet in diameter has been built for the University of Chicago by the Chicago Manual Training School. The theoretical and time calculations were made by the instructor, Mr. E. B. Ferson, but the drawings, patterns and machine work are the work of the pupils of the school—boys ranging from 14 to 18 years of age. A 64-page booklet has been published by Mr. Ferson giving diagrams and a full description of the clock, together with detailed information concerning the school.

The first annual convention of the American Railway Mechanical and Electrical Association will be held at Saratoga Springs, N. Y., on September 1st to 4th. The association now has 75 members enrolled and a successful convention is assured. Papers will be read on the "Care and Maintenance of Car Bodies," "Improvements in Street Car Motors," "The 'M' Type of Control," "Use and Abuse of Controlling Mechanism," "Shop Kinks" and "Car Shop Practices." Notices concerning railroad rates, etc., will be given out later. Walter Mower of the Detroit (Mich.) United Railways is the secretary.

PUBLICATIONS.

A booklet on "Lavite," the new insulating material, is sent on request by the D. M. Steward Manufacturing Company of Chattanooga, Tenn.

The Northern Electrical Manufacturing Company issues a motor catalogue showing, among other things, applications of spherical, vertical and back-geared motors.

Bulletin No. 8, issued by the De Laval Steam Turbine Company, 78 Cortlandt Street, N. Y., is devoted to train lighting with De Laval steam turbines. Diagrammatic illustrations of turbines and dynamos are given and also diagrams showing wiring and cable connections for train lighting.

The World's Fair Bulletin for June is devoted principally to the dedication ceremonies of last month and is a richly illustrated and particularly interesting number. Provided with a cover in colors depicting the discovery of the Mississippi by De Soto, the magazine forms a valuable record, with many well-executed pictures, of the three-day celebration marking the dedication of the Louisiana Purchase Exposition.

Volume II. of The Blue Print, the annual of the Engineering Society of the University of Nebraska, is out. Among the articles presented are the following: "The Utilization of Waste Heat from Steam Boilers," by Prof. C. R. Richards; "The Heating Value of Some Coals Sold in Nebraska," by Prof. C. R. Richards; "The Electric Arc and Furnace," by Herbert S. Evans, and "The Independent Telephone Movement," by Guy A. Joy.

"Electricity in Mining" is the subject of a tasteful booklet published by the Westinghouse Electric and Manufacturing Company of Pittsburg. The advantage of electric power over other means of transmission in mines is clearly shown. The company manufactures all kinds of mining machinery, such as electric generators, motors, pumps, air compressors, fans, blowers, etc., all of which are well illustrated and described in the booklet. Illustrations are given of a number of plants which are installed and successfully working. The book will be sent to anyone upon request.

Morehead tank and return traps are clearly described and illustrated in a brochure issued by the American Blower Company of Detroit, Mich. A return trap is a device which receives the water of condensed steam from whatever source and automatically delivers it into the boiler at practically the temperature due to the pressure at which the steam is condensed. It is located six feet or more above the water line of the boiler. The tank trap holds the steam in check in a heating, cooking or drying apparatus until it is condensed, thus preventing waste of steam. Power-plant superintendents will be interested in the pamphlet in which these traps are described.

The Turner Brass Works, 23 North Franklin Street, Chicago, are distributing to the trade copies of their new 56-page catalogue on gasoline torches and other gasoline appliances. The pamphlet is fully illustrated and describes several new styles of double-jet torches and other appliances recently placed on the market. The "Old Reliable" torches and "Straight Turner" brazing forges have been favorably known to mechanics for several years, but the Turner gasoline Bunsen light and manyscope, Franklin torch, crucible furnace outfits, pressure indicating pump and several new styles of double-jet torches are shown in this catalogue for the first time. A full description of the Turner double-jet torches is given, explaining the underlying principles. The demand for these torches is increasing, as mechanics are proving to their own satisfaction, it is declared, that they save one-half the time on every job.

TRADE NEWS.

W. B. Dugane and Joseph Cowan have formed a partnership at Cedar Falls, Iowa, in the electrical supply business.

Charles L. Pillsbury of Minneapolis has purchased the electrical contracting business of W. J. Bonwell of St. Paul, conducted as the Northwest Engineering Company, and will continue the business.

Sealed proposals will be received until July 14th for the construction (including plumbing, heating apparatus, electric wiring and conduits) of the U. S. Postoffice at Winston, N. C., in accordance with the drawings and specifications, copies of which may be had at the office of the postmaster at Winston, N. C., or of James Knox Taylor, supervising architect, Treasury Department, Washington, D. C.

The Electric Storage Battery Company of Philadelphia has recently closed another large contract for the installation of Chloride accumulators on the Pacific Coast. The Seattle Electric Company has contracted for 154 cells to be installed in the Post Street Station at Seattle, to be used in connection with the lighting load. These elements will have a capacity of 14,400 ampere hours, and, aside from caring for the peak, one of the most important features in connection with the installation is its value as a reserve. The containing tanks for this battery will be of sufficient size to allow an increase of 25 per cent. in capacity.

The Nernst Lamp Company of Pittsburg, Pa., has established a maintenance bureau for the purpose of supplying users of Nernst lamps with new burners or holders, so it will not be necessary for the customer to visit or call upon the electric-light stations when one of his lamps gives out. The maintenance bureau makes a contract to supply to its customers a certain number of extra holders which are kept in a box especially made for this purpose. The user simply takes one of these extra holders and replaces the old one with it, returning the old holder to the box, which is called for by a messenger attached to the maintenance bureau.

BUSINESS.

W. T. Reynolds of Minneapolis, Minn., the well-known producer of white and red-cedar poles, states that he is now in a better position to make quick shipments and right prices than heretofore, supplying nothing but the best stock. Mr. Reynolds is recognized as one of the leading pole men of the Northwest and has furnished some of the largest consumers of poles in the United States.

Francis Raymond III., manufacturers' agent, who has been of late energetically pushing the transformer business of the Moloney Electric Company of St. Louis throughout the Chicago territory, reports a most excellent trade. Mr. Raymond makes a business of handling only high-class specialties, and his success with the Moloney transformer is characteristic of his usual energetic business methods.

The Gordon Battery Company of New York calls attention of the members of the telephone association and those in attendance at the convention to the Gordon cell. The company will have an exhibit at the convention and extends a hearty invitation to all to call and look it over. Gordon cells are particularly well adapted for telephone uses, central energy, switchboard, etc., as certified to by the well-satisfied telephone companies and manufacturers who are using them. The company has a Chicago office at 358 Dearborn Street in charge of E. M. Deems, and is represented by the Wrenn Commercial Company, 515-519 Mission Street, San Francisco, as sole agent for the Pacific Coast.

A partial list of engine sales for May, 1903, of the Allis-Chalmers Company, Chicago, is as follows: Northwestern Elevated Railway Company, Chicago, one 34 and 70 by 60-inch, heavy-duty Reynolds-Corliss; Tintic Mining and Developing Company, Salt Lake City, Utah, one 12 by 50-inch, heavy-duty Reynolds-Corliss; Munising Paper Company, Munising, Mich., two 20 and 40 by 42-inch, heavy-duty Reynolds-Corliss; Illinois Steel Company, Chicago, two 24 and 60 by 48-inch duplex Reynolds-Corliss; East Rockford Mantel Company, Rockford, Ill., one 22 by 48-inch Reynold-Corliss; Gluck Mills, Anderson, S. C., one 18 and 38 by 48-inch Reynolds-Corliss; St. Louis Exposition, St. Louis, Mo., one 44 and 94 by 60-inch combined vertical and horizontal Reynolds-Corliss; Calumet and Arizona Mining Company, Arizona, one 12 by 15-inch geared hoisting engine; Board of Public Works, Kansas City, Mo., one four-cylinder, triple-expansion Corliss, 24, 42 and two 50 by 42-inch, with auxiliary machinery.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 9, 1903.

730,234. Electric Time Switch. Henry J. Cogswell, Hartford, Conn., assignor to the Acme Switch Company, Hartford, Conn. Application filed December 26, 1901.

This is an automatic switch consisting of a clock mechanism with a dial adapted to be moved so as to release the switch-throwing mechanism when the dial is rotated in one direction but not when the dial is rotated in the opposite direction.

730,236. Repeating Break for Electric Circuits. Leo Daft, Ealing, and Alfred Williams, Wimbledon, England, assignors to the Electrical Ore Finding Company, London, England. Application filed November 3, 1902.

There is, in combination, a rod adapted to be reciprocated, connected with a source of electricity, a motor adapted to be rotated at a regulated speed, a mechanism connecting the above two elements of the combination, adapted to vary the amplitude of the reciprocation, a wheel carried at the end of the rod adapted to be revolved, a circular disk mounted so as to revolve and also accompany the wheel in a part of its reciprocation, the disk also being connected with the source of electricity; a ratchet and pawl adapted to rotate the circular disk on its reciprocation, an arresting screw adapted to be adjusted in position and terminate the motion of the last-named disk and a bath of insulating fluid in which the contact-surfaces are immersed.

730,246. Space Telegraphy. Lee de Forest, New Haven, Conn., assignor to the Greater New York Security Company, New York, N. Y. Application filed March 8, 1902.

An antenna is combined with two conductors, each equivalent in length to a multiple of a quarter-wave length and adapted to the production in each other of stationary electrical waves.

730,247. Wireless Telegraphy. Lee de Forest, New Haven, Conn. Application filed November 4, 1902.

The conductor consists of two twisted wires insulated from each other and equivalent in length to a multiple of a quarter-wave length, one of the wires being connected with the antenna and the other with a capacity.

730,251. Electric Motor Car and System of Mounting and Wiring Electrical Apparatus Thereon. George Gibbs, New York city. Application filed December 1, 1902.

A system of wiring for electric-motor cars, in which the wires are incased in fire-resisting envelops mounted underneath the car and free from all inflammable and metal portions of the car.

730,252. Electric Cooker. Edward E. Gold, New York, N. Y. Application filed July 16, 1896.

The resistance coils in an electric cook-stove are confined between horizontal plates, connected together to form a casing, provided with exterior terminal connections.

730,259. Electric Sparker. Darwin Hanauer, Long Island City, N. Y., assignor to the Daimler Manufacturing Company, Long Island City, N. Y. Application filed December 29, 1900.

A sparker designed particularly for gas-engine ignition is described, consisting of a pair of contact points and a resilient conductor designed to vibrate between them.

730,262. Electric Meter. Eugen Hartmann, Frankfort-on-the-Main, Germany. Application filed February 24, 1902.

The device is a maximum-current indicator and combines an electromagnetic ammeter with a damping device and a registering device. Means controlled by the return movement of an iron core, for transmitting motion from the ammeter to the dial of the registering device are provided. The core is returned to its original position by means of a spring.

730,287. Telephone Switchboard. William E. McCormick, Chicago, Ill., assignor to the International Telephone Manufacturing Company, Chicago, Ill. Application filed January 2, 1902.

A lamp signal for a telephone switchboard is mounted in a socketed rail in the front of the board. In the back of the board is a second rail carrying line terminals and inwardly facing lugs which engage with the lamp terminals.

730,291. Telephone Exchange System. Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed November 30, 1900.

A circuit connecting a sub-station with the main office is described. It consists essentially of a line circuit, source of current, a switch for determining the flow of current and two subsidiary signals operated by line relays. Switch contacts controlled by a relay bring one or the other of the signals alternately under the control of the line relay.

730,293. Receptacle for Incandescent Lamps. Henry T. Paiste, Philadelphia, Pa. Application filed January 23, 1902.

A block of insulating material bearing contact pieces is inclosed by an insulating shell having grooves for conducting the line wires to the contact pieces. A socket for the lamp is mounted on the block.

730,312. Railway. Edward Stiles, New York, N. Y. Application filed September 29, 1902.

The third rail of this system runs parallel to the others. It is provided with a wide top extending partly over the distance intervening between the third and one of the grounded rails. An intermediate and movable shield is so arranged as to be moved laterally and partly under this projecting top during the presence of the car wheel on the track rail, and by means of loosely fitted electrical connections render the third rail "alive" during the passage of the car. (See cut.)

730,341. System of Motor Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 12, 1900.

A source of current supply, a motor, a storage battery, a resistance, and a controlling device in one position connecting the motor to the source in series with the storage battery, and in another position connecting the storage battery and the resistance in multiple between the motor and the source. The controlling device is actuated electromagnetically and a master controller regulates the supply of current to the same. The system will operate one or more motor cars in a train.

730,342. System of Motor Control. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 24, 1902.

In this system automatic means for securing the opening of the motor circuit upon an abnormal flow of current therein, and means for rendering the same inoperative when a resistance sufficient to protect the motor is included in the motor circuit, are provided. The system is operated electromagnetically.

730,343. Alternating-current Motor. Alexander J. Churchward, Brooklyn, N. Y. Application filed March 29, 1897.

The motor is self-starting and has a field arranged in series during non-synchronous operation. The exciting circuit has a field-coil included therein, and a means of regulating the fields so that an increase of power with an increase of load is obtained during synchronous operation.

730,346. Electrically Controlled Lock. James Corbett, Toronto, Canada. Application filed November 27, 1901.

A latch is pivoted within the door casing in such a manner that it will swing down into position in a catch. A stop is located above the outer end of the latch. A magnet is suitably held within the casing in an electric circuit with means for throwing it out of circuit. A lever is interposed between the magnet and the latch, and is so arranged that the long end forms the armature of the magnet when the door is closed and thereby allows the latch to lock the door, and as soon as the circuit is broken to drop down of its own gravity and strike the latch to release it from the catch.

730,369. Electric Arc Lamp. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 9, 1901.

The lamp is supplied with series and shunt magnets, and compensating coils wound on the shunt-magnet spools in parallel with each other and with the series magnet, and also with an adjusting resistance in parallel with the series magnet. Each magnet is provided with a rocker-arm fulcrumed near the other magnet, the arms being so connected as to move simultaneously.

730,371. Reverse-current Relay. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 3, 1902.

Essential features are a magnet polarized by a conductor in series relation to the circuit controlled, an armature normally held against a back-stop with its major axis at right angles to the polar axis of the magnet, a retractile agency for the armature, means for polarizing the armature, and means for developing a magnetic flux in the field-core opposing the flux due to the series excitation.

730,376. Controlling Electric Motors. James W. Kellogg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 28, 1902.

The device is for motor starting and comprises in combination a main circuit-breaker, mechanism for operating the circuit breaker, an overload magnet and a no-voltage magnet independently connected with the mechanism, a series of resistances and a starting-switch for throwing the resistances into and cutting them out of the motor armature circuit containing a normally open cut-out in the no-voltage magnet-circuit, and means whereby the operator may temporarily close the cut-out while manipulating the starting switch, and means for retaining the cut-out closed when the starting switch is in a running position.

730,379. Circuit-controller for Surgico-dental Engines. Joseph S. Letord, William W. Alexander, and Henri Letord, Kansas City, Mo., assignors to the L. A. Rheostat Company, Kansas City, Mo. Application filed July 7, 1902.

This apparatus consists of an electric motor, a handpiece, a main circuit-closer, a resistance controller in the main circuit, a variable resistance, and an attachment to the handpiece for operating the controller and main circuit-closer. The handpiece attachment is composed of superimposed alternate plates of conducting and non-conducting material, a contact-pin extending upwardly therefrom, a spring member arranged for contact therewith, and a switch lever with means for moving the same into electrical contact with an intermediate conductor.

730,397. Power-factor Indicator. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 26, 1903.

The power-factor indicator consists of the combination of two angularly displaced coils in fixed relation to each other, means for supplying to one of the coils current in phase with the impressed electromotive force of the system in connection with which the power-factor indicator is used, and means for supplying to the other coil currents which respectively lag and lead with respect to the electromotive forces. These two coils are suspended so as to swing in a horizontal plane between two other current-carrying coils in series with a circuit containing no power factor.

730,401. Mechanical Ventilation of Electric Machines. Auguste C. E. Rateau, Paris, France. Application filed June 28, 1902.

This is an electric machine having a field structure formed of fixed assemblages of sheet iron, separated from each other by an odd number of radial gaps forming air-channels. They are pierced longitudinally by channels traversing the radial gaps, in combination with a suitable source of air supply under pressure in open communication with alternate gaps, the remaining gaps being connected with the alternate gaps and in open communication with the external atmosphere.

730,403. Bond for Railway Rails. John Risbridger, Northeast, Pa., and Milton W. Risbridger, Cleveland, Ohio. Application filed October 17, 1902.

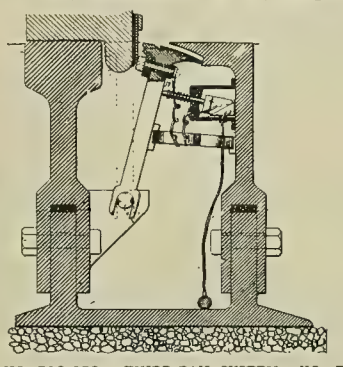
The device is an electric bond for railway rails comprising a head at each end and a double series of flat strands uniting the heads, and the heads each having a pair of diverging projections overlapping the ends of the strands.

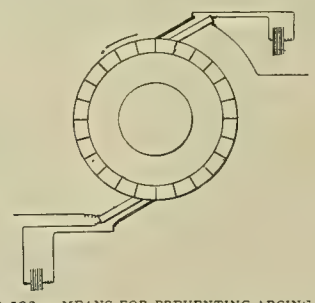
730,405. Hot-wire Instrument. Maurice C. Rypinsk, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1902.

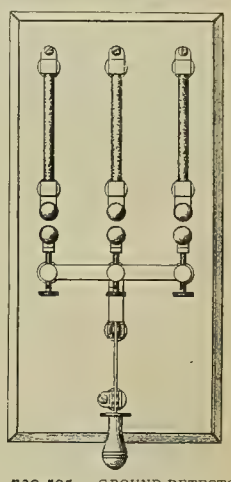
This instrument consists of a stretched wire adapted to carry current, an elastic abutment to maintain it under tension, an indicator to determine its amount of sag, and a compensating wire connected to the abutment and disconnected from the circuit.

730,422. Electric Protective System. Joseph Weatherby, Jr., Philadelphia, Pa., assignor to S. O. Spring, Peoria, Ill. Application filed August 11, 1902.

This protective system consists of a feed-circuit, a signal device installed within the circuit, magnets located within the safe and in series and installed within the feed-circuit, a shunt-circuit tapped into the feed-circuit, an automatic circuit-controller for the shunt-circuit, whereby at predetermined intervals, governed by the automatic circuit-controller, the feed-circuit will be shunted from the signal device.







NO. 730,312.—THIRD-RAIL SYSTEM. NO. 730,523.—MEANS FOR PREVENTING ARCING. NO. 730,595.—GROUND DETECTOR.

730,420. Watchman's Clock. Albert E. Waggoner, Grand Rapids, Mich. Application filed August 13, 1902.

The clock moves a record underneath a striker. The striker is normally out of contact with the record. An electromagnet operates the striker, and means are provided for repeatedly and automatically magnetizing and demagnetizing the magnet when the exciting-circuit of the magnet is closed.

730,519. Sparking Mechanism. Joseph S. Dikeman, Torrington, Conn., assignor of one-half to Charles S. Dikeman, Torrington, Conn. Application filed January 3, 1903.

A stationary and a movable contact point are so arranged that the movable one can be brought closer or farther away from the stationary one by means of a cam-lever. The interval of sparking is regulated by changing the cam-lever arm.

730,523. Means for Preventing Arcing in Direct-current Motors or Generators. Herbert H. Dow, Midland, Mich. Application filed January 2, 1903.

The two brushes resting upon the commutator are connected by a polarized battery capable of generating a counter electromotive force which prevents arcing. (See cut.)

730,545. Electric Foot-arch Supporter. Frank B. Lee, Buffalo, N. Y. Application filed December 30, 1902.

A pair of plates of aluminum, one provided with a copper electrode and the other with a zinc one, fit the soles of the feet, the two dissimilar metals forming a galvanic couple.

730,567. Electric Push-button. August W. Plassmann, New York, N. Y., assignor to the Richmond Electric Manufacturing Company. Application filed January 29, 1902.

A pair of electrical contacts consisting of two spiral springs are arranged with their convolutions alternating with each other, and means for forcing the convolutions into and out of contact with each other are provided.

730,573. Ceiling Switch. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 20, 1901.

The blade of the switch is spring-actuated. A cord for closing the blade, and a latch to lock the blade closed are provided. The weight is sufficient to cause its inertia to prevent it from falling instantly when thrown up by a sudden further closing movement of the blades.

730,576. Electric Alarm System. Solomon Schwarzschild, Rochester, N. Y. Application filed July 25, 1902.

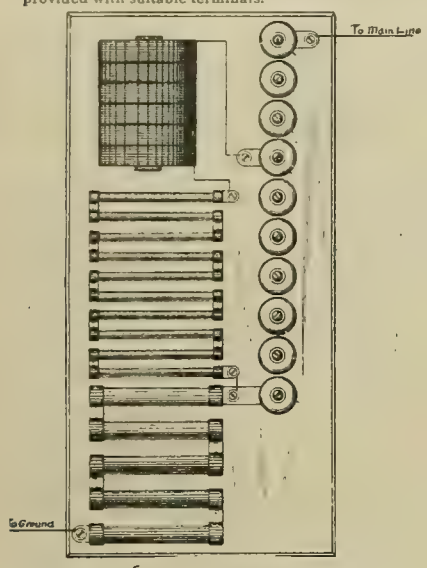
In this system a telephone-circuit is combined with electromagnetic inductive means for sending over the telephone-circuit a telephonic signal characterized by a sound peculiar to the signal thus transmitted. A local alarm circuit initially controls the electromagnet. Means are provided for shunting the electromagnetic device and continuing the signaling.

730,582. Armature for Dynamo-electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 16, 1899.

The inventor provides the machine with a plurality of windings on one of its members, one of the windings being of the squirrel-cage type, and the other having a variable number of active turns.

730,594. Enclosed Fuse for Electric Circuits. Willard S. Atkinson, New Brunswick, N. J. Application filed February 10, 1902.

A mixture of comminuted mica and sodium bicarbonate surrounds the fuse, which is enclosed in a glass tube and provided with suitable terminals.



NO. 730,601.—LIGHTNING ARRESTER.

730,595. Ground-detector. Charles C. Badeau, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 26, 1901.

A spark gap is provided between each line wire and ground, and a resistance in series with each gap. Means for connecting a ground with a less part than the whole of the aggregate sparking gap are also provided. (See cut on preceding page.)

730,601. Lightning Arrester. Louis Bell, Newton Center, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 5, 1900.

Two non-identical paths to earth are placed in the circuit, both of which paths include in common a spark gap or gaps and a resistance. In one of the paths is a sectionally wound inductance device not included in the other path. (See cut.)

730,613. Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 24, 1903.

A magnet having two poles, one of which surrounds the other is combined with a rotatable annular armature formed of magnetic material placed between the poles and held in place by magnetic attraction.

730,621. Magnetic Clutch. Arthur C. Eastwood, Cleveland, Ohio. Application filed April 2, 1903.

The idea embodies one member having a magnet winding, and a second member constituting an armature for the magnet. A series of shoes of non-magnetic material carried by one of the members for maintaining an air-gap between them when the clutch is in operation is provided. There are also means for adjusting the shoes.

730,629. Constant-current Rotary Converter. Richard Fleming, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 12, 1900.

The converter is provided with a commutator and collector rings, means for supplying constant-potential alternating current to the collector rings, automatic means for shifting the brushes on the commutator, and a circuit fed from the brushes with direct current of constant value.

730,644. Rheostat. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 21, 1902.

In a rheostat provided with spider-beads, the essential features are a central standard having grouped around it blocks of insulating material wound with resistance wire.

730,652. Phase Indicator. Otto Holz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 27, 1902.

In this device are combined two relatively movable members, and electrostatic means for causing a movement of one element relatively to the other in accordance with the shifting in phase of a current or currents of an alternating-current system.

730,667. Controller for Electric Motors. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 28, 1900.

An attachment for a controller, comprising a casing containing connected mechanism is so arranged that the contact cylinder and reversing switch can be controlled by one handle, the casing fitting on top of the controller casing.

730,673. Method of Generating Alternating Currents. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 25, 1899.

The method consists of deriving a rotary magnetic field from a single-phase magnetomotive force and producing by the rotation of conductors in the rotary magnetic field a multiphase alternating current of a frequency bearing a definite ratio to the frequency of the single-phase magnetomotive force.

730,696. Electrical Rosette Cut-out. Clarence D. Platt, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed March 4, 1903.

A circular base with radial connecting plates of uniform width throughout is combined with a circular cap having flat radial plates and elastic contact plates clamped between the flat plates and the body of the cap making contact with the plates on the base.

730,698. Electrical Measuring Instrument. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1902.

An electrical measuring instrument has a double armature. Each part has its own coil system, and an insulating spacer between the two systems is embraced in a common magnetic field embracing the two.

730,704. Circuit-breaker for Electric Circuits. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 24, 1902.

A switch or circuit-breaker comprises a plurality of breaks in series relation. One contains a tubular contact, an inclosing casing and a means for drawing an arc at the break. An inclosure for directing the pressure due to the arc heat to the inclosure for the tubular contact is provided.

730,746. Art of Making Steel Direct from Iron Ore. Michael R. Conley, Brooklyn, N. Y., assignor to the Electric Furnace Company, New York, N. Y. Application filed January 27, 1902.

In this method the materials for the charge are fed into a closed furnace and passed through an electric field containing incandescent plates of very high temperature.

730,750. Radiant Heat and Heat-light Bath. Herbert J. Dowsing, London, England. Application filed July 14, 1902.

Heat and light are produced electrically and the radiant energy thereby produced is reflected upon the patient.

730,753. Signaling by Electromagnetic Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed April 9, 1903.

In this method of electromagnetic wave signaling a radiating conductor can be charged and discharged without disconnecting from the source of constant voltage. (See cut.)

730,768. Incandescent Lamp. Christian Hoelscher, Warren, Ohio. Application filed April 2, 1902.

The essential features are a lamp having a central contact post, a base piece removably secured on the lamp, an insulating body within the base piece, a terminal plate with which the post is designed to contact, a central contact-pin at the end of the base piece, a connecting plate for the pin, and a binding screw connecting the terminal plate to the connecting plate, and holding the insulating body within the base piece.

730,785. Apparatus for Radiotherapeutic Treatment. Eugen K. Müller, Zurich, Switzerland. Application filed January 10, 1902.

An apparatus for radiotherapeutic treatment is provided with a laminated straight core having a central opening, a wooden framework within which the core is located, a coil wound on the framework, means for energizing the coil with undulatory currents, means for supply a cooling agent to the central opening of the core, and a cylindrical casing having open ends, whereby the ends of the core are exposed to the air.

730,791. Governor for Pneumatic Pressure. William H. Nightingale, Philadelphia, Pa., assignor to John E. Reyburn, Philadelphia, Pa. Application filed March 17, 1902.

The compressor is governed electromagnetically by a switch which is forced in and out of circuit by the elongation and contraction of a flexible cylinder directly connected to the source of pneumatic pressure.

730,805. Insulator. William G. Stroh, Hume, Ill. Application filed March 7, 1903.

A sinuous slot is so cut into the insulator that a wire will be directed accurately into the slot by turning it.

730,810. Switch Especially Adapted for Third Rails for Electric Railways. William A. P. Willard, Jr., New York, N. Y., assignor to Pierre Lorillard, Jr., Tuxedo, N. Y. Application filed November 11, 1901.

The apparatus comprises a switch-box provided with two rotatable switches located in proximity, each switch being pivotally mounted upon a separate stud, in combination with a track rail and means to operate both switches simultaneously. The switch-box above described, consists of a central gear and two side gears, each in mesh with it, and each carrying a switch, the central gear being provided with pins and a pawl adapted to engage the pins to rotate the central gear.

730,819. Wireless Signaling. Lee de Forest, New Haven, Conn., assignor to the Greater New York Security Company, New York, N. Y. Original application filed March 8, 1902. Divided and this application filed November 20, 1902.

The essentials of this apparatus are the combination of an antenna, and parallel conductors, one of which is connected with the antenna. Each of the conductors contains a plurality of sections which are each equivalent to half a wave-length, the conductors being adapted to produce a change in the relative proportions of the electrostatic and the electromagnetic energies by the transmission from one set to the other.

730,828. System of Phase Transformation. Frank H. Jeannin, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 20, 1902.

Three windings are connected in series with each other in this system. The three-phase mains are connected, one to the junction between two of the windings and the other two to intermediate points in the remaining winding. There is also a means of impressing a quarter-phase electromotive force between the third main and the ends of the winding.

730,833. Galvanic Battery. John R. Lord, Tottenville, N. Y. Application filed February 20, 1903.

Exhausted electrical batteries are rehabilitated by arranging the electrodes so that any solids formed during evaporation will be deposited by gravity upon or in proximity to the anode, but will be prevented from lodging upon the active surface of the cathode; then heating the battery at a temperature and for a time sufficient to evaporate the contained electrolyte causes the deposition of the non-volatile constituent in a chemically and electrically active form upon the anode.

730,840. Magnetic Suspension Device. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1902.

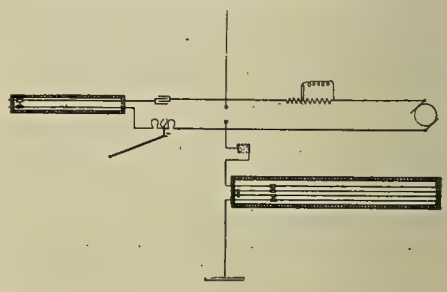
A radial magnetic field is produced and in this field is an annular armature carrying a shaft, the armature being so arranged as to have considerable reluctance in a circumferential direction.

730,844. Arc-lamp Hanger. Charles H. Schultz, St. Joseph, Mo., assignor to John L. Zeidler, St. Joseph, Mo. Application filed June 9, 1902.

The essential features of the hanger are a base, a frame carried by it, a metallic socket supported by the frame and electrically connected to one of the line-wires, a metallic ring of larger diameter than the socket connected to the second line-wire, a vertically movable plunger having contacts electrically connected to the lamp-wires, a vertical post or standard arranged below the base and electrically connected to the metallic ring, a contact plate arranged at the upper end of the standard, a combined switch and locking lever pivoted to the socket member, a spring tending to force the lever into engagement with the contact plate to short-circuit the main line, a revoluble disk carried by the frame and having on its periphery a series of alternate recesses and plunger-engaging dogs, ratchet teeth arranged on the disk, and a pawl pivotally connected to the combined switch and locking lever and adapted to engage the ratchet teeth.

730,847. Flexible Electrical Conductor. Lincoln Van Gilder and Edward M. Post, Philadelphia, Pa., assignors of one-half to Harold Godfrey and Clinton Godfrey, Philadelphia, Pa. Application filed November 8, 1902.

An insulating tube containing a solid or stranded conductor with metallic terminals extending into the tube is filled with an electrically conducting fluid material surrounding and contacting with the solid conductor.



NO. 730,753.—SIGNALING BY ELECTROMAGNETIC WAVES.

730,852. Bulb for Incandescent Electric Lamps. Elias L. Elliott, Yonkers, N. Y., assignor to the Illuminating Engineering Company. Application filed October 15, 1902.

A bulb is formed of clear blown glass of substantially uniform thickness and with a part of its surface corrugated on both sides, and a part plain. The angles of the sides of the corrugations are so formed as to reflect the major portion of the rays of the light backward through the plain portion, substantially parallel with the incidental rays.

EXPIRING PATENTS.

Following is a list of electrical patents that expired on June 15, 1903:

343,602. Induction Coil. Gustav Pfannkuche and Alfred Pfannkuche, New York, N. Y.

343,603. Distribution of Electric Energy. Gustav Pfannkuche and Alfred Pfannkuche, New York, N. Y.

343,642. Electro-automatic Valve. Abraham S. Kissell, Chicago, Ill.

343,676. Electric Cable. Sidney F. Shelbourne, New York, N. Y.

343,719. Electric-railway System. Samuel Miller, Mohawk, N. Y.

343,738. Signal-call Telegraph Box. John E. Smith, New York, N. Y.

343,811. Electric Arc Lamp. Valerian V. Golitzinsky and Paul O. Rymascheffski, Moscow, Russia.

343,863. Electric Alarm Apparatus. William C. Smith, New Haven, Conn.

343,869. Burglar Alarm. James Tomney, New York, N. Y.

343,884. Electric Railway. Edward M. Bentley, Brooklyn, N. Y.

343,886. Governor for Electromagnetic Motors. Chas. F. Brush, Cleveland, Ohio.

343,930. Dynamo-electric Machine. Samuel H. Tacy, New York, N. Y., assignor of one-half to James Boyce, Baltimore, Md.

343,939. Electric Fence. David H. Wilson, St. Louis, Mo., assignor of one-third to Dent G. Tutt, St. Louis.

343,953. Dynamo Telegraphy. Stephen D. Field, New York, N. Y., assignor to the Western Union Telegraph Company, New York.

343,976. Electric Clock Movement. Phillip Lange, New York, N. Y., assignor to Edgar W. Moore, New York.

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Steam Turbines in British Electrical Generating Stations.

[From the London correspondent of the Western Electrician.]

In Great Britain, as in the United States, a steady development has been taking place in the last two or three years in the application of the steam turbine to the driving of electrical generating machinery. A large number of central-station engineers, viewing the possibilities of this prime mover from the experimental point of view, installed small units of this character as a kind of plaything. But the universal experience of these engineers has been such that in a very short period the turbine-driven machine was taking a very serious part in the daily routine of the station, chiefly by reason of its greater adaptability to load fluctuations, and generally to its greater efficiency.

That the present output of this class of machine in England, at any rate, is limited, goes without saying, but a reliable guide to the future is afforded by a few instances of the present attitude toward the steam turbine, both as regards those machines which are already installed and the recent orders which have been placed by English concerns, both with American and British manufacturers. Dealing, first of all, with the two views typical of the English turbine employed in central stations, Fig. 1 is the prototype of four which have just been installed in the large Willesden works of the Metropolitan Electric Supply Company of London, in which plant, it may be remarked, almost every kind of engine in existence has been tried at various times. The new turbo-alternators each have a capacity of 500 kilowatts at 1,000 to 1,200 volts, running at a speed of 1,800 revolutions per minute. They are two-phase, and have a periodicity of 60 cycles per second, being worked non-condensing at a steam pressure of 150 pounds to the square inch.

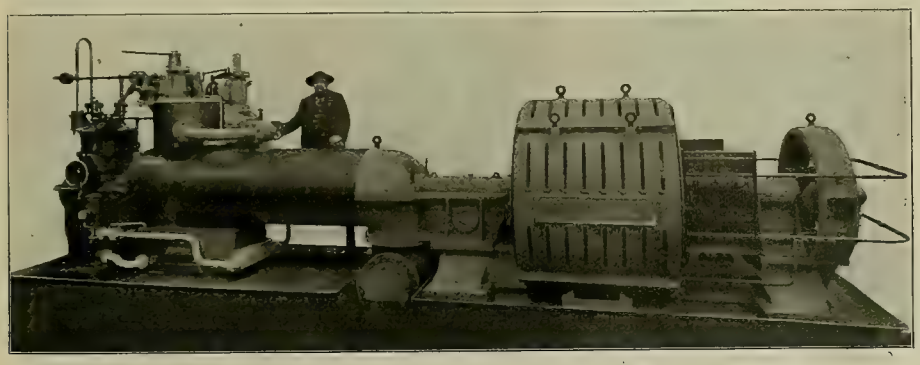

Fig. 1. Turbo-alternator of 500 Kilowatts in London.

STEAM TURBINES IN BRITISH ELECTRICAL GENERATING STATIONS.

Fig. 2 shows one of two steam turbines supplied to the Dickinson Street station of the Manchester corporation, which, by the way, now has three generating stations in operation for dealing with a very large lighting, traction and power load, the whole of the tramways having recently been converted from horse to electric traction. These sets, it will be seen, are coupled to the generators in tandem. The two generators connected to each turbine each have a capacity of 900 kilowatts at 400 to 450 volts. The sets are run condensing.

In addition to these two examples, the corporation power houses at Sheffield, Hastings and Tunbridge Wells also contain turbine-driven dynamos, while orders for quite a number of small machines of this type have recently been given out. Included in the latter are a 350-kilowatt set at 460 to 500 volts (condensing), for the Battersea (London) Borough Council power house; two 250-kilowatt sets at 480 to 550 volts, for the West Bromwich corporation, while a contract has just been let by the committee managing the joint power house of the Kensington and Knightsbridge Electric Lighting Company and the Notting Hill Electric Lighting Company (two London companies which take power "in bulk" from a large station erected by themselves) for a 750-kilowatt, three-phase steam turbo-alternator at 3,000 volts and a periodicity of 45 cycles per second. Further, from America will come the large turbo-alternators for the separate power houses of the Metropolitan Railway Company and the Metropolitan District Railway Company, the joint owners of the Inner Circle Railway, which is now being converted for electrical working.

As a matter of fact, a great deal of regret has been expressed by English turbine manufacturers that the orders for the latter machines were allowed to go out of the country. The assigned reason for this was that British dynamo makers could not yet turn out a satisfactory machine for coupling to a turbine. At present the turbine makers design their own dynamos, and complain at the apathy of the dynamo makers, pure and simple, in not directing more attention to this matter. In the opinion of the turbine firms, this has been the cause of the loss to them consequent on the orders above mentioned being sent to the United States.

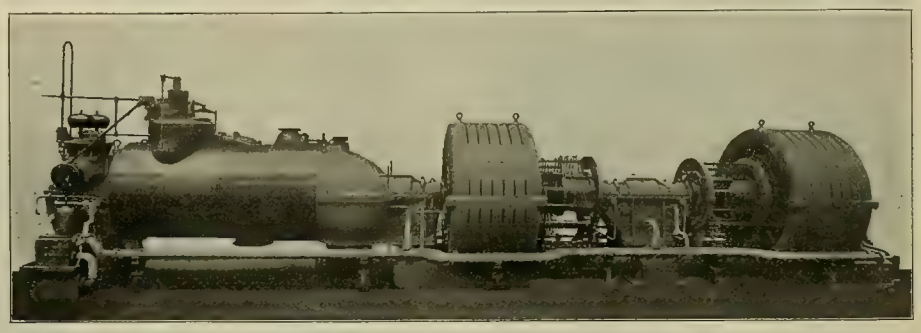

Fig. 2. Tandem Set, with 900-kilowatt Generators, in Manchester.

But station engineers and consulting engineers in England are now so favorably inclined toward the steam turbine (some even dream of an even more ideal machine; i. e., the gas turbine) that a demand is really only waiting to be developed, and it may reasonably be expected that dynamo manufacturers will seriously consider the design of machines from that standpoint. The turbine manufacturer has already offered his help.

Size Limits of Steam Turbines.

In the discussion of a paper on "Testing Methods of the Westinghouse Machine Company for Steam Turbines" read by Edwin Yawger before the Electric Club of Cleveland recently, a member asked how small a turbine can be built of the Parsons-Westinghouse type with economical steam consumption. In answer Mr. Yawger said: "There is no real limit to the size. A very small turbine would have to travel at a tremendous rotative speed, because the peripheral speed of the vanes on a small turbine would probably be as great as on one of the largest sizes. One of the first turbines that Parsons built was, I think, 10 kilowatts, and ran about 18,000 revolutions. However, 400 kilowatts is the smallest size we build."

Another member asked how large turbines are being built at the present time, and Mr. Yawger said: "We took an order last week for three 5,000-kilowatt turbines. That is practically the largest we have ever designed. They are not yet built. I don't know whether we will design them for 10,000 kilowatts or not, but I do not see why it could not be done. There seems to be no drawback to making them large."

Internal Resistance of Primary Batteries.

A Pennsylvania correspondent submits the following, the letters (A) and (B) being substituted for the actual names of the primary cells mentioned: "In setting up some batteries for an experiment and testing their amperage, I can obtain only about 1.2 volts and 2.7 amperes from a fresh (A) cell and 2.1 volts and 3.5 amperes from a fresh (B) cell, while both of the above cells in series give 3.2 volts and 3.4 amperes. I have used four dry and two (A) cells in series, obtaining but 6.2 volts and 2.2 amperes; also four dry cells in parallel, obtaining 1.2 volts and six amperes. The readings were checked by a Weston portable ammeter. The voltage of each cell is very near the rated output. Should not each cell give from at least 10 to 15 amperes at one to two volts, and when in series give the combined amperes of each cell?"

It would appear that the querist, in making his calculations, entirely disregarded the internal resistance of the batteries. Thus, from a fresh (A) cell, he is able to secure 2.7 amperes at 1.2 volts. This would show an internal resistance of 0.44+ ohm for the (A) cell. Taking the (B) cell, a current of 3.5 amperes is secured at 2.1 volts. This would indicate an internal resistance of 0.6 ohm, while, with the cells connected in series, a current of 3.4 amperes is had with an electromotive force of 3.2 volts. In this experiment, as the two cells are connected in series, we have the internal resistance of the two cells to be taken into consideration, which would be somewhat over 0.940 ohm. Thus, in connecting the batteries in series, we are increasing the power of the batteries only through increasing the voltage. In connecting in parallel four dry cells, however, our voltage remains at 1.2, and the current output is raised to six amperes. In this plan we have reduced the internal resistance, and, the voltage remaining the same, increased the current output.

The correspondent's last question, as to why each cell should not give out at least 10 or 15 amperes, has already been answered in stating that the internal resistance of the cell must be taken into consideration. In the same way, when the cells are connected in series, the internal resistance of the series of cells is increased through adding the resistance of each cell; while, when the cells are connected in parallel or multiple, the resistance is reduced. Thus, with four dry cells connected in parallel, six amperes is obtained at 1.2 volts. This indicates an internal resistance of 0.2 ohm. The internal resistance of a battery, where the voltage and current are known, may be obtained by dividing the voltage by the current output. Thus: (volts) 1.2 ÷ (amperes) 6 = (ohm) 0.2.

United States Delegate to Berlin Space-telegraph Conference.

John A. Waterbury, president of the Manhattan Trust Company of New York and prominent in the Chamber of Commerce and other commercial organizations of that city, has been designated by the secretary of state, on the nomination of Secretary Cortelyou of the Department of Commerce and Labor, as a delegate on the part of the United States at the preliminary conference at Berlin, August 4, 1903, to formulate regulations governing the international control of space telegraphy.

Radium and Its Relation to the Theories of Matter and Energy.

[illegible] London come accounts of the remarkable experiments of Professor Curie of Paris, the discoverer of radium, before the Royal Institution, on June 19th. These experiments have established ground for a new theory, which supported by such men as Professor Crookes and Professor Lodge, seems to indicate that the world is on the verge of new discoveries almost too astounding for belief. The old theory that the atoms of elements consist of indivisible units of matter seems now about to be discarded. Instead, we now are told that each atom is a whole stellar system of infinitely smaller

FIG. 1. WEST END OF MACHINERY HALL, WORLD'S FAIR.

but absolutely identical units, all in a regular orbital motion. The nature or identity of each substance depends upon the number of such ions contained in each atom. Thus, 11,200 ions in each atom produces what we know as oxygen; 37,200 of the same ions if combined in a single atom would yield gold. The nature of these ions is, for want of a better word, said to be electrical. In other words, electricity and matter are one and the same thing.

Everyone is familiar with the process of disintegration of matter which is merely a breaking up or rearrangement of the elements which were thought to be the indecomposable constituents of all matter. In the scientific world the new theory has been hinted at for several years, but it remained for Professor Curie, with his remarkable discovery, radium, to demonstrate clearly those things which before had been hazardous guesses. The Roentgen rays hinted at a solution of the problem, but there was still a

FIG. 2. DÜRR BOILER AT WORLD'S FAIR.

missing link, which Professor Curie has at last supplied.

Professor Curie, in his experiments in London, on June 19th, showed that radium spontaneously and continuously disengaged heat so rapidly that it affected photographic plates, even through opaque bodies. It discharged an electroscope when merely brought in its vicinity and gave off emanations similar to itself in constant, even violent, streams or radiations. In other words, the 150,000 ions which composed each atom of radium, rotated so violently that they flew apart into original units. It has been calculated, however, that this efflux from radium is so infinitely small that a square inch of surface would lose only one grain in 10,000 million years. Professor Lodge surmises that this process of disintegration of atoms may constitute the evolution of the chemical elements.

The lecturer announced that Professor Rutherford had observed that a few atoms of a radioactive substance seemed to reach a critical stage, at which they fling away small portions of themselves with great violence. The residue having the same property of unstability for some time, until ultimately it settles down into a presumably different substance. Changes of this sort in more stable atoms would seem to require millions of millions of centuries—so long, in fact, that the longest periods in astronomical evolution seem but hours in comparison.

Professor Lodge affirms, however, that these changes seem bound to occur, according to fixed laws. So the state of flux and decay is recognized not only in the stars and planets, but in the foundation stones of the universe. The elemental atoms themselves are in process of regeneration. It is impossible to imagine what would occur if the separate ions ever aggregated themselves together by their mutual attractions into fresh material.

It will be seen the whole theory is an astronomical one, and one is led to wonder, then, if the earth and the other planets are not mere ions forming a single atom of the higher universe.

Properties of Siloxicon.

By Edward G. Acheson.

The descriptions of the new refractory substance siloxicon that have recently appeared in the journals have created such a widespread interest, as shown by the numerous inquiries received from all parts of the country and all lines of industry, that it is desirable to correct a statement that was contained in these publications.

It was there stated that siloxicon was inoxidizable, but recent investigations have shown that this is not true. When it is heated to, or above, 2,674° F. in an atmosphere containing a large amount of free oxygen decomposition occurs.

Siloxicon, while variable in composition, may be represented by the formula Si_2C_2O, and when heated, as above stated, in presence of free oxygen, decomposition takes place, probably in accordance with the following equation:

$$Si_2C_2O + 7O = 2SiO_2 + 2CO_2.$$

If the siloxicon be in the form of a brick or other molded mass, the reaction occurs on the surface, producing a vitreous glaze, which, in most instances, is tinged light green from the presence of iron.

In the absence of free oxygen or in a reducing atmosphere, no such decomposition occurs, and the temperature may be raised to the point of the formation of carborundum, or, approximately, 5,000° F., before any change occurs, and then it takes place, it is thought, in accordance with this equation:

$$Si_2C_2O = SiC + Si + CO.$$

Solid carborundum remains, while the vapors of silicon and carbon monoxide are given off.

It is interesting to note that after having discovered this oxidation of siloxicon, tests were made with carborundum, and it was found to be affected in a manner exactly similar to siloxicon; this notwithstanding the fact that for more than 12 years it had been generally considered inoxidizable.

Electricity Building and Temporary Power Plant at St. Louis Exposition.

Mention has been made in the Western Electrician of the temporary power plant erected to supply current for the St. Louis Exposition during the dedication period and until the large Westinghouse units are installed in Machinery Hall. The accompanying view (Fig. 1) of the western end of this latter building shows how rapidly it is approaching completion, and also shows the general type of architecture and decoration. The temporary installation, immediately west of this point, contains at present three boilers, of which the Dürr marine boiler, shown in Fig. 2, is to the American engineer the most interesting. This boiler is chiefly noted for its small weight and size, excellence in mechanical details and ability to be forced. A glance at the illustration shows the clean-cut appearance and small size, the boiler being rated at 700 horsepower. Particular attention has been given the accessories, such as gauges, etc., and the installation has elicited the admiration of visiting engineers. Fig. 3 shows the 200-kilowatt Stanley generator direct-connected to a Buffalo engine. This unit supplies the transformers on the arc-lighting circuits.

Recent contributions to the exhibitor power plant that have been secured bring the grand total up to 60,000 horsepower.

The Electricity Building at the St. Louis Exposition is now complete, except the addition of the groups of statuary that will crown its corner towers and the portrait statues of prominent electricians to be placed abot its walls. Fig. 5 shows the building as it stands to-day, while Fig. 4 is a detail.

FIG. 3. TEMPORARY POWER PLANT AT WORLD'S FAIR.

In laying out the main palaces of the exposition, in view of the importance of the electrical industry as manifested by the wonderful developments of the last few years, the authorities placed the Electricity Building in what will be the most prominent location on the grounds. The focal point of the main picture is the cascades, of which detailed information has already been given in the Western Electrician. From Cascade Hill will rise the beautiful Festival Hall, the dome of which will be the largest in the world. Down the cascades and into the head of the Grand Basin will pour nearly 100,000 gallons of water per minute; and the scheme of illumination of this feature, which has been carefully worked out by Chief Electrical Engineer Rustin, will require over 5,000 kilowatts of electrical energy.

The location of the Electricity Building, the south end of which faces the cascades and the east the Grand Basin, will make it, aside from the importance of its exhibits, one of the most frequented of the exhibition palaces. The architects, Walker & Kimball of Omaha, have displayed great skill in the general arrangement of the building as well as in the architectural features. The facades are broken by entrances placed in the middle of each side, and on two sides of the building between twin Corinthian columns pedestals have been provided for the portrait statues. The roof consists of several steps, each capped with a row of the conventional Greek honeysuckle device, which is freely

used in carrying out the decorative scheme. Upon each of these will be placed from one to five incandescent lamps, while the cornice and towers will be marked with lines of light. It is estimated that nearly 20,000 lamps will be used on this building alone. Nearly all the main buildings of the exposition will enclose a court, and in the Palace of Electricity this area will probably contain an electro-aquatic fountain, while palms and flowers will enhance its beauty. Careful attention has been paid to the lighting of this building, with the result that there is not a dark area in the entire building. The roof and trussing have been painted white, while the walls have been plastered to a considerable height. The illustration (Fig. 5) shows how the

FIG. 4. EASTERN ENTRANCE, ELECTRICITY BUILDING, WORLD'S FAIR.

wide spacing of the supporting posts and the height of the trusses above the floor accentuate the unbroken areas in the four corridors of the building.

The north entrance leads to a court through a high-vaulted corridor, the effect of which prepares one for the great expanse within. To the left of this corridor will be located the French exhibit, occupying the entire space of the northern corridor and extending partly into the eastern portion. Germany has reserved a large space in the eastern corridor, and here will be exhibited products of the largest and most important of the German firms. It is worthy to note the attitude of the foreign firms, who, while they realize the impossibility of competing for American trade, will direct their attention more to the representatives of foreign countries who will be at the fair. The interest they are taking is shown in a cablegram recently received from Siemens & Halske by Dr. Lewald, the German imperial commissioner, in which that well-known concern stated that it would exhibit in the Electricity Building on a scale commensurate with the position it occupies in the European engineering world. It is understood that the European systems of space telegraphy will be largely exploited, while the alternating-current apparatus, for which European engineers are noted, will be shown on a large scale. American engineers who have been or are now in Europe report that since the flying trip made by Governor Francis in the interest of the exposition, the European countries are pushing exhibit matters with great vigor. Mr. W. J. Hammer, the well-known consulting engineer of New York, has traveled extensively during the past year and has done much toward interesting those with whom he has come in contact in exposition matters. Mr. M. R. Hutchinson, also of New York, who has been appointed honorary commissioner of the Department of Electricity to Europe, is also using his best efforts in behalf of the department, and these two gentlemen will be in no small way responsible for the showing in the foreign section.

Belgian and Swiss manufacturers will also occupy space in this section of the building. England, through Colonel Watson of the Royal British Commission, who has just returned from an extended visit to St. Louis, has applied for a large section in the northern corridor of the building, where the products of her leading manufacturers will be shown. The runway for a 30-ton electric crane has been placed in the western corridor and will serve the heavy exhibits which will occupy the entire length of the building; these will include generators, motors, rotary transformers, static transformers, storage batteries and similar apparatus. All of the heavier installations will be grouped in or about the space served by this crane, and it is improble that exhibits of like character will be grouped together, thus facilitating the comparison of like classes of machinery.

The eastern section of the building will be devoted to exhibits of telephone and telegraph apparatus, electrical instruments of all kinds and light electrical apparatus. Cables will be shown, and it is possible that one or more companies may exhibit their cable-making and insulating machinery. Exhibits of full-size telephone switchboards in actual use are promised, while space telegraphy, X-ray work and the various refinements in the transmission of intelligence, such as the printing telegraph, telautograph and multiplex systems of transmission will be shown.

In connection with its exhibit of space-telegraph methods the De Forest Wireless Telegraph Company will install on the grounds what will be the largest space-telegraph station in the world. Plans have already been drawn up, contracts let, and ground will be broken for the construction in a short time. The station will be located on the highest portion of the exposition grounds and will consist of three wooden towers 235 feet high, with a power house and station located between them. This station will receive and transmit messages in connection with the stations now being erected by the De Forest company in Kansas City, Omaha, Chicago and other western cities. Communication will be established between it and the exhibit in the Electricity Building, from which commercial messages may be sent.

Mr. Edison, who, as recently noted in the Western Electrician, has just accepted the appointment as honorary chief consulting electrician of the Department of Electricity, will make a large personal exhibit, the historical importance of which can hardly be overestimated. The "old man," as he is admiringly called by his disciples, has evinced more than ordinary interest in this exposition, and coming, as it does, on the twenty-fifth anniversary of his perfection of the incandescent lamp, it is fitting that an "Edisonian demonstration" should be made.

Although there is still a period of eight months during which application for exhibit space will be received, yet it is reported on good authority that those applications now on record aggregate considerably more than the total area of the building, and, at the same time, a large portion of Machinery Hall will be devoted to electrical exhibits, as all direct-connected generators supplying current will be installed in this building on account of the inability to supply live steam in large quantities to the Electricity Building.

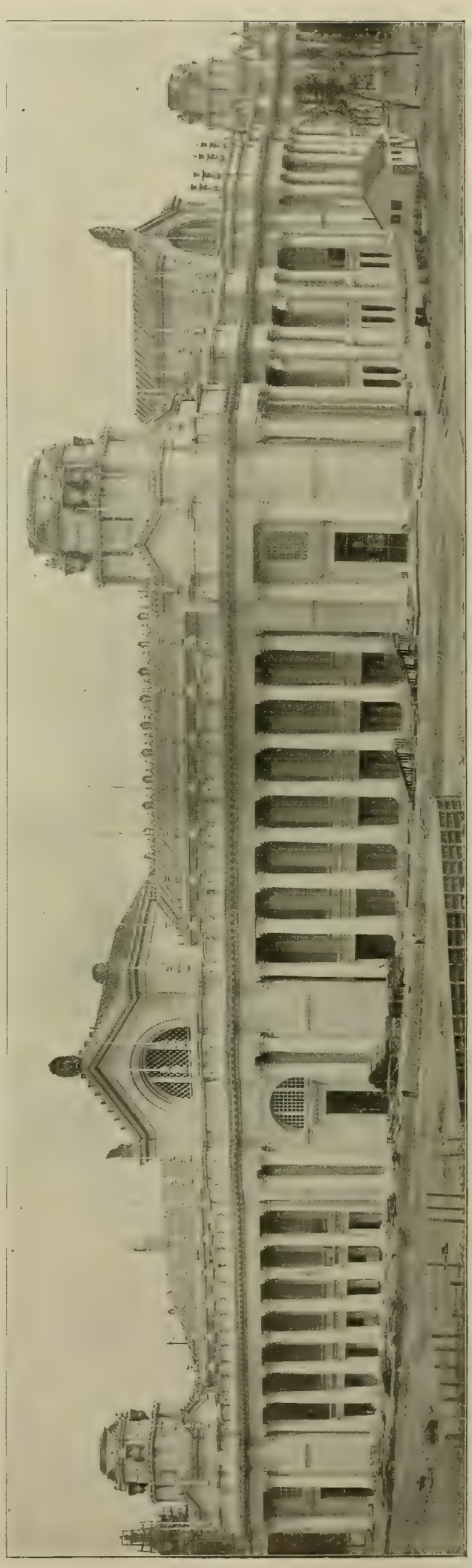

FIG. 5. ELECTRICITY BUILDING AT THE LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, MO.

How to Remedy Interference on Grounded Telephone Lines.

A correspondent of the Western Electrician in York, Pa., writes as follows: "I have a 30-mile grounded, bridged telephone system to keep in repair, and am troubled with considerable noise from long-distance telephone and Western Union telegraph wires, which are strung on the same poles for about 11 miles. From the following particulars and diagrams, can you suggest the best remedy to remove the noise?

"There are 14 bridging telephones equipped with double-pole receivers and two cells of battery. I tried single-pole receivers and one cell of battery, but the noise was about the same. The telephones are situated as follows, referring to Fig. 1: Three at (A), six at (B), one at (C), two at (D), and two at (E). From (A) to (B) it is 11 miles, from (B) to (C) seven miles, from (C) to (D) six miles and from (D) to (E) six miles. From (A) to (F) it is six miles. On the same poles there are six wires of long-distance telephone and 10 wires of Western Union Telegraph, strung as shown in Fig.

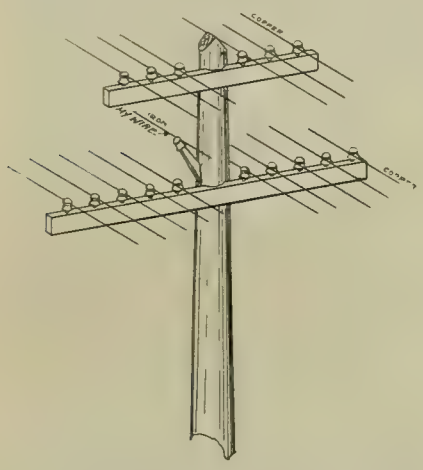

FIG. 2. INTERFERENCE ON GROUNDED TELEPHONE LINES.

2. As shown, the long-distance wires are on the top arm, my wire is on the bracket about 20 inches under it, and the Western Union wires are on the lower arm about 10 inches under my wire. At (F), Fig. 1, all the Western Union and four of the long-distance wires branch off from our poles, and from (F) to (B), a distance of five miles, my wire is strung, as shown in Fig. 3, on the arm alongside of the long-distance circuit, the long-distance wires being transposed about every one-half mile.

"The line is entirely clear. There is not a twig touching it anywhere. I cut my wire between (A) and (B), and then the three telephones at (A) and the six at (B) and all the rest above that were as quiet as a mouse. I thought I might be getting some of my noise from the grounded side, but this test goes to show that I wasn't. Between (B) and (E) my wire is on separate poles.

"The noise is a frying and cracking one, and as soon as I cut the wire which runs along the long-distance and telegraph wires it is all removed. There are no electric-light or power lines near my wire anywhere. I was about to experiment with repeating coils, but not knowing exactly what style was needed for this case or whether they would work at all, I thought I would refer to you first. Would it help to put my wire on the peaks of the poles from (A) to (F) and on the extreme outside pin from (F) to (B)? Would my wire, being on a grounded system, act as a lightning arrester to the other wires if I were to place it on the peaks from (A) to (F)? Except for the noise the telephones work O. K."

ANSWER.

This difficulty is often met with where telephone lines are strung on the same poles with telegraph circuits. The statement of conditions shows that the grounded line is exposed to both telephone and telegraph interferences. The fact that the long-distance lines are transposed does not insure freedom of interference from the long-distance lines to the grounded lines.

The correspondent asks whether it would be of any advantage for him to place his telephone circuit on the "peak of the pole." The long-distance lines, as shown by Fig. 2, are on the upper cross-arm, while the Western Union lines are on the lower cross-arm, and the grounded telephone circuit is placed between the two cross-arms on one side of the pole, while in Fig. 3 the grounded line is on the outer pin of the cross-arm, the center pins of which are occupied by the long-distance telephone line. In answer to this question, it might be suggested that not enough advantage would be obtained through making this change to permit of securing a satisfactory service.

In relation to the wire serving as a lightning guard for the remaining circuits, this is true only to a limited extent.

Now to consider some means which might be adopted for clearing the disturbances. It is suggested that, first, we have a positive and absolutely certain plan as shown by Fig. 4, where the circuits from (A) to (B) are made metallic and a repeating coil is inserted at the point (B), in the manner indicated. The construction of the repeating coil does not call for any special requirements, aside from the fact that it must be the so-called "ring-and-talk-through" type with the turns of the primary and secondary windings equal. Briefly the specifications for such a coil would be as follows:

On a wooden spool five inches long and two inches in diameter, provided with a core space of five-eighths inch, wind four concentric windings of No. 31 single silk-covered, copper wire. In one form of coil which is meeting with considerable success the first winding consists of 3,300 turns of No. 31 wire, resulting in a resistance of 96 ohms; the second winding, of 3,300 turns, same size wire, measures 122 ohms; the third winding, same number of turns, same size of wire, measures 148 ohms, and the fourth winding measures 172 ohms. After the coil has been wound up in the manner indicated, a well annealed grade of No. 24 iron wire is threaded through the core and wrapped over the outside of the windings, the core space being well filled with this iron wire. After this has been done, and all terminals brought out, the repeating coil is practically ready for service. In practice, however, the formed-up coil is usually slipped into an iron tube and the ends closed with an iron washer. This is done principally for the purpose of preventing cross-talk between the repeating coils connected to different circuits, and where the coils might be required to set alongside of each other in mounting. It is, of course, understood that the first and third windings are connected together and usually form the primary winding of the repeating coil, while the second and fifth windings are connected together for the secondary.

Another plan which has been applied with marked success on grounded telephone circuits passing through a network of telegraph wires and paralleling such circuits is to apply the principle that the Western Electrician correspondent in part tried to follow by reducing the sensitiveness of his receiver, though he did not carry the experiment sufficiently far to give him any appreciable favorable results.

The plan suggested is as follows: Supply each telephone on the circuit with a special receiver, especially low wound. Possibly 1½ ohms of wire placed upon the standard receiver core will give satisfactory results, and, rather than reduce the battery power at the subscriber's station, increase the power by adding another cell. It will be observed that the theory of this plan is to reduce the sensitiveness of the telephone receiver to such a degree where it will not pick up any noises from the long-distance lines or the telegraph circuits, and, second, that the subscribers' transmitters are made especially powerful, so as to easily transmit speech betwen the most distant stations on the circuit.

In order to go to as little expense as possible in making the experiments, it is suggested that the York correspondent order from any manufacturer a low-wound telephone receiver. One is all that is necessary for making the experiment. He should specify that the receiver shall work on 30 miles of line. In fact, simply ordering a double-pole receiver wound to 1½ ohms will give him the means for determining whether the application of the low-wound receiver will clear the inductive disturbances.

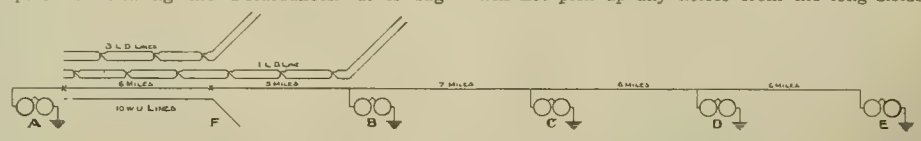

FIG. 1. INTERFERENCE ON GROUNDED TELEPHONE LINES.

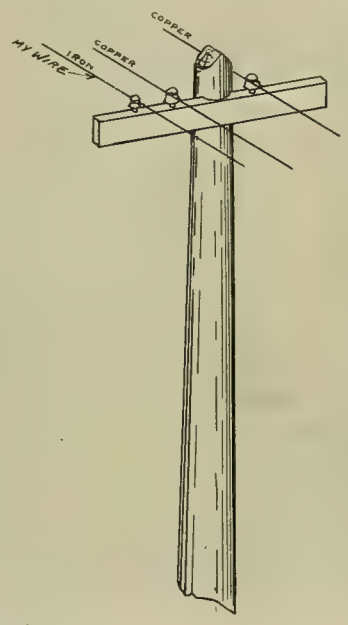

FIG. 3. INTERFERENCE ON GROUNDED TELEPHONE LINES.

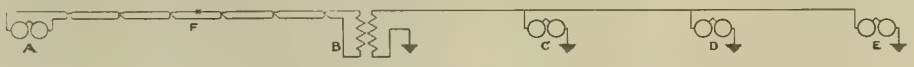

FIG. 4. INTERFERENCE ON GROUNDED TELEPHONE LINES.

Pacific Coast Electric Transmission Association.

[From a special correspondent of the Western Electrician.]

San Francisco, June 18.—The seventh annual convention of the Pacific Coast Electric Transmission Association was begun on June 16th at Hotel Rafael, Cal., a suburb of San Francisco. About forty electricians were in attendance, including representatives of some of the principal electric-power companies west of the Rocky Mountains.

The greater part of the first day was taken up with the reading and discussion of papers. The following papers were read and considered: "After the Ions, What?" by Prof. A. G. McAdie; "Electric Automobiles as Income Producers to Central Stations," by A. E. Brooke-Ridley; "Single-phase Motors on Polyphase Systems," by H. A. Bullard; "The Influence of Periodicity on Line Capacity," by W. F. Lamme; "A. C. and D. C. Arcs in Street-lighting Service," by P. C. Butte; "Electric-railway Service as Supplied by Long-Distance Power Transmission," by A. H. Babcock; "The Engineering Organization of a Transmission Company," by L. M. Hancock; "Buckets for Tangential Water Wheels," by George J. Henry, Jr.; "Electric Power for Mining Purposes," by George Scarfe; "The Local Distribution of Polyphase Currents," by George C. Holberton.

Following the discussion of the papers the election of officers was taken up. The officers elected for the coming year were: President, H. H. Noble, Northern California Power Company, Redding; vice-president, H. H. Sinclair, Edison Electric Company, Los Angeles; treasurer, F. M. Ray, California Gas and Electric Company, San Francisco; secretary, George P. Low, editor of Journal of Electricity, Power and Gas, San Francisco; executive committee, C. W. Hutton, Sacramento Electric, Gas and Railway Company, and Rudolph Van Norden, Central California Gas and Electric Company, Sacramento.

At the evening session George J. Henry, Jr., chief engineer of the Pelton Water Wheel Company, delivered a lecture on "Buckets for Tangential Water Wheels," which was illustrated with stereopticon slides. Mr. Henry also gave demonstrations of the action of various nozzles and buckets by operating two miniature water wheels in glass cases, which were set up for the occasion in the rear of the hotel. Robert Doble and others engaged in a discussion of tangential-wheel constructing as the closing feature of the day.

On Wednesday, June 17th, the members of the association who spent the night at Hotel Rafael made the ascent of Mt. Tamalpais via the Scenic Railway, taking luncheon at the tavern of Tamalpais, near the summit.

An inspection tour of the North Shore Railroad Company's third-rail electric-railway system, which is almost completed from Sausalito to Mill Valley, was next made. The party then crossed the bay to San Francisco and inspected the new electric-generating station of the United Railroads of San Francisco as

guests of the General Electric Company, which has just installed two 1,200-kilowatt 13,200-volt 25-cycle three-phase generators. The initial installation is for 8,000 horsepower, and there is space for a 16,000-horsepower plant. The Turk and Fillmore Streets sub-station, which is equipped with six 750-kilowatt 600-volt rotary converters, was also visited.

Some of the papers read aroused a great deal of interest. W. F. Lamme's paper, entitled "The Influence of Periodicity on Line Capacity," caused something of a sensation when it was read, but as Mr. Lamme was unable to be present to defend his views in person the discussion was not exhaustive. His main contention was that electric-power plants generating alternating current at high frequency, such as 7,200 to 6,000 alternations per minute, which is the practice on the Pacific Coast, are sacrificing economy in power transmission. While admitting that high-frequency apparatus is satisfactory for arc lighting, and perhaps in plants devoted exclusively to city lighting, he holds that 25-cycle apparatus is much more economical for transmitting power through long distances. It is to be inferred from the facts as presented by Mr. Lamme that the principal electric-power companies on the coast could save 2½ per cent. in transmission by adopting say 25-cycle generators, which is the practice with many large eastern companies, instead of 60-cycle and 50-cycle apparatus, as is the rule on the Pacific slope. The United Railroads of San Francisco has the only large establishment in California equipped with 25-cycle generators, and this is not yet in operation.

Among those attending the sessions of the association were Alex. McAdie, Eugene Curry, A. E. Brooke-Ridley, J. L. Holland, F. M. Ray, George P. Low, H. C. Bullard, J. M. Shawhan, R. P. Daggett, F. V. Lee, E. J. de Sabla, Jr., Otto Scarf of Nevada City, John A. Britton, C. W. Hutton of Sacramento, William Angus, H. H. Noble, L. M. Hancock, W. A. Doble, Robert Doble, P. C. Butte, George O. Holberton and R. W. Van Norden of Sacramento.

The full membership of the association consists of the 24 following-named companies: Blue Lakes Water Company, San Francisco; Central California Electric Company, Sacramento, Cal.; Edison Electric Company, Los Angeles, Cal.; Merced Falls Electric Company, Merced, Cal.; Mt. Whitney Power Company, Visalia, Cal.; Bay Counties Power Company, San Francisco; Portland General Electric Company, Portland, Ore.; Power Development Company, Bakersfield, Cal.; Sacramento Electric, Gas and Railway Company, Sacramento, Cal.; Salt Lake City Water and Electric Power Company, Salt Lake City, Utah; San Joaquin Electric Company, Fresno, Cal.; Snoqualmie Falls Power Company, Seattle, Wash.; the Standard Electric Company of California, San Francisco; Truckee River General Electric Company, San Francisco; Seattle Electric Company, Seattle, Wash.; California Central Gas and Electric Company, San Francisco; Shasta Electric and Power Company, Redding, Cal.; Southern California Power Company, Los Angeles; United Electric, Gas and Power Company, Santa Monica; United Gas and Electric Company, San Jose, Cal.; Pacific Light and Power Company, Los Angeles, Cal.; Suburban Electric Light Company, San Leandro, Cal.; Northern California Power Company, Keswick, Cal., and the Northern Electric Gas and Power Company of San Francisco.

The following are the honorary members of the association: Prof. C. L. Cory of the California State University; Dr. Cary F. Hutchinson of New York; Marsden Manson, San Francisco; A. G. McAdie of the U. S. Weather Bureau, San Francisco; Dr. F. A. C. Perrine, Pittsfield, Mass., and W. R. Eckart, San Francisco.

Besides the above, 35 engineers, supply men and the like of San Francisco hold associate membership in the association.

G. P. M.

Wireless Communication Between Santa Catalina Island and the Mainland.

By Frank C. Perkins.

As readers of the Western Electrician are aware, communication by space telegraphy is maintained between the mainland of Southern California and the island of Santa Catalina, across some 30 miles of the Pacific Ocean. A "wireless" newspaper is published in Avalon, on the island, by the Los Angeles Times, Los Angeles being the nearest large city, and the work of transmission is done by the Western Union Telegraph Company over the land stretches and the Pacific Wireless Telegraph Company through the ether over the sea. The latter company has offices on Ocean Avenue in Avalon, Santa Catalina Island. The accompanying pictures of the Avalon "wireless" station and down-town office and the additional details here given will be of interest.

Up to the time of the installation of this space-telegraph station there had been no telegraphic communication between the mainland and Santa Catalina, which is quite a summer resort, and having an almost perfect climate during the entire year, is becoming very popular as a winter resort as well. The main village upon this island is known as Avalon and has a population of several thousand. The island is owned by the Banning Company, and several boats run between it and the mainland daily. The "wireless" station, shown in Fig. 1, with an interior view in Fig. 2, is located on a high bluff on the north side of Avalon Bay. The space-telegraph instruments are of the Swenson type, and the service has been satisfactory to the present time, several thousand messages having been sent with accuracy and dispatch. The vice-president of the Pacific Wireless Telegraph Company is General A. L. New, and the plant, which is located at Sugar Load Rock, is operated in connection with the Western Union Telegraph system, as the signs on the "down-town" office in Avalon (Fig. 3) plainly show.

The newspaper known as The Wireless of Avalon is published on the island of Santa Catalina, and the news of the day is communicated from the mainland to the island by the space-telegraph system. The instruments record the messages with accuracy, even during the most severe storms, which are of frequent occurrence about the island. These storms are terrific and the wind and waves are so high between the island and the mainland that the steamer communication is often stopped, and the space-telegraphic system is the only means of conveying messages to and from the mainland. As will be noted by reference to Fig. 2, showing the interior of the station, a complete generating plant is installed within the building for supplying the necessary current for operating the transmitting apparatus. The generator of this set is belt-driven by a vertical gasoline engine and is controlled by a switchboard upon which are mounted the usual pilot lamps, ammeter, voltmeter and main and feeder switches as well as the rheostat for varying the resistance of the field. The high-pressure coil is located at the left and is mounted upon a low platform, as noted in the picture. The aerial wires are connected with a pole of great height located on the bluff above the station. The Western Union wires are used in conveying the messages from the wireless-telegraphic stations at the water side to various points on the island and the mainland.

FIG. 1. SPACE-TELEGRAPH STATION ON SANTA CATALINA ISLAND

FIG. 2. INTERIOR OF SPACE-TELEGRAPH STATION ON SANTA CATALINA ISLAND.

FIG. 3. SPACE-TELEGRAPH OFFICE IN AVALON, SANTA CATALINA ISLAND.

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DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Niagara Falls, N. Y., June 29th to July 3d.

National Electrical Contractors' Association, Light Guard Armory, Detroit, Mich., July 14th, 15th and 16th.

American Street Railway Association, Grand Union Hotel, Saratoga, N. Y., September 2d to 4th.

International Association of Municipal Electricians, Hotel Rudolf, Atlantic City, N. J., September 2d to 4th.

American Electrotherapeutic Association, Hotel Windsor, Atlantic City, N. J., September 22d to 24th.

American Association for the Advancement of Science, St. Louis, December 28, 1903, to January 2, 1904.

THE accounting of the committee on patent litigation was presented at the convention of the Independent Telephone Association of the United States at Chicago this week. It is presented in full elsewhere and will be read with much interest by telephone men of all shades of opinion. The committee has been criticized for its reticence heretofore, but it gives a plausible reason and now presents what will generally be considered a satisfactory report. It is shown that some $50,000 was raised to defend the Berliner and Carty suits, and it is all accounted for. The lawyers received most of the money, as was to be expected, although it is explained that some of the sums set opposite their names were advanced to them for disbursements in securing witnesses, printing briefs, paying court costs, and the like. One thing stands out clearly, and that is that patent litigation is expensive business. If the national Independent association is through with it at last, it is to be congratulated.

NOTHING is now left of the old Independent Telephone Association of the United States of America but the name. It has a new administration throughout and a brand-new constitution. Membership is no longer restricted to operating telephone companies, but is now open to all individuals interested in Independent telephony, thus embracing manufacturers and supply dealers as well as exchange managers. The wisdom of this policy may be doubted, as it seems to open the door for trade jealousies to disrupt the organization. Still, all depends on the way the association is conducted, for it is to be remembered that in societies of the class of the American Institute of Electrical Engineers, affiliation with a manufacturing or trading concern is no bar to membership. The morale of the society is the important thing. Mr. Dougherty, the new president, is a man of character and ability, and he may do much for the reorganized association. If, as is proposed, a purely technical telephone organization arises from the present transformation, all will be gratified. The suggested combination with the Interstate association was not brought about, but the national body can find plenty of work in considering the many problems that constantly arise in technical work.

TELEPHONE rivalry in Great Britain is shown along lines differing considerably from the competitive conditions in this country, but nevertheless the National Telephone Company, corresponding in large degree to the American Telephone and Telegraph Company of the United States, is no stranger to the grief caused by an active opposition. In Glasgow, for instance, there is a municipal exchange—pretty nearly everything seems to be done "municipally" in Glasgow—and the wide variance of the claims of the rival managers gives the disinterested American observer quite a home-like feeling, with the additional warm glow of interest which one feels in a shindig on the other side of a neighbor's fence which affords the onlooker all the joys of a bellicose spectacle without any of the perilous 'scapes that may befall a participant. Mr. Bennett, the general manager of the Glasgow municipal exchange, states the case plainly. In a letter to the papers he lifts his voice to the following effect: "I perceive that Mr. Gaine, general manager of the National Telephone Company, is reported to have said at the recent dinner of the employes of that company that the company's exchange telephones in Glasgow numbered 18,000. I am at a loss to understand how such a statement could be made, as, on the testimony of the company's most recent directory and supplement, the number of their exchange telephones cannot much exceed 8,600, even including a very large number of party-line instruments, toll instruments, penny-in-the-slot instruments and other odds and ends. This statement, if not challenged, is calculated to do the corporation exchange, which is now in reality the larger of the two, considerable injury, and I shall be glad if you will allow me to correct it. The corporation exchange now numbers within a few of 9,000 exchange instruments. These are almost exclusively direct lines to the exchange; they are also, with the exception of some four per cent. of toll lines, unlimited flat-rate lines, so that the corporation service is to a much greater extent more direct than that of the competing exchange. Basing on the figures used by Alderman Franklin in February last at the company's soirée at Glasgow, the corporation now carries the bulk of the telephone traffic in Glasgow, and is, besides, extending in every direction by leaps and bounds."

Truly, Mr. Bennett is a zealous public servant. What a fine contempt for the other fellow's "odds and ends," and how our side is increasing by "leaps and bounds," and really doing the bulk of the traffic! Very familiar talk, all this. Candidly, we have little faith in the municipal operation of a telephone system or any other purely industrial enterprise; but in the United Kingdom an appeal to government or municipality seems to be the only relief from the exactions of monopoly. One who has no sympathy for an unbridled monopoly on the one hand or a municipal cure-all panacea on the other can only hope that, in the case of Glasgow, the best man may win, but as to which is the better—ay, there's the rub.

MUNICIPAL-OWNERSHIP advocates do not have everything their own way. Occasionally they receive a setback, as they did last week when the high-school boys from Omaha journeyed to Chicago to argue the question in joint debate with a team of high-school students from Chicago. The question disposed of was "Resolved, That municipalities should own and operate their street railways." Omaha had the affirmative, but the judges decided unanimously in favor of the negative and Chicago. The event is not of great importance, except, perhaps, as showing the wide consideration of the public-ownership problem, when even the lads in preparatory schools debate it publicly.

Of greater significance was the action of the Iowa Democratic state convention in Des Moines on June 24th, when the conservative forces of the party defeated a public-ownership "plank" by the decisive vote of 628½ to 129½. The committee on resolutions debated the question for several hours, and finally referred the subject to the open convention with the result noted. This is certainly an encouraging sign of a revulsion of feeling among politicians, some of whom, in Illinois and elsewhere, have traded very effectually on the municipal-ownership issue. If the question is left to be decided squarely on its merits, the advocates of private ownership for purely industrial enterprises have little to fear.

AFTER the X-rays the N-rays. Roentgen named the rays that he discovered X-rays because he could not account for the phenomenon he described, and he attached to it the term applied to the unknown quantity of the mathematician. The name was, in truth, a poor one—a perpetual inquiry—for there is no reason why we should not have a name for a well-recognized thing, even if we do not understand it; but it has stuck, and no one has proposed a better one. Now Blondlot proposes to call the obscure rays with which his name has been connected N-rays, after the Nancy University, in France, where they were discovered. We have now Roentgen rays, Becquerel rays, Rutherford rays, Blondlot rays, X-rays, N-rays and others. Really, the phraseology of the new radiation is becoming involved and perplexing. The new Blondlot rays, for which the term N-rays is proposed, are contained in the light from an Auer burner, as mentioned in the Western Electrician a couple of weeks ago. They are also found in an ordinary gas flame burning without a chimney. Their discoverer thinks that, although invisible, they are of frequent occurrence. The electric spark is not essential for their detection. Mr. Blondlot has found that a screen of calcium sulphide exposed to sunlight shows a notable increase of phosphorescence under the influence of the new rays. This furnishes a good means of detecting them. But we must enter a mild protest against the name proposed. If we are to honor the universities by their initials in names of rays, pray how shall we distinguish between Cambridge and Chicago, Munich and the Massachusetts Institute of Technology? No, no; somebody must stand for the integrity of the letters of the alphabet.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES.

Marking the close of what may be regarded as the first stage of its existence, the seventh annual convention of the Independent Telephone Association of the United States of America was held in the Auditorium Hotel, Chicago, on June 24th and 25th. Those in attendance numbered about 200. The sessions were held in the banquet hall on the sixth floor. Judge James M. Thomas of New York presided, and Secretary J. B. Ware of Buffalo performed the duties of his office. Other well-known out-of-town telephone men present at the opening session were Hugh Dougherty of Bluffton, Ind.; Richard Valentine, Janesville, Wis.; S. P. Sheerin, Indianapolis; L. A. Frazee, Connersville, Ind.; E. B. Fisher, Grand Rapids, Mich.; S. E. Wayland, Scranton, Pa.; F. A. Demarest, Trenton, N. J., and H. C. Young, Columbia, Pa.

Judge Thomas called the convention to order at 2:30 p. m. on Wednesday, June 24th. The address of welcome and response were dispensed with, and with a few prefatory remarks the president delivered his annual address, which was in this case a valedictory address also. This address, in full, was as follows:

Judge Thomas' Annual Address.

There is no time when the worker is so happy as when his task is complete. If he has the consciousness of knowing that his efforts have met with success, it is glory enough. After all, we only really enjoy that which within ourselves we know to be the result of honest endeavor.

Since the very first meeting held by Independent telephone investors and promoters my duty has been that of chairman or president, and having been kept always at work in committees and for the good of the cause I have had no chance to look at the structure which we have built from the standpoint of a critic. Knowing, however, of the work, the builder can well afford to allow thorough inspection of the structure.

After six years of labor as your president, it seems that I am entitled to retire from the burdens and responsibilities of that position and to turn over to your chosen executive the future of this association. In doing so it would be far from my personal feelings to have my successor feel that he was taking a position where the responsibilities far outweighed its pleasures.

I shall never forget the pleasant associations of this organization and shall always remember with pleasure the confidence, respect and honor which have been shown me by you in electing me, without opposition, for six consecutive terms. It is a compliment never to be forgotten by myself and friends. With all my heart I thank you for it.

The policy of the association—like that of all other organizations—has been formed from necessity. The cause which made it imperative that we should organize made our policy; and the men who were selected as your trustees to protect and further your interests wisely yielded to the necessity of accomplishing the one thing more essential in the past than all others, and we became therefore what some say now, an organization of one idea. We are all glad that that one idea set in so strongly that it caused us to save ourselves the right to carry on telephone business. (Applause.)

When those of us who had invested our money in telephone plants found that our enthusiastic friends who had become interested in manufacturing were—through their desire to sell us their goods—blinded to the dangers of patent litigation, we concluded that the old adage, "If you want your work done well you must do it yourself," held good in this case, and so we organized and placed our shoulders to the wheel with a few who were already trying to uphold our rights in the courts, and have kept at it until the courts have announced that we have a right to not only manufacture and sell telephones but to operate them—a right which the owner of telephone patents claimed belonged to them only. Men must always establish their rights to do business. This is the first and fundamental part of any business proposition. It has taken us several years to do this in the courts.

Our right having been established, we find that, as another evidence that we were right in our contention, the investors of this country have placed in use more telephones than are operated by the Bell Telephone Company—a fact most remarkable and one hard to believe.

We feel, after our right has been established and so much capital has been invested in the business, that we have reached a place where the best interest of the business requires a reorganization of this association. Upon what lines shall it be reorganized? This is the most important question to be considered by this convention. This organization up to the present time has always been neutral so far as conflicting interests have been concerned, and has always taken the broad ground of protection and promotion of general interests only. We will all agree that in this there shall be no change; that the organization must not be allowed to get into the hands of people who would turn it into a machine to promote the interests of persons or corporations against the interests of others.

We fought this all out in the first convention at Detroit, when there was an effort made to capture it for the benefit of a manufacturing and construction company. The question was so thoroughly settled at that time that there has been nothing of a serious nature in this line with which to contend since. We can take it for granted, therefore, that the majority of the delegates, if properly informed, will vote for a continuance of that policy.

But, having established our right to do telephone business by appeal to the courts, and having succeeded in building up a business equal to that of the Bell Telephone Companies, the most important questions for discussion and determination are those relating to the economies in construction and operation in order to give to the investor the largest net profits under existing telephone rates. As is always the case in competition, we find our companies giving a greatly extended telephone service at a greatly reduced price, so that the question of economy is of great importance. There should, therefore, be an organization which will devote its time to this. We believe this is the next duty presented to this association. Place it for management into the hands of technical telephone men, who, during the year and at the annual meetings will educate us as to the best and cheapest way of carrying on the business. We have in our ranks a great number of competent and able men who will place this organization on a footing with other technical organizations in other lines.

I submit this to your consideration and deliberation and hope that the idea can be carried out completely when the new organization is formed.

Since the courts have sustained us we must expect that we will find other obstacles to overcome. We must expect that capital will seek its greatest reward, that it will not stand by and submit to loss when ways are open to make money. We must see that the business makes money for capital. We cannot expect to continue to get money to invest unless we can show proper results. So, in turning our attention to these questions of reward to capital through an organization as above outlined, we will do much toward overcoming the dangers which arise from a purely commercial fight for supremacy.

Every city and district of the United States has benefited on account of telephone competition. Not only has service been extended about six-fold, but rates have been reduced more than 25 per cent., so that these conditions bring to us new problems continually. We believe they must be solved by rules governing commercial business, and practical telephone men must determine how best to subserve the interests of the investors and the patron.

What we all want and what every one should work to accomplish is to bring the business up to a commercial level with other public utilities, so that the investor will feel that with greater development comes a more stable investment. (Hearty applause.)

Hugh Dougherty's Report on Patent Litigation.

The reading of the report of Hugh Dougherty of Bluffton, Ind., from the committee on patent litigation was the second feature of the meeting. This important report, in full, is as follows:

To give you a simple statement of figures showing amount of money received and paid out in the matter of defending your interest against suits brought by the Bell Telephone Company against Independent operators would scarcely be satisfactory, and yet I must be to some extent brief in general details.

In the month of May, 1897, there was a meeting of a few persons representing telephone interests in Ohio and Indiana at Fort Wayne, which resulted in the meeting being called at Chicago in the month of June of the same year, when your association was formed, and Hon. James M. Thomas was elected president of the association, and has been re-elected each succeeding year since that time.

The first steps that were taken looking to some protection of your interests against patent suits by the Bell Telephone Company was at the next meeting while in the city of Detroit. There was professed great interest in that city in Independent telephony. There had been much money spent and an exchange well along under construction, and of course it was proper and right that the people of Detroit should be interested in this association.

It developed before the time of the meeting that the persons in charge of the Detroit exchange were intending to capture the convention and control the officers that they might turn the convention to their selfish interest. This they failed in, and subsequent events have proved that those who secured their defeat acted wisely, because they soon thereafter sold out to the Bell, and that there was no original honest purpose to build a great Independent system in this country by them.

The fight in the convention at Detroit developed the fact, through the speeches of lawyers, who ar-

Cross Indicates Hugh Dougherty, the New President.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES.—GROUP PICTURE AT CHICAGO CONVENTION.

gued in behalf of the people of Detroit, that should your association take up the question of defending the suits brought in Boston against the National Telephone Company and the Century Telephone Company, every contributor to your association would be a party to the suit, and the Advisory Board wisely concluded that while these suits must be defended through the influence and machinery of your association, yet the record of such defense or contributions must be kept and handled so as to entirely lose the chain that would lead up to the discovery of how and by whom the defenses were made; for if the contributors had been exposed it was believed by the best legal authority, that should the Bell win the first suit, an injunction would lie against each one of the contributors; otherwise they might insist they had not had their day in court, and the Bell would have to continue its individual suits against each company or individual user of telephones.

This made it extremely embarrassing to the Advisory Board and the committee on litigation and gave an opportunity to the jealous-hearted and suspicious-minded members to censure the Advisory Board and executive officers of your association, because of a lack of knowledge as to what was being done; but for all that I am very proud of the fact that the confidence in the Advisory Board and executive officers was sufficient to keep them in office until the end of the litigation has been reached and the investments represented by this association have been made safe.

While I feel it my duty to say that the members of the Advisory Board and the executive officers as a whole, or as individuals, never faltered in their efforts to raise money, gather evidence and do everything necessary to put in a proper defense against these suits, yet I want to especially mention that Judge Thomas, the president of your association from the beginning up to this time, not only gave up every moment of time necessary but practically abandoned his business. For months his entire time was given, and the best part of it is when he gave his time he gave skill and ability in your behalf, which as a whole has been worth to you, representing the entire Independent system of this country, millions of dollars.

While it would be asking too much of this association to remunerate each member of the Advisory Board of the litigation committee, I insist that you cannot do less than pay Judge Thomas for his time and ability spent in your behalf. At Detroit his salary was fixed as president of the association, which was not paid him because of the fact that it would hazard your interest, yet that salary was intended to pay him for his efforts and skill in your behalf, but when it was found that money could not be secured to furnish means to keep the litigation going, Judge Thomas very generously declined to allow any money paid him for his services and time, and would not allow the matter to be considered until every dollar was provided for covering the litigation fund. I now insist that it is your duty as a convention not to adjourn until means be provided so that he be paid that which is justly due him, and if you do less than this you will not only have failed to do your duty toward him but will have robbed him and his family of money due him for services and time rendered which have been of vast benefit to you. But I do not believe this association can or will take this view of it.

The first litigation committee was appointed at the Detroit meeting of the National Association and was composed of Judge J. M. Thomas, Hon. H. D. Critchfield of Ohio and Judge Savage of Pennsylvania. At the time this committee was appointed there were two suits pending in the United States Circuit Court at Boston, which were defended by E. P. Payson, an attorney of ability; but Mr. Payson found his client in the hotbed of the Bell Telephone Company interests without means to defend itself. The president and other officers of the defendant company had abandoned it—all but its treasurer, J. N. Leatherber, who had employed Mr. Payson to make the defense, and the two were entirely unable to get together the evidence and pay the expert witnesses, so that the litigation committee commenced at once to make such arrangements and to have money put in the hands of Mr. Payson from unknown sources that he could use it in procuring evidence. This enabled him and Judge Taylor, who was afterward associated with Mr. Payson by your committee, to defeat the Bell Telephone Company in the United States Circuit Court. The case was appealed by the Bell to the United States Court of Appeals, where it was again defeated, and as it has not appealed to the United States Supreme Court up to this time, the question is settled.

It was partially agreed that Hon. Charles H. Aldrich of Chicago be employed prior to the time Judge Taylor was employed in the case, but this plan was changed to the satisfaction of Mr. Aldrich, and the amount of money to be paid him, $4,000, was then changed to E. P. Payson of Boston, attorney, and paid over to him.

At our next meeting while in the city of Chicago there was formed a new deal by which Mr. James B. Hoge of Cleveland was made a trustee of the fund at the request of Judge Thomas, and subsequently he was superseded by Hon. S. P. Sheerin of Indianapolis. In the meantime Hon. R. S. Taylor of Fort Wayne was employed to act in conjunction with E. P. Payson, when Judge Thomas and myself were appointed at a called meeting of the Advisory Board at Cleveland to take charge of the management of the case.

At this time funds had been exhausted, and the expert witnesses, court costs, briefs, etc., had to be paid for. Money was raised, and Judge Thomas and I proceeded to Boston, where we went to aid Payson in whatever way we could to prosecute the case and furnish whatever money was necessary to pay the expenses. We found Payson absent, and upon inquiry traced him to Moosehead Lake in Maine, where we proceeded, when we found him in a retired place with the room full of books and papers, preparing himself for the case to be held before the United States Circuit Court in Boston. We paid him $2,000 at this time, which gave him new courage and energy, although he was not lacking in interest or industry when we reached him.

I will not undertake to mention the trips that were made by Judge Thomas and myself, but there was a considerable number, covering nearly the entire country, and I have personal knowledge that Judge Thomas made a great many trips and spent a great deal of time with the former committee on litigation before I became active with him. He also attended court when the arguments of the case were made and did everything he could to get such influence before the court that would show the importance of the case on our side.

The labor done, however, by Judge Thomas and those associated with him was not all for the Berliner patent in Boston, but another case nearly equal in importance, but not quite so vital if lost, known as the Carty case.

The litigation in this case was largely carried on during the period when Judge Thomas and myself were in charge of the litigation for your association. This required quite as much time in gathering evidence and looking after the defenses and as much money to carry it on as did the Berliner case, as the evidence had to be gathered from people throughout the entire United States that had been in the services of the Bell Telephone Company of Chicago and knew of the prior use of the Carty patent. These witnesses had been scattered all over the country, having left the employment of the Bell Telephone Company of Chicago, and had to be looked up, depositions taken and witnesses brought into court from long distances and at immense expense.

In this case the Bell Telephone Company had won the case against the Independents, having commenced suit at Pittsburg against the Milheim Telephone Company, a very small company. After the case had been commenced it was alleged that the Bell bought out the defendant company and directed the litigation secretly on both sides, and of course got a judgment against the Independents for infringement. In this case we employed C. C. Bulkley of Chicago and Hon. R. S. Taylor of Fort Wayne. After the Bell company had obtained judgment it undertook to enjoin the Independents from the use of the Carty patent under its judgment. Through great effort and loyal ability it was thwarted in this and its judgment set aside because it was obtained through fraud.

In this case everything has been paid, including the argument in the case now before the United States Court of Appeals, which is not decided, but, as a committee, we feel confident that the United States Court of Appeals will decide in our favor.

It would require too much time and space to go into detail as to what was done by your committee in gathering together the money at times when it seemed almost impossible to further retain the confidence of the association, but it is sufficient to say that the committee had to go into bank at one time and borrow a sum of money on its own credit in order that the evidence be gathered in time for the case.

At another time Judge Thomas and myself gave a personal guaranty to the amount of $4,000 to the attorneys to keep the case going. In addition to this fact, when the suit had been won at Boston in the United States Circuit Court and while pending on an appeal, Mr. J. N. Leatherber, treasurer of the company, who is named as defendant, made a demand on us for $10,000; and, if not paid promptly, he would refuse to allow the suit to be defended in the United States Court of Appeals. Through the tact and skill of Judge Thomas the name of the electrician of the company defendant at the time the suit was commenced, was found, looked up, and his consent secured to make him the defendant instead of the treasurer, who had refused to stand unless we paid him the $10,000.

After we had these obligations out, for which we were personally liable, the question of fee for Judge Taylor for the final argument of the Carty case came up, and we were compelled to say to him that we could not personally guarantee his fee, when he very generously said all he would require of us was that we would do our best to see that he was paid, and he has been paid.

It is difficult to have you understand why large sums were paid out when you were not present through the entire transaction and could not see the immense amount of work necessary to do and which was done to cover these expenses. We were not permitted to give a detailed statement of what had been done with their money; but I am sure that now a full and complete statement and an expose of everything that has been done cannot help but make the Independent telephone people of the United States feel that in Judge Thomas they have had a true and tried friend, whose acts have always been unselfish and wise.

Following I give you a statement of receipts and expenditures, not one dollar of which has ever been paid to any officer of your association, except Mr. Carr, of Durham, South Carolina, who retained what was originally allowed for salary for him as treasurer out of money that went into his hands as treasurer of the association. No other member has felt he was entitled to take any money for his services as an officer or for his time given; no other person was ever paid any money except upon a voucher properly signed by the committee on litigation or the president and secretary.

I now submit to you in detail a statement of receipts and expenditures covering the entire time from the beginning of your association up to the present time and covering the funds collected for the purpose of carrying on the litigation. The expenses for dues of the association is a matter entirely of a different character and not in the least included with the fees collected or expended for this purpose. I am pleased to call your attention to the generous contributions by the manufacturers as well as by the operators:

RECEIPTS.

C. H. Aldrich	$ 2,000.00
J. M. Thomas	1,000.00
Aldrich and Thomas	1,000.00
United States Telephone Co.	750.00
Milo G. Kellogg	1,000.00
P. C. Burns	500.00
New Telephone Co., Indianapolis	200.00
New Long Distance Telephone Co., Indianapolis	200.00
United Telephone Co.	10.00
Home Telephone Co.	50.00
Ed. L. Barber	250.00
P. C. Burns	300.00
George W. Beers	500.00
Citizens' Telephone Co., Muskegon	150.00
Citizens' Telephone Co., Grand Rapids	200.00
Cuyahoga and United States Telephone Cos., Cleveland	1,000.00
New Telephone Co., Indianapolis	500.00
New Long Distance Telephone Co.	500.00
Sterling Electric Co.	500.00
Kellogg Switchboard and Supply Co.	1,000.00
American Electric Telephone Co.	1,000.00
Citizens' Telephone Co., Grand Rapids	300.00
Holtzer-Cabot Electric Co.	500.00
Citizens' Telephone Co., Columbus, Ohio	250.00
Federal Telephone Co., Cleveland, Ohio	250.00
United States Telephone Co., Cleveland, Ohio	250.00
Cuyahoga Telephone Co., Cleveland, Ohio	250.00
Anthracite Telephone Co., Wilkesbarre, Pa.	50.00
People's Telephone Co., Wilkesbarre, Pa.	100.00
Lackawanna Telephone Co., Scranton, Pa.	100.00
United Telephone Co., Bluffton, Ind.	200.00
New Long Distance Telephone Co., Indianapolis	300.00
Kellogg Switchboard and Supply Co.	1,000.00
American Electric Telephone Co.	1,000.00
Citizens' Telephone Co., Ashland, Ky.	50.00
Lawrence Telephone Co., Ironton, Ohio	50.00
Cedar Rapids and Marion Telephone Co.	100.00
Pittsburg and Allegheny Telephone Co., Maryland Telephone and Telegraph Co.	100.00
Lorain Savings and Banking Co. (loan)	2,530.00
Small companies in Pennsylvania	153.50
Anthracite Telephone Co., Hazleton, Pa.	50.00
People's Telephone Co., Wilkesbarre, Pa.	100.00
Lackawanna Telephone Co., Scranton, Pa.	100.00
Holtzer-Cabot Electric Co.	300.00
Central Construction Co., Wauseon, Ohio	250.00
State Belt Telephone and Telegraph Co., Nazareth, Pa.	16.50
Millville Telephone Co.	1.00
Lebanon Telephone Co., Indiana	10.00
Standard Telephone and Telegraph Co., Philadelphia	10.25
Home Telephone Co., Crawfordsville, Ind.	45.00
United Telephone Co., Bluffton, Ind.	100.00
Rochester Telephone Co., Indiana	30.00
Stromberg-Carlson Telephone Manufacturing Co.	2,500.00
Kellogg Switchboard and Supply Co.	2,500.00
Chicago Telephone and Supply Co.	250.00
American Electric Telephone Co.	2,500.00
Farr Telephone Construction and Supply Co.	200.00
James B. Hoge, trustee for Ohio	4,000.00
Fulton Telephone Co., Covault, Pa.	1.90
Twin City Telephone Co., Minneapolis	100.00
Ladoga Telephone Co., Indiana	12.00
Darlington Telephone Co., Indiana	20.00
Newton Telephone Co., Indiana	9.60
Shannondale Telephone Co., Indiana	10.70
Indiana Telephone Co., Indiana-Pennsylvania	17.50
Roachdale Union Telephone Co., Indiana	10.70
Waveland Telephone Co., Indiana	15.00
Forest Telephone and Telegraph Co., Marionville, Pa.	5.20
Bloomington Telephone Co., Indiana	25.00
Sterling Electric Co., Lafayette, Ind.	1,250.00
Rochester Telephone Co., Indiana	15.00
National Telephone and Telegraph Co., Fort Wayne, Ind.	125.00
Tipton Telephone Co., Indiana	42.84
Wabash Telephone Co., Indiana	51.33
Danville Mutual Telephone Co.	69.75
South Morrison Telephone Co., Greenfield, Ind.	67.50
Greencastle Telephone Co., Indiana	52.50
Advance Telephone Co., Advance, Ind.	13.50
United Telephone Co., Bluffton, Ind.	161.25
Home Telephone Co., Richmond, Ind.	200.00
Lebanon Telephone Co., Indiana	20.00
Lafayette Telephone Co.	195.00
Franklin Telephone Co., Indiana	33.75
Indiana Mutual Telephone Association	398.35
W. H. Durin, Cedar Rapids, Iowa	130.00
Julius Andrae & Sons, Milwaukee	25.00
F. Bissell & Co., Toledo	25.00
West Michigan Telephone Co., Allegan, Mich.	10.00
New Telephone Co., Indianapolis	600.00
New Long Distance Telephone Co., Indianapolis	90.00
Martinsville Telephone Co., Indiana	52.00
Union Telephone Co., Alma, Mich.	150.00
Citizens' Telephone Co., Columbus, Ohio	58.00
Sumter Telephone Manufacturing Co., Sumter, S. C.	100.00
Kellogg Switchboard and Supply Co.	1,000.00
Central Electric Co., Chicago	125.00
Electric Appliance Co.	125.00
International Telephone Manufacturing Co.	100.00
Illinois Electric Telephone Co., Chicago	50.00
Menominee Electric Manufacturing Co., Mich.	100.00
Telephone Magazine, Chicago	25.00
Fred DeLand, Pittsburg	100.00
Vought-Berger Co., LaCrosse, Wis.	25.00
F. Bissell Co., Toledo, Ohio	25.00
Valley Telephone Co., Saginaw, Mich.	75.00
Sterling Electric Co., Lafayette, Ind.	250.00
Monroe County Telephone Co., Dundee, Mich.	5.00
W. G. Nagel Electric Co., Toledo, Ohio	50.00
Swedish-American Telephone Co., Chicago	125.00

Citizens' Telephone Co., Muskegon, Mich.	150.00
Telephony Publishing Co., Chicago	50.00
Kinloch Long Distance Telephone Co., St. Louis	50.00
Louisiana Telephone Co., Louisiana, Mo.	25.00
Kirksville Telephone Co., Kirksville, Mo.	20.00
Macon Telephone Co., Macon, Mo.	12.50
Palmyra Telephone Co., Palmyra, Mo.	10.00
DeSoto Telephone Co., DeSoto, Mo.	5.00
Nevada Telephone Co., Nevada, Mo.	5.00
Livingston Home Telephone Co., Howell, Mich.	25.00
Kinloch Telephone Co., St. Louis, Mo.	200.00
Louisville Home Telephone Co., Louisville, Ky.	500.00
Automatic Electric Co., Chicago	2,500.00
Frontier Telephone Co., Buffalo	250.00
F. Bissell Co., Toledo, Ohio	50.00
Standard Underground Cable Co., Pittsburg	250.00
Sumter Telephone Manufacturing Co., Sumter, S. C.	100.00
New Long Distance Telephone Co., Indianapolis	75.00
Kellogg Switchboard and Supply Co.	340.00
United Telephone Co., Bluffton, Ind.	100.00
Greencastle Telephone Co., Indiana	15.00
New Telephone Co., Indianapolis	75.00
New Long Distance Telephone Co., Indianapolis	25.00
New Telephone Co., Indianapolis	25.00
North Electric Co.	1,000.00
American Electric Telephone Co.	1,250.00
Kellogg Switchboard and Supply Co.	660.00
Hugh Dougherty	220.00
Mr. Kellogg	250.00
Total receipts	$50,127.12

DISBURSEMENTS.

E. P. Payson, attorney, Boston, Mass. (four payments)	$ 6,000.00
R. S. Taylor, attorney	750.00
J. M. Thomas, expense to Boston	92.16
Hugh Dougherty, expense to Boston	87.84
R. S. Taylor, attorney, by Hoge	1,220.00
C. C. Bulkley, attorney	6,107.49
R. S. Taylor, attorney	4,014.85
J. W. Brennen	1,800.20
Lorain Savings and Banking Co. (balance on note)	1,080.00
Interest on same	16.20
Interest on above note, postage and telegram	89.59
Western Union Telegraph Co.	18.62
Postal Telegraph Co.	2.00
R. S. Taylor, attorney, expense in Berliner case	522.60
C. C. Bulkley, services Carty patent case	5,000.00
J. W. Brennen, services Carty patent case	600.76
E. P. Payson, attorney, fee Berliner case	4,000.00
E. P. Payson, attorney, expenses	1,100.00
S. P. Sheerin, expenses	1.81
C. C. Bulkley, services Carty case	1,000.00
R. S. Taylor, services Carty case	1,500.00
E. P. Payson, expenses Berliner case	231.89
J. W. Brennen, services in Carty case	50.00
J. W. Brennen, services in Carty case	115.00
Exchange on draft	.20
R. S. Taylor, services Carty case	1,000.00
R. S. Taylor, expenses Carty case	272.41
Hugh Dougherty, expense Washington to Boston and return	31.00
J. M. Thomas, expense New York to Boston and return	19.50
R. S. Taylor, expenses Berliner case	286.18
J. B. Ware, expenses	52.95
J. M. Thomas, expenses	41.40
C. C. Bulkley, services in Carty case	1,000.00
R. S. Taylor, services in Berliner case	2,000.00
J. B. Ware, expenses	32.08
E. P. Payson, copies of Berliner decision	20.00
J. M. Thomas, hotel and traveling expenses	303.00
Hugh Dougherty, hotel and traveling expenses	155.25
E. P. Payson, attorney, Berliner case	2,500.00
E. P. Payson, attorney, Berliner case	1,000.00
C. C. Bulkley, services and expenses in Carty case	475.00
E. P. Payson, balance in full for services Berliner case	500.00
Jennie McFall, services as stenographer	25.00
J. B. Ware, expenses	40.00
C. C. Bulkley, Carty case	1,000.00
C. C. Bulkley, "in full"	3,250.00
F. W. Dunbar, in full for services as expert	660.00
Balance in treasury, June 23, 1903	62.74
Total	$50,127.12

ADOPTION OF A NEW CONSTITUTION.

On motion of L. A. Frazee, the Dougherty report was accepted with a vote of thanks to the committee and also to all the officers of the association, who had made such a report possible. In speaking to this motion, E. B. Fisher took occasion to praise the report highly, saying that he knew of the difficulties experienced in raising money for the patent-litigation fund, and that the committee was entitled to great credit for its intelligent, loyal and unceasing efforts. By its applause, the convention seemed to agree with the speaker.

J. C. Kelsey, professor of telephony in Purdue University, Lafayette, Ind., then read his paper on "The Telephone and the Technical School." After reading his paper Mr. Kelsey further impressed the value of a two-year course in telephony to the telephone engineer. He also stated that the technical schools are unable to supply the demand for this class of engineers.

Hon. S. P. Sheerin of Indianapolis, Ind., asked permission to offer an amendment to the constitution, which was granted. After a few remarks, in which the speaker said that nearly all who were thoroughly informed on the Independent situation were of the opinion that the time had arrived for a reorganization of the national society, and that the membership should be made up of individuals instead of companies, he offered a radical amendment which practically wipes out the old constitution and virtually reorganizes the association. Mr. Sheerin said that up to the present time it has been the object and purpose of the Independent Telephone Association to fight patent suits in the courts, and that in this it has been victorious in nearly every instance. Now that the battles have been won and but slight cause exists for further fear in this direction, he thought it time to reorganize on different lines and place the association in a position where it can better advance the present cause of the Independent movement. Mr. Sheerin's argument was in line with President Thomas' address. When put to a vote the amendments were unanimously adopted. The new constitution is as follows:

Article First.—Name. The name of this organization shall be the Independent Telephone Association of the United States of America.

Article Second.—Objects. Section 1. The objects of this association shall be to encourage in every proper way the development of the Independent telephone business of the United States, by embracing within its membership all owners, operators, employes and manufacturers of Independent equipment.

Sec. 2. Diffusion among its members of all attainable knowledge of the art that may tend to broaden their information and add to their usefulness, efficiency and economy in operation.

Article Third.—Membership. Section 1. Any person of good character engaged in any branch of Independent telephony within the limits of the United States shall be eligible to membership, upon election as hereinafter provided, and the payment of a membership fee of $2 and annual dues of $1.

Article Fourth.—Officers. Section 1. The officers of this association shall be a president, a vice-president, a secretary and treasurer (which latter two offices may be filled by one and the same person) and an executive committee of eleven members, two of whom shall be the president and secretary, who shall be ex-officio chairman and secretary, respectively, of said executive committee.

Sec. 2. The officers shall be elected by ballot, at each annual meeting of the association, and shall hold their respective offices for one year and until their successors shall have been chosen and qualified.

Sec. 3. Duties of Officers. The president shall preside at all meetings of the association and executive committee, sign all orders on the treasurer, and discharge such other duties as usually devolve upon the president of an association. The vice-president shall, in the absence or inability of the president, perform all duties of president. The secretary and treasurer shall keep accurate minutes of the association, collect all moneys due the association, give proper receipts for same, shall be responsible for the safe keeping of all funds, and pay the same out upon the order of the president for allowances duly made by the executive committee, and not otherwise. He shall also be the custodian of all books, papers and other property of the association, and shall give notice of all meetings. The executive committee shall have all the authority of the association, except when the association is in session, not herein specifically delegated to the other officers.

Sec. 4. Salaries. The secretary and treasurer shall be allowed such reasonable salary as may be determined by the executive committee.

Sec. 5. The president, vice-president and members of the executive committee shall be allowed their actual expenses for attending meetings.

Article Fifth.—Meetings. Section 1. A majority of all the members present at any annual or special meetings shall constitute a quorum. Thirty days' written notice of time and place of each meeting shall be mailed by the secretary to each member of the association. A majority of the members of the executive committee shall constitute a quorum.

Article Sixth.—Elections. Section 1. All elections shall be by ballot. The presiding officers shall appoint tellers to conduct the same.

Article Seventh.—By-Laws. Section 1. The executive committee may, in its discretion, adopt such by-laws as it may deem expedient, not inconsistent with this constitution.

Article Eighth.—Amendments. Section 1. This constitution may be amended at any annual meeting of the association, by an affirmative vote of a majority of the members present.

TO MEET IN ST. LOUIS NEXT YEAR.

A letter from T. C. Martin of New York was read. The services of Mr. Martin have been engaged by the Census Bureau to assist in compiling telephone statistics. In his letter he expressed regret at not being able to attend the convention, and urged the co-operation of every member of the association in securing data for statistics in telephone matters. Secretary Joseph B. Ware spoke in support of Mr. Martin's request for co-operation and pointed out the value and importance of accurate statistics to every telephone company. He stated that there are at present about 7,000 Independent telephone companies in the United States.

Professor W. E. Goldsborough, chief of the Department of Electricity of the St. Louis Exposition, was introduced and gave a short address. He extended a hearty invitation to the association to hold the 1904 meeting in St. Louis. The week of September 12-17, 1904, is a special electrical week at the exposition, and Professor Goldsborough suggested that this would be an excellent time to hold the convention. He said the fair association would supply a place to hold the meetings and would assist in other ways. A written invitation from President R. D. Francis of the World's Fair to the same effect was read. Immediately following the reading of President Francis' invitation, and just before adjournment for the day, a motion to have the next meeting in St. Louis was carried. The 1904 convention will therefore be held in St. Louis during the week of September 12th.

WEDNESDAY EVENING'S ENTERTAINMENT.

The entertainment features of the programme were well arranged and successfully carried out, which result was assured when J. G. Ihmsen was made chairman of the local committee of arrangements, the other members of which were H. D. Critchfield, W. Forman Collins, Henry Shafer, A. E. Barker, C. W. Stiger, H. B. McMeal and J. R. Dare. At 7 p. m. on Wednesday a party of about 100 left the Auditorium in large tally-hos for a long drive through the South Side boulevards and park, the ride terminating at Sans Souci Park. Here a special high-class vaudeville performance was given, reserved seats at which had previously been secured by the committee for the convention guests.

THURSDAY'S SESSION.

The session of Thursday was convened at 10:45 a. m. President Thomas introduced C. E. Tarte, general manager of the Citizens' Telephone Company of Grand Rapids, Mich., who read an excellent paper on "The Value of Good Work." This paper will be presented in full in a future issue of the Western Electrician. The next paper read was by F. A. Demarest of Trenton, N. J. This paper was on "Eastern Telephone Development." The development shown in the East in recent years is somewhat surprising. Even in the New England states, where, up to two years ago, it was impossible to obtain a footing, the people are awakening to the benefits to be derived from competition, and Independent companies are getting franchises in nearly all the larger cities. L. W. Stanton of Cleveland, Ohio, gave a short illustrated talk on the economies in operating telephone exchanges. His suggestions were valuable and instructive.

J. G. Ihmsen then arose to introduce a feature not down on the programme. Prefacing his action by a brief speech, he presented President Thomas with a fine gold watch and fob as a token of appreciation of his untiring efforts in behalf of the association. Judge Thomas responded in a fitting manner.

ELECTION OF OFFICERS AND ADJOURNMENT.

The name of the Hon. Hugh Dougherty of Bluffton, Ind., was presented to the convention by H. D. Critchfield of Chicago as a candidate for the presidency. There were no other nominations, and the secretary was instructed to cast one ballot for Mr. Dougherty, which was done. Mr. C. W. Kline of the Interstate Telephone Company of New Jersey, Hazleton, Pa., was also unanimously elected vice-president and Frank G. Jones of Chicago was elected secretary and treasurer.

A nominating committee was appointed to present a list of names to constitute the executive committee. The committee report was accepted, and the following-named were declared elected members of the executive committee: W. E. Goldsborough, St. Louis, Mo.; H. D. Critchfield, Chicago; J. G. Ihmsen, Chicago; Thomas Finucan, Rochester, N. Y.; W. E. Doolittle, Lafayette, Ind.; C. E. Tarte, Grand Rapids, Mich.; E. E. Clement, Washington, D. C.; Capt. E. H. Moulton, Minneapolis, Minn., and A. L. Tatetu, Louisville, Ky. The president and secretary of the association are included in the executive committee by the constitution.

Before adjourning H. D. Critchfield suggested a vote of thanks to the retiring officers for their excellent work in behalf of the association, and the motion was carried unanimously.

The convention then adjourned to meet in St. Louis in September, 1904.

THE NEW PRESIDENT.

After the adjournment of Wednesday's session a group picture of most of the delegates was taken on the steps of the Art Institute. This picture is reproduced on page 505. Mr. Hugh Dougherty, who was elected president at Thursday's session, is shown standing in the front row, and is indicated by a cross. Mr. Dougherty is one of the most prominent of Independent telephone-exchange operators, and is highly esteemed as a man of approved integrity and conservative judgment. He has been identified with the Independent Telephone Association of the United States since its organization and was first vice-president when promoted to the presidency. He is president of the United Telephone Company of Bluffton, Ind., and a director of the New Long-distance Telephone Company of Indianapolis. His counsel has always been highly valued by his associates in the association, and his report from the patent-litigation committee was one of the most important features of the convention. It is safe to say that a report from no other man in the society would carry greater weight. Mr. Dougherty was not present when elected to the presidency, as he was compelled to leave on Wednesday evening, to attend the exercises marking his daughter's graduation.

ATTENDANCE OF EXCHANGE OPERATORS.

In addition to the old "stand-bys" mentioned in the introductory paragraph of this report, there was a fair attendance of men actually engaged in the operation of Independent telephone exchanges. Following is the list:

Alderson, J. W. ..... Mineral Point, Wis.
Ames, F. Z. ..... Rutland, Ill.
Barnett, James F. ..... Memphis, Mo.
Bishop, Fred ..... Central City, Iowa
Bromley, Thomas, Jr. ..... Muncie, Ind.
Burns, R. L. ..... Hutchinson, Kan.
Burr, C. ..... Gallipolis, Ohio
Christian, George W., Troy Telephone Company ..... Troy, Ohio
Conklin, A. B., Interstate Telephone Company ..... Aurora, Ill.
Curren, A. J. ..... Muncie, Ind.
Demarest, F. A., Interstate Telephone and Telegraph Company ..... Trenton, N. J.
Donald, J. B., Western Telephone Company ..... Calgary, Alberta, Can.
Dorland, P. O. ..... La Porte, Ind.
Douglass, H. A., Citizens' Telephone Company ..... Jackson, Mich.
Ebert, W. E. ..... Effingham, Kan.
Ellenwood, W. R. ..... Leon, Iowa
Emrick, C. E., Progress Telephone and Telegraph Company ..... West Milton, Ohio
Fair, George W. ..... Chrisman, Ill.
Fennell, W. F. ..... Charleston, S. C.
Fisher, John, Citizens' Telephone Company ..... Grand Rapids, Mich.
Forbes, C. W., United Telephone, Telegraph and Electric Company ..... Chicago
Freeman, Frank R., Union Telephone Company ..... Dodgeville, Wis.
French, O. F., Federal Telephone Company ..... Cleveland, Ohio
Hall, Wilber, Eddyville Telephone Company ..... Eddyville, Iowa
Halloway, W. B. (with Mrs. Halloway), Eddyville Telephone Company ..... Eddyville, Iowa
Hampton, E. C. ..... Marion, Iowa
Hans, W. W. ..... La Porte, Ind.

Hodges, Louis A., Monroe Telephone Company.....Monroe, Wis.
Hodges, [illegible] Sherman, Texas
Hodges, [illegible] Norwalk, Ohio
Hodges, [illegible] Ottumwa Telephone Company.....Ottumwa, Iowa
[illegible] Independent Consolidated Telephone of Wisconsin.....Weyauwega, Wis.
[illegible] Blissfield Telephone Company.....Blissfield, Mich.
[illegible] Victoria, Ill.
Johnson, Roy H., Ogle County Telephone Company.....Oregon, Ill.
[illegible] Bremen, Ind.
[illegible], W. W. Dodgeville, Wis.
Miller, Robert Muncie, Ind.
Nelson, H., Dane County Telephone Company.....Madison, Wis.
Nelson, R. N., Dane County Telephone Company.....Madison, Wis.
Pancost, H. E., Northern Illinois Telephone Company.....Mendota, Ill.
Penn, Jerome, Washington Home Telephone Company.....Washington Court House, Ohio
Price, H. A. Bay City, Mich.
Remey, O. D. Bay City, Mich.
Rentz, John, Blissfield Telephone Company.....Blissfield, Mich.
Reeve, C. A., Plymouth Telephone Company.....Plymouth, Ind.
Rex, O., North Manchester Telephone Company.....North Manchester, Ind.
Robinson, William Muskegon, Mich.
Rouder, B. Dwight, Ill.
Rudy, G. B., York Telephone Company.....York, Pa.
Rushing, F. O. Indianapolis, Ind.
Sale, H. B. Indianapolis, Ind.
Schade, E. D. Johnstown, Pa.
Serviss, W. B. Owosso, Mich.
Sherman, O. M. Wanatah, Ind.
Shimel, C. W., Shimel Telephone Company...Casey, Ill.
Smith, D. Muskegon, Mich.
Smith, J. A. Bellflower, Ill.
Stacey, A., Citizens' Telephone Company.....Grand Rapids, Mich.
Starkey, N., Pineville Telephone Company.....Pineville, Ky.
Stevens, C. F., Princeton Telephone Company.....Princeton, Ind.
Stoops, Claude R. Nappanee, Ind.
Stratton, C. D., Union Telephone Company.....Lancaster, Wis.
Talbrett, W. M. Havana, Cuba
Tarte, C. E., Citizens' Telephone Company.....Grand Rapids, Mich.
Trask, C. O. Springfield, Mo.
Van Gundy, H. Saybrook, Ill.
Van Middlesworth, W., Citizens' Telephone Company.....Racine, Wis.
Weinis, P. J. Monroe, Wis.
Wilson, D. B. Shelbyville, Ind.
Winter, H. C., Dane County Telephone Company.....Madison, Wis.

Convention Notes and Personal Gossip.

George W. Conover of Chicago was "right there" every day.

Attorney Edward E. Clement of Washington, D. C., was at the convention.

The Edison Lamp Works of Harrison, N. J., was represented by John I. Solomon.

General Manager J. Cecil Finch of the Chicago Pay Station Company was early on hand and stayed late.

Manager E. F. Kirkpatrick of the McRoy Clay Works of Brazil, Ind., was, as usual, decidedly "in evidence."

H. R. Hughes, representing J. F. Butterfield, electrical engineer and contractor, Chicago, was in attendance.

Western Manager Charles L. Hibbard of the Varley Duplex Magnet Company was, of course, among those present.

Fuses were talked, as usual, in a most fluent manner by President Jones of the American Electric Fuse Company.

Messrs. Turley and Smith of the Chicago Insulated Wire Company were in attendance on the last day of the convention.

Leroy W. Stanton, the able consulting telephone engineer of Cleveland, was one of those who came in on Wednesday.

Edgar H. Hammond, in his usual energetic manner, kept the American Electrical Works' western office well to the front.

Providence, R. I., came to the front in the person of Manager J. L. Putnam of the Clark Automatic Switchboard Company.

The W. G. Nagel Electric Company was represented by E. J. Paradis. This concern made no attempt at an exhibit.

M. M. Clark of the battery department of the LaSalle Electric Company of Chicago was daily on hand, pushing his batteries.

William H. Slingluff of the J. A. Roebling's Sons Company mingled with the convention people in the rotunda of the Auditorium.

Secretary and General Manager S. W. Moon put in an appearance, representing the Illinois Electric Specialty Company of Chicago.

The Independent Construction Company of Archibald, Ohio, and Kankakee, Ill., appeared in the person of Manager A. J. Vernier.

C. W. Farr of the Farr Telephone and Construction Supply Company was on hand, and this time no effort was made to have an exhibit.

H. Grant Thompson and H. J. Minhinwick, representing the New Haven Novelty Machine Company, presented this company's new device, through which the wiped joint on terminal heads may be done away with.

"Joe" Williams of the Williams Electric Telephone Company of Cleveland was, of course, one of those who mingled with the guests.

Kempster B. Miller of Chicago, the well-known telephone engineer and author, was an interested visitor at the sessions of the convention.

H. P. Clausen, the well-known engineer of the American Electric Telephone Company, Chicago, was in daily attendance at the convention.

E. J. Noblett of the E. J. Noblett Company, Chicago, maker of telephone cabinet work and other specialties, was in attendance at the convention.

H. H. Hipwell of the Hipwell Manufacturing Company, manufacturer of high-grade telephones and switchboards, came up from Allegheny, Pa.

President and Treasurer John Fowler of the Fowler-Jacobs Company, producer and wholesaler of white-cedar products, dropped in on Wednesday.

Frank B. Cook made a most interesting exhibit of the Cook terminals and protectors. Rumor has it that the Cook factory is filled to overflowing with orders.

J. E. Keelyn of the Western Telephone Manufacturing Company was warmly greeted by many friends. Mr. Keelyn is considered the father of the association.

The Bogue and Crowe Manufacturing Company, metal worker, presented a line of name-plates of interest to telephone manufacturers. A. S. Porter represented this company.

Of course, L. L. Sands of the Williams-Abbott Electric Company of Cleveland put in an appearance and brought with him quite an interesting exhibit of the products of his factory.

The Valentine-Clark Company was decidedly in the swim. On hand were President E. H. Valentine, Secretary and Treasurer E. L. Clark, F. L. McGillan and Joseph Greenwood.

W. P. Bowring, secretary and treasurer of the C. H. Worcester Company, was one of the interested pole men at the convention. Mr. Bowring looked after the interest of the Worcester company in his usual affable manner.

J. H. McGill of the Crescent Company, Omaha Building, Chicago, was on hand Thursday at the Auditorium. The Crescent soldering stick already has many friends among telephone mechanics; its virtues are leading daily to increased sales.

Of course, James S. Cuming of the Central Telephone and Electric Company of St. Louis was on hand. Mr. Cuming built up one of the most prosperous telephone businesses in the Southwest, and he is an ever-welcome guest at telephone conventions.

Oscar L. Gagg was on hand calling attention of the telephone people to the product of the Jones Perpetual Ledger Company. The books of this institution were of decided interest to telephonic accountants, and were on exhibition in Chicago at 171 LaSalle Street.

The Sterling Electric Company, Lafayette, Ind., like most of the other manufacturers, made no exhibit. On hand, however, were H. F. Doolittle, F. E. Rotchka and Evan Shelby. President W. E. Doolittle was prevented by pressing business from putting in an appearance.

The Monarch Telephone and Manufacturing Company of Chicago invited exchange managers to visit its parlor and examine the parts that made Monarch telephones famous. The company's interests were looked after by President E. E. Yaxley, W. H. Trimm and J. C. Hubacher.

A. T. Naugle, manager of the cedar-pole department of the E. E. Naugle Tie Company, Chicago, was warmly received by his many acquaintances at the convention. Mr. Naugle made no attempt at an exhibit, but looked after the interests of his company with tact and skill.

J. J. Lothian represented Baker & Co of Newark, N. J., the gold, silver and platinum refiners, and told the convention people all they needed to know about platinum and its applicability in telephonic construction. Mr. Lothian presented a souvenir in the form of a celluloid pocket rule.

The Carney Bros. Company, Chicago, producer of cedar poles, took advantage of the convention, and Messrs. Carney and Kaufman took care to impress exchange managers with the merits of the Carney products. This company is well fitted for furnishing the best in the cedar line.

The North Electric Company of Cleveland this time made no exhibit, but was represented by President Charles North, L. G. Bowman of the sales department and F. F. Sapp, manager of the advertising department. A souvenir was given away in the form of a miniature gold transmitter.

President Miller of the Miller Anchor Company of Norwalk, Ohio, made an interesting exhibit of the Miller pole anchor and augur for setting anchors. The Miller anchor has won great favor with telephone-construction men, owing to the ease with which it can be applied and the solidity of its grip in the earth.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago and Rochester appeared with its usual "army" of representatives. Among those present were A. Stromberg, E. L. Brown, C. W. Stiger, D. M. Christ, W. D. Christ, J. J. Nate, E. C. Lewis, E. P. Shafer, F. L. Martin, G. Babcock and Mr. Jackman.

President Henry Shafer of the International Telephone Manufacturing Company, like the majority of the telephone manufacturers in Chicago, made no attempt at an exhibit. Mr. Shafer was, however, constantly on hand, as were Vice-president W. E. McCormick, Sales Manager F. L. Middleton and Secretary J. C. Burmeister.

"Bond issues financed" was an advertisement indicative of the interest in telephone purchase now being taken by the Royal Trust Company Bank of Chicago. This bank acts as trustee for all classes of bonds in all states and territories, registrar and transfer agent of stock and financial agent and depository under consolidations.

Francis Beidler & Co., producers and wholesalers of forest products, were represented by M. B. Cross, manager of the cedar department, and W. G. Ramshaw. This company displayed a unique sign on the main floor, representing a number of cedar poles, which attracted considerable attention. Beidler & Co. continue to do a large business.

Western Manager E. L. Draffin of the Gould Storage Battery Company made no exhibit, but was in constant attendance at the convention. Under Mr. Draffin's management the Gould storage battery has found its way into many telephonic exchanges throughout the West, and the company's prospects in this direction never looked better.

The Swedish-American Telephone Company, although making no exhibit, was not forgotten by any means. President E. B. Overshiner, General Manager Macklin, State Manager A. V. Overshiner and J. A. Russell were on hand. An automobile was constantly ready for the transportation of visitors to the Swedish-American factory.

Of course, Lindsley Bros. Company, the well-known pole dealer, was decidedly in evidence. On hand were George L. Lindsley, Edward A. Lindsley and J. A. Navarre. Lindsley Bros. is one of the most successful firms of pole dealers in the United States, and the Lindsley "cat" is now looked upon as a trademark that reads "fair dealing."

I. A. Maltby, the energetic manager of the Maltby Lumber Company of Bay City, Mich., was on hand as usual. Mr. Maltby is a firm believer in publicity, and his long experience has enabled him to make the most of every convention. Mr. Maltby reports a good business in poles and ties and states that the outlook for fall trade is unusually bright.

G. P. Gleason came from St. Louis as the representative of President Henry Wrape of the American Carbon Battery Company. Mr. Gleason presented a line of samples of telephone carbons and carbon battery specialties. This company has begun the manufacture of electrical porcelain, and there were also presented samples of this class of ware.

H. E. Cobb, manufacturer's agent, Chicago, displayed a line of new glass insulators for telephone lines, manufactured by the Ohio Valley Glass Company of Pleasant City, Ohio. Mr. Cobb was kept busy explaining the merits of these insulators. Mr. Cobb also represented the Crawfordsville Wire and Nail Company, maker of telephone and telegraph wire, and was assisted by Charles O. Hatch.

The Chicago Telephone Supply Company of Elkhart, Ind., was represented by President G. A. Briggs, Secretary H. C. Randall and S. A. Duvall. This company has just brought out a new switchboard. The peculiarity of this board is its tubular drop and jack, which is individually removable. Its drop coils, too, are removable in 30 seconds from the drop without tools and with the drop still in the board.

Mr. Murdock of William J. Murdock & Co. of Chelsea, Mass., came to the front with one of the most unique souvenirs at the convention. Mr. Murdock presented an attachment for the coat lapel in the form of a full-sized transmitter shell, upon which was inscribed "talk to Murdock." Mr. Murdock is the well-known advocate of the "solid" receiver that has won so much favor in the electrical trade.

This time the Standard Underground Cable Company sent three representatives to the convention. As usual, Western Manager J. R. Wiley was on hand, accompanied by W. M. Rogers. F. S. Viele of the construction department came in from Pittsburg. Mr. Viele has not been a resident of Chicago for a number of years, and was warmly welcomed by his many friends on this his return to his old territory.

The Kellogg Switchboard and Supply Company put up a splendid front at the convention. No attempt was made at an exhibit other than an invitation to visit the Kellogg company's large factory

on the West Side. Following is a list of those who were on hand: Milo G. Kellogg, L. D. Kellogg, Kempster B. Miller, F. W. Dunbar, F. J. Dommerque, A. E. Barker, Wm. J. Gunn, A. B. Kratz, C. P. Platt, S. E. Platt, G. H. Lutz, G. L. Ainesworth, R. S. Mueller, R. H. Manson, W. R. Hind and others.

President P. C. Burns and General Manager Ihmsen of the American Electric Telephone Company were constantly in attendance. Mr. Ihmsen won the praises of all hands through his courtesy in looking after the visiting delegates. However, at every convention where the interests of the Independent people are at stake Messrs. Burns and Ihmsen are constantly on the lookout to do good turns for everybody.

The Gordon Battery Company made quite an exhibit of its product in one of the parlors on the sixth floor. Gordon cells were explained by Western Agent E. M. Deems and Electrician W. C. Banks of the company's New York office. The Gordon battery is a great favorite in the electrical trade, and as this company is always studying improvement, the Gordon Battery Company's parlor was an object of interest to telephonic people.

President Joseph C. Belden of the Belden Manufacturing Company was in constant attendance. Mr. Belden, until about a year ago, was prominently connected with the Kellogg Switchboard and Supply Company, but severed his connection from this latter institution to start in business for himself as a manufacturer of insulated wires. The Belden Manufacturing Company is now running full blast on the North Side, Chicago, with orders that keep the factory busy at practically its full capacity.

Miller Hopkins, vice-president of A. P. Hopkins & Co., Escanaba, Mich., producers of cedar poles and ties, is a conspicuous figure at electric-light and telephone conventions, and this occasion was no exception. Mr. Hopkins is one of the most genial men in the cedar business, and in addition to being ever on the alert to talk "shop" he has the pleasant faculty of making a host of friends. "Hopkins' Choice" was seen all over the hotel, and many visitors visited the Hopkins parlor to make further inquiry.

The convention was made noteworthy by the retirement of Judge James M. Thomas of New York, the president for six years and the only president of the association up to this meeting. Originally from Chillicothe, Ohio, where he served as probate judge, Judge Thomas has achieved a commanding position in the Independent telephone field, and his services have been of great value to the association. He retires to practice law in New York city, having an office at 68 William Street. Many friends wish him success.

The Eureka Electric Company of Chicago displayed a very catchy sign, "Good Enough for Uncle Sam Good Enough for You," indicative of its success in securing government orders after rigid tests. This company was represented by I. J. Kusel, Harry Kusel. D. L. Canman, R. S. Mitten and Sales Manager H. P. Didriksen. Incidentally, it may be noted that the Eureka company has just placed on the market a new Bell style "ring-down" switchboard. This board is made in two styles, and possesses many novel points worthy of investigation.

The Turner Brass Works, Chicago, made quite an exhibit in one of the parlors, showing different lines of metal specialties applicable to telephonic work. Special attention was called to the company's gasoline torch. The interests of the company were looked after by Thomas R. Ferris, Charles H. Binkley, P. Henderson, F. A. Reid and A. W. Straight. The company distributed handsome souvenirs in the form of a paper knife and paper weight. Anyone who witnessed the scramble for these souvenirs could testify that they were greatly appreciated.

Hubbard & Co., construction material, of Pittsburg, came to the front in the person of General Superintendent C. Seyler. Mr. Seyler was in daily attendance during the sessions of the convention. Few persons except those who have made the trip to Hubbard & Co.'s Pittsburg plant realize the extent of this company's works. The Hubbard plant covers a large area just outside of Pittsburg, and to realize the extent of the business done by this company in the manufacture of telephone construction specialties alone all that is necessary is a walk through the plant.

The Moon Manufacturing Company of Chicago made no attempt at an extensive exhibit, but Messrs. Procunier and Wood were constantly on hand. There was shown, however, in one of the parlors a Moon terminal head. This terminal head may be fitted with carbon arresters or with copper arresters. The Moon terminal has certain valuable features which afford the surest protection to telephonic conductors, and in evidence of this fact the Moon company offers the records of service of the Moon terminal. The peculiarity of the carbon arrester in the Moon terminal head is that it will withstand without injury heavy currents. Attention is called to the Moon outer case or storm box.

As usual, J. F. Crook, that courteous and energetic representative of the Automatic Electric Company, was always on hand and explained the advantages of automatic operation in telephone-exchange service in contradistinction to the young-lady operator. Mr. Crook had a line of automobiles constantly on hand in front of the Auditorium, and many visitors were whirled over to the West Side for a glimpse of the Automatic Electric Company's magnificent factory. Incidentally, it may be said that a visit to this institution, as usual, reveals a surprise to the out-of-town Independent telephone man in that few people realize the extent of the completeness of the Automatic Electric Company's large factory.

The American Stone Conduit Company, Chicago, manufacturer of "stone pipe," was represented by W. Dunbar, H. C. Avery and W. W. Smythe, Jr. The attractive booklet, "Are You Interested in Conduits?" was distributed among the delegates by this company. Mr. Smythe made his debut as a conduit man at this telephone convention. He has recently received an appointment as a repreesntative of the American Stone Conduit Company, Chicago, and the convention at the Auditorium was his first opportunity to talk "stone pipe" to an aggregation of telephone men. His energy in the electrical business is well known, and the little pamphlet he distributed in the interests of his institution, referred to above, spoke well for his grasp of the needs of contractors in telephonic underground work.

The Elliott and Hatch Book Typewriter and the Fisher Book Typewriter Company made a very interesting exhibit in a parlor at the Auditorium under the care of Manager M. B. Locke of these companies' railway department. These companies showed Fisher and Elliott billing machines and illustrated their application in the business of the New York Telephone Company, the New York and New Jersey Telephone Company and the Cleveland Telephone Company, showing the writing of monthly statements for toll charges, installation order forms, time books, pay rolls, instrument and pole records, purchasing department orders, tabulated forms, etc. As the telephone-exchange business has become so vast, the applicability of a typewriter on this unique work was of decided interest and excited much comment on the part of exchange managers.

The exhibit of the Thomas E. Clark Wireless Telegraph and Telephone Company was pronounced one of the most interesting at the Auditorium. In charge of the apparatus were Secretary and Treasurer Gustave E. Riefstahl and Advertising Manager Ackland Stiling. The Clark Wireless company had a full set of space-telegraph instruments, and sent messages and recorded them between two adjoining rooms. Incidentally, it should be noted that this company manufactures wireless apparatus, but it does not install the outfits. In a word, it does a simple manufacturing business, and the purchaser is obliged to set up his own apparatus. The company desires particular attention called to this fact, as many buyers of space-telegraph outfits seem to misunderstand the exact nature of the Thomas E. Clark Wireless Telegraph and Telephone Company's business.

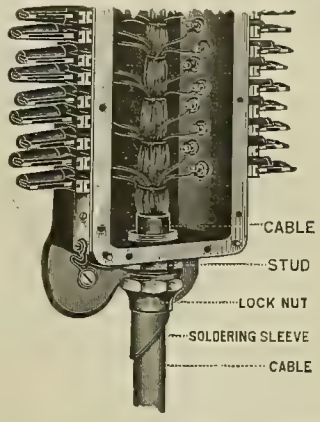
The National Telephone Supply Company, 1430 Superior Street, Cleveland, under the management of Fred P. Auxer, made an exhibit of decided interest to telephone construction men. Mr. Auxer presented as his most interesting specialty the National cable hanger. This hanger has already met with decided favor on the part of the Independent telephone people, as it is simple, durable, readily adjustable and in all a thoroughly practicable device. When this hanger is attached to the cable it holds it in an absolutely tight grip. The National company also exhibited a line of Marlin cable hangers. This last-mentioned type of hanger is equipped with only the long-fiber American hemp, and the hooks are neat and durable. Mr. Auxer also exhibited the company's type of "unbreakable" malleable messenger hangers. There was also exploited galvanized-pole protection strips. The National Telephone Supply Company has made a specialty of construction equipment, and purchasers of this line of telephone specialties will find it to their interest to correspond with the company. In order, however, to appreciate the merits of the specialties, samples should be inspected.

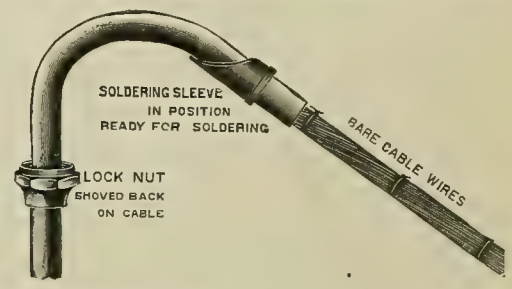
Simple Means of Installing a Terminal Head.

The accompanying cuts show a new manner of connecting a cable to a terminal head by means of what is termed a "novelty nozzle," similar to what is known as the "novelty sleeve" used in splicing cable and manufactured by the New Haven Novelty Machine Company.

The nozzle consists of three parts. They are the stud, which is set in the terminal head; the soldering sleeve, which has a tinned and tapered lip, and a lock or retaining nut. With this style of nozzle a wipe joint is done away with and the terminal is as easy to install as a pot head. The solder is run inside of the tinned and tapered lip, with a soldering iron, forming a strong and complete joint.

The operation of connecting the cable to the terminal head and sealing it by this joint is quite simple. The lock nut is first slipped over the cable, and then the soldering sleeve is soldered onto the cable in its proper place, which is determined by measurement. Before passing the cable end into the terminal head, a sufficient amount of lead casing of the cable is stripped off to enable the cable wires to be connected to the terminal connections on the inside of the terminal head. The cable is passed through the stud into the terminal head, then the lock nut is slipped to its place and screwed hard to the stud in the terminal head, and the operation is complete.



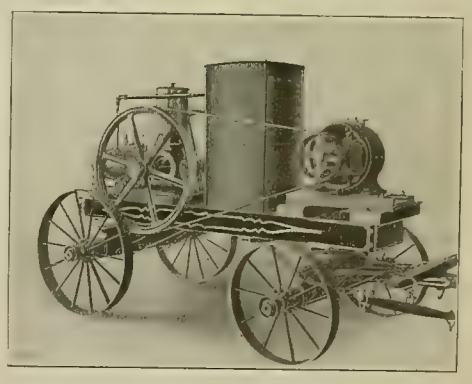


NEW MEANS OF CONNECTING CABLE TO TERMINAL HEAD.

The advantages of the "novelty nozzle" are many. The terminal may be fastened in place on the pole before the cable is attached, and, of course, there is no wipe joint used. Any lineman can solder this connection. The Moon Manufacturing Company of Chicago is using this style of nozzle and is placing it in the Moon terminal head where desired, with no additional cost.

Mietz & Weiss Portable Electric light Plant.

The latest departure in the kinetoscope or moving-picture line, is a complete electric-lighting outfit built by A. Mietz, 128 Mott Street, New York. It has been transported to India, where it is expected to reap a large profit for its owners. The outfit, which is shown in the accompanying picture, will be drawn through the country by horses or bullocks, from one town to another, and moving pictures will be presented with an arc light operated by electricity generated by the machine. Some 800 feet of conducting wire are provided, so that the apparatus



MEITZ & WEISS PORTABLE ELECTRIC-LIGHT PLANT

can be placed in any convenient location outside of the theater or hall.

The machine consists of a standard truck, built of steel, upon which are mounted a kerosene engine, dynamo and water and oil tanks. The engine is of four horsepower, and drives by belt a General Electric generator of 2¼ kilowatts capacity. The large tank, in the center of the truck, contains water, which, by means of a small circulating pump, is forced through the cylinder jacket for cooling purposes. The oil supply is sufficient for 10 hours. The weight, with full supply of oil and water, is 4,500 pounds. Mr. Mietz has built several outfits of this character, which have been shipped to distant countries.

Indiana Telephone Items.

The Charlottesville Telephone Company, recently incorporated, will build and operate telephone lines in Hancock and Rush Counties. The service will be free to stockholders. Asa L. Sample, R. W. Gilbreath, William C. White, John H. Lane and W. H. Lee of Charlottesville are the incorporators.

At a recent meeting of the Manufacturers' Association in Evansville the principal subject under discussion was the municipal telephone question. Major Rosencranz gave the history of the municipal telephone from its first inception. Mayor Covert was present and predicted the success of the municipal telephone company.

The Mooresville Home Telephone Company has increased its capital stock from $10,000 to $25,000. The company will now proceed to finish the line from Mooresville to Edgerton and make other extensions. S. E. Mentzer is president and G. E. Spake, secretary.

Notices to corporations are being sent out by the state auditor relative to the approaching session of the Indiana State Board of Tax Commissioners. The hearing of statements regarding the assessment of the properties of telephone and telegraph companies will begin July 28th.

The City Council of Portland has sustained the mayor in the veto of the ordinance granting a franchise to the Hoosier Telephone Company. A new franchise ordinance will be passed. The company's managers say they are ready to contract for the erection of a plant and the stringing of wires in the 21 counties named in its articles of incorporation.

A stock company composed of business men has been organized to purchase and operate the Converse telephone plant, now owned by Barger & Son, and the Converse electric-light plant, owned by H. S. Bowers. The telephone plant is taken at $8,000. The amount of capital subscribed is $25,000. A new power house will be constructed and the plants will be operated under one management. The telephone lines will be extended.

The strike among the Central Union and the New Telephone Company's linemen in Indianapolis assumed a serious phase last week. For over four weeks they have been out and commanded the field against all recruits. Last week the telephone companies procured police powers for a number of "watchmen." It turned out that these "watchmen" were experienced linemen and were put to work stringing wires and making repairs. The strikers approached them, and it is alleged assaulted them One of the watchmen used his revolver, shooting another man in the shoulder. Upon his arrest the companies furnished bond for his release. The city at once revoked the police powers. The matter has been referred to Labor Commissioner McCormack, who will endeavor to settle the trouble between the linemen and their employers. R.

Telephone News from the Northwest.

The Supreme Court of Minnesota has handed down a decision in the suit of the Northwestern Telephone Exchange Company against the Twin City Telephone Company, in favor of the former. The Twin City company, in constructing lines in Minneapolis, ran some of its lines under the wires of the Northwestern, thereby cutting off the latter from adding lines on its poles between the crossarms already in place and the ground. The court holds that the newer company is bound to pass its wires over those of the older company, which is held to have prior rights. The court declines to pass upon the Northwestern's claim to all the space between its wires and the ground.

The Twin City Telephone Company of Minneapolis has ignored a resolution of the council which requires constructing subway work for three blocks on Second Street North, where the council has granted a railroad company the right to build tracks. The telephone company asserts that the council cannot grant this right to a railroad company.

The city of Brookings, S. D., has closed a deal for the purchase of the telephone exchange.

The Elk Mound Telephone Company has been formed at Elk Mound, Wis., with a capital of $5,000 to build a line to Fall City and to Amy.

A company has been formed at Nebagamon, Wis., to install a local exchange. It will connect with the toll line to be built from Ashland to Superior.

The Michigan Telephone Company will move its exchange at Menominee, Mich., to new quarters in the new Spies Building. A modern switchboard of multiple type, central energy, will be installed.

The Independent Mutual Telephone Company of Shenandoah, Iowa, has declared a dividend of five per cent. on preferred stock and 7½ on common.

The Rural Telephone Company at Anita, Iowa, has bought the local exchange of Mussen Bros., and will secure toll connections over the lines of the latter. This leaves but one local exchange in Anita.

The Washington Telephone Company of Washington, Iowa, has been incorporated with a capital stock of $60,000. The company will take over the business of Robinson & Wilson, and will make improvements.

The Iowa Telephone Company has asked the council of Waterloo, Iowa, for permission to make extensive changes to its system there.

Carl V. Dyvig will install a local telephone exchange at Inwood, Iowa.

The Rocky Mountain Bell Telephone Company announces an increase, from July 1st, of the party-line service rate by 50 cents a month. This increase is due to increased wages paid to operators and to linemen, and to the fact that the company's taxes have been increased by assessing its franchise at $25,000. R.

Ohio Telephone Notes.

Probate Judge Nippert of Hamilton County has overruled the demurrer of the city of Cincinnati to the petition of the Cincinnati Telephone Company by which it is sought to have the manner of laying its system of underground wires defined and the routes laid out, and the company will, therefore, receive a franchise to build and operate its system through the court. On the other hand, Judge Nippert sustained the demurrer of the city in the case of the Fitzsimmons Telephone Company, which had applied for permission to change its system from overhead to underground. The court holds that it has jurisdiction in the case of a new company applying for a franchise, where the city authorities have refused or neglected to take the matter up, but in case of an operating company applying to be allowed to change its system the court has nothing to do. This is an important distinction, and will be studied by telephone men in this state, as it is probably the first of the kind to be decided.

The employes of the Independent telephone companies at Ironton, this state, and Ashland and Catlettsburg, Ky., went out on a strike last week because of the employment of a number of non-union men. The strike included operators, linemen and clerks.

The commissioners of Butler County have granted the Oxford Telephone Company, Oxford, a franchise to build country lines along the roads leading from the town to the county line. Hamilton, Reiley, Jacksonboro, Collinsville and Somerville will all be connected with Oxford in this way.

The Newark Telephone Company, Newark, has been authorized by the secretary of state to increase its capital stock from $60,000 to $100,000.

The London Home Telephone Company, which recently increased its capital stock to $200,000, will make some extensive improvements on its property, it is stated.

The management of Spring Grove Cemetery, Cincinnati, has decided to install a telephone system that will reach all parts of the grounds from the office. For many years a bell has been used to notify employes when a funeral party has arrived and the employes would be compelled to come to the office to learn the details of their work. The telephone system will do away with the bell tolling and the trips to the office, as any part of the grounds may be reached by it. There will also be pay stations installed, so that persons visiting the cemetery and having occasion to talk to anyone in the city may do so. The Cincinnati and Suburban Telephone Association will put in the system. O. M. C.

Southern Telephone Developments.

The Caroleen-Henrietta Telephone Company has been chartered to operate a telephone line in North Carolina. Thomas P. Reynolds is interested. The capital stock is $600.

The Hamilton Telephone Company of Chattanooga, Tenn., has received a charter. Capital, $5,000. The incorporators are Z. C. Patten, T. W. Fritts, L. J. Sharp and others.

A number of outside employes of the Georgia Telephone and Telegraph Company went out on a strike recently.

The construction department of the Bell Telephone Company is making estimates at Greensboro, N. C., for cables, underground wires, etc., to be used in rebuilding the recently absorbed local telephone company's plant in Greensboro. L.

The Expense of Moving Telephones.

The last quarterly meeting of the managers of Federal Telephone properties was held at the Electric Building, Cleveland, Ohio, on June 19th, when nearly all were present. The managers of these companies have established the custom of meeting every three months to talk over matters in connection with their business, to secure uniform practice.

One of the subjects discussed at the last meeting was the manner of meeting the expense of installing, removing and moving telephones from one place to another at the request of patrons. Such expenses vary from 50 cents for moving an instrument from one side of a room or office to the other to $16 for moving it from one portion of a city to another. This has always been met by making the rates high enough to cover it, but President F. S. Dickson of the Federal company, in discussing the matter, said that this in reality is not an equitable arrangement, although there is seemingly no way of getting around it. He said that a man might have his telephone moved half a dozen times a year, and no one but himself is benefited, yet all are paying for the work that it takes to do this. The man should pay for it himself, and then this would permit a slight reduction in the service rates. However, he said the managers agreed to a man that they would prefer to have the rates advanced rather than attempt to collect charges from the ones who have their telephones removed from one location to another Probably no change will be devised for the present.

Municipal Telephony in Canada.

A Canadian correspondent to the Western Electrician writes that the thriving towns of Port Arthur and Fort William, at the head of Lake Superior, are, so far, satisfied with their telephone service. Fort William installed its own telephone system, in opposition to the Bell, in December last. (See Western Electrician of January 3, 1903.) The central-energy system was put in at a cost of about $15,000, including central equipment, poles, lines and telephone boxes complete. There are already some 350 subscribers, and the present income derived amounts to $5,000 a year at the rate of $1 per month for domestic and $2 for business telephones. Port Arthur, which is three miles distant from Fort William, has a similar system, and there is free exchange between the two towns. By parliamentary enactment, neither town may sell, lease or impair its system without the consent of the majority of taxpayers of both towns. The cost of maintaining the system is not over $3,500 per annum for each town, which also includes interest and sinking-fund payments on 20-year debentures, provision for depreciation of plant and operating expenses.

Central Union Retires from Wabash, Ind.

After 25 years of occupancy the Central Union Telephone Company has, apparently, abandoned the Wabash (Ind.) field. The company's franchise expired last week, and no application has been made for a renewal. The business of the company has dwindled until it is said that the exchange is operated at a considerable loss each year, while the Home Telephone Company has practically all the valuable connections. When the Independent service was established several years ago the Central Union gave service substantially free, but in spite of this competition the Independent company thrived, and a year ago the Central Union returned to the old rates, which are 50 per cent. above it competitor's, with the result that it got no new business. A toll station, however, will be maintained in Wabash.

Bell Company Issues New Stock.

The American Telephone and Telegraph Company's directors have voted to issue new stock amounting to $21,943,200 to stockholders at par. They also declared the regular quarterly dividend of 1½ per cent. and an extra dividend of three-fourths of one per cent., payable July 15th. The present authorized capital amounts to $250,000,000, of which $136,826,600 is outstanding. The current issue is on the basis of one new share for five old shares. It is understood that the company has $8,000,000 cash, but new construction and equipment of the 36 sub-companies requires about $30,000,000.

TELEPHONE MEN.

F. C. Smith, manager of the Citizens' Telephone Company of Houston, Texas, left Chicago on Wednesday of last week for New York.

Charles J. Glidden, of Erie Telephone fame, and his wife have gone abroad to make an automobile trip north of Christiania, Norway. They hope to go into the Arctic Circle. En route to Norway, they will attend the Gordon Bennett international cup race in Ireland.

George F. Hurd, for the last 10 years in the treasurer's office of the American Telegraph and Telephone Company, died at his home in Swampscott, Mass., June 17th. He had been in poor health for several months, and heart failure was the immediate cause of his death.

C. H. Judson, general superintendent of the Twin City Telephone Company of Minneapolis, Minn., has resigned to become general manager of the Home Telephone Company at Kansas City. He will leave on July 1st. Mr. Judson has been with the Twin City company since its formation and was with its predecessor, the Mississippi Valley Telephone Company, from its organization.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Chicago and Rochester has recently sold a magneto switchboard to the Deerfield Telephone Company, North Benton, Ohio; also a large number of bridging telephones to the Clinton Telephone Company of Wilmington, Ohio.

The Eureka Electric Company of Chicago announces that on June 19th Judge Shiras of the United States Circuit Court for the Northern District of Iowa, sitting at Dubuque, dismissed all suits filed on the Meissner and Overshiner patents against the County Telephone and Telegraph Company of Waterloo, Iowa. These suits were defended by the Eureka company, which guarantees that it will defend suits filed against its patrons for the use of its apparatus on the ground of alleged infringement. The company is issuing a handsome new catalogue, which is sent on request.

Metered Telephone Service.

Automatic telephone service in Chicago, as proposed by the Illinois Telephone and Telegraph Company, is a radical departure from methods heretofore adopted by any other operating company as regards the methods of charging for service. The Illinois company prefers to speak of this system as the meter system intead of the measured-service system, as it is more generally known. A telephone will be placed in the office of any responsible individual or firm with the understanding that the user shall pay five cents for each connection. This does not mean that he must each time deposit a five-cent piece in a slot machine, as in the present pay-station system. That annoying feature is done away with by the meter on a selector switch at the central office, directly connected to each telephone. As soon as a call is made and a connection secured this meter, which closely resembles a cyclometer, registers the connection. If the telephone called is busy, no registration is made.

The Illinois company proposes to sell telephone service on the same plan that gas companies sell gas. It is estimated that there are 200,000 gas meters in operation in Chicago. These meters are put in at considerable expense—streets must be torn up, pipes laid and precautions taken to prevent leakage or explosions. In fact, the average expense of installing a gas meter is greater than that of installing a telephone. No one is required to use a certain amount of gas per month or per annum, but each patron pays for the amount actually used. The Illinois Telephone and Telegraph Company believes that there should be 250,000 telephones in use in Chicago, taking the number of gas meters as a basis of calculation. It plans to put the telephone in reach of every person in the city who at any time has a use for it.

It will be seen that the reading of its meters is a simple proposition as compared to the reading of gas meters. All telephone meters are in the exchange building, and the greatest economy of time is therefore secured in keeping up with the business.

GENERAL TELEPHONE NEWS.

Articles of association have been filed by the Washtenaw Home Telephone Company, Ann Arbor, Mich., with a capital of $250,000.

J. C. Henry, O. F. Hutton and others of Blythedale, Mo., are interested in the Blythedale Telephone Company, recently incorporated with capital stock of $5,000.

The Algansee Rural Telephone Company has completed its line into Quincy, Mich., and it connects with the Michigan (Bell) Telephone system and with the local exchange at Quincy.

The Cape Girardeau (Mo.) Bell Telephone Company has been incorporated. The capital of the company is $20,000 and the incorporators are J. F. Le Peck, H. L. Rozier and E. J. Rozier.

The Livingstone Telephone Company has been organized at Livingstone, Texas, for the purpose of establishing a local telephone exchange at that place and to build lines to different points of that section.

The Interstate Telegraph and Telephone Company of Parkersburg, W. Va., has been incorporated with a capital stock of $25,000 by Charles Bekure, Jr., E. E. Ryan, J. H. Fletcher, A. C. Budd and W. B. Harley, all Parkersburg men.

A company has been incorporated to operate a telephone system at Berwick, Ill., under the name of the A. B. C. Telephone Company. The capital is $2,000. L. H. Robertson, Thomas Meadows and C. L. Miller are the incorporators.

The Southern State Telephone and Telegraph Company of Parkersburg, W. Va., has been incorporated with a capital stock of $25,000 to build and operate lines. John Stander, Samuel Trissler and other Parkersburg men are interested.

The Consolidated Telephone Company of El Reno, Okla., has purchased the stock of the Oklahoma Southwestern Telephone Company. Extensive improvements will be made, including an exchange at Clinton, Okla., and additional wires from El Reno to Foss. W. T. Beeks is secretary of the company.

The Cumberland Telephone and Telegraph Company has applied for a franchise to operate a plant at Versailles, Ky. The Town Council agreed to grant the franchise on condition that the company agree to charge subscribers in Woodford County not more than $2 per month for service, but the company has not yet concluded to bind itself to these terms.

A. S. Foote, general foreman of telegraphs and telephones for the Southern Pacific Railroad, has contracted with the Stromberg-Carlson Telephone Manufacturing Company of Chicago, Ill., and Rochester, N. Y., for equipment to be used on the division from El Paso to New Orleans. Mr. Foote is stringing copper circuits between cities, and from stations to sections he uses grounded circuits. This places section, engine and work crews at the disposal of the dispatcher. It is also proposed to place at every blind siding some kind of a telephone or other apparatus that will enable wrecking crews to communicate with the dispatcher.

The Telephone and the Technical School [1]

By J. C. Kelsey.

In this commercial age whenever a new branch of science or industry exhibits unusual activity and growing importance the authorities of our universities are ordinarily prompt in adopting a course of instruction especially adapted to that particular work. Electrical engineering, journalism, insurance and commerce are some of the branches which in these later days have received consideration by leading universities. A late and prominent branch of industry is that embraced by telephony, and this lusty offspring of electrical engineering now vigorously demands recognition. But progress will be slow in this direction if we rely upon scholastic opinion. For prior to the adoption of the course of telephone engineering at Purdue University inquiries were made of many persons known to be interested in the telephone and of a number of professors of electrical engineering. Nearly every person interrogated who was interested in the telephone from a manufacturing or operating viewpoint was in favor of the movement, while nearly to a unit the idea was opposed by the college people on the ground that there was no call for such a course.

There is a great deal of justification for the attitude of the teachers. For years they have tried to look into the possibilities of the telephone. There was not much to look into, for the pains taken by the telephone interests of past years to help them were microscopic. In most of university laboratories, even to this day, a Blake set and an obsolete drop are the sole representatives of a great branch of electrical engineering. Surely in these there is not much to attract the teacher or the student, much less induce him to look with favor upon the advantages of studying telephony as a life work.

But changes have taken place. Competition brings out man's best effort. The old and experienced telephone man with his knowledge of detail has combined his talents with the later generation of electrical engineers, and as a result a system of engineering has been evolved which combines all the lighter as well as much of the heavier construction features of electrical engineering, making the practice of telephone engineering an acceptable profession. However, to place telephone engineering where it rightly belongs one thing yet remains, and that is, the attention of the scientific world must be attracted by our deeds and words. The American Institute of Electrical Engineers is the body to which we look for the official expression of the electrical profession. Everything good, novel and interesting is brought before this body in the fullness of time. It is discussed freely and honestly, and if found meritorious is given a place in the records for all men to read and to think about. If all the telephone engineers had permission or had the inclination to take broad and comprehensive papers before that body—there is plenty of material—the engineering world would more fully realize the breadth of telephony and scientific men would take more interest in studying the various and vexatious problems now confronting the practice of telephone engineering. But all that has been thus far brought before the Institute is in general a sort of apology, an evasion of the subject by a prolonged discussion of rates, or an assurance that telephone engineering is a broad profession. It will take more than assurances to establish this fact. How much better it would be if an institute of telephone engineers could be organized and perpetuated.

The general public has not been fully educated as regards the telephone. It has seen demonstrations of light and power and transportation and has been impressed. But the telephone is not a spectacular agency, and the public is not at all impressed. When students enter college to take mechanical or electrical engineering they think they have a definite idea of what they want and ask no questions. But regarding the teaching of telephone engineering many questions are asked. What do you teach? Of what value is it? Is it necessary? Why cannot one learn in practical work? What is there about a telephone that takes two whole years of study? Why, my son could talk from the barn to the house years ago.

And a more intelligent lot of questions is asked. Is it of benefit to the telephone field? Are you training young men for the benefit of manufacturers? Are you trying to make them conversant with the operating side? Is the work of a practical nature? If we hire your graduates, will they be able to take an active hand in our business? And last, but not least, are you Bell or Independent?

This last question cannot be evaded and will be answered here. There seems to be no neutral ground, and a school naturally has to seek neutral ground, not being so constituted as to recognize business complications. Must the telephone be an exception? The university works in the open field, and its investigations belong to the world. The apparatus it uses must necessarily come from the open field. Freely the open field gives and freely it should receive.

To say what should be taught would be impertinent. We want to know that, for we want to make the course for you, to meet your needs. As now planned and administered the telephone course begins in the junior year, after the student is grounded in mathematics and the fundamental principles of electricity. The regular electrical course is taken, simply substituting the telephone for the steam engine. The first consideration is a study of circuits, beginning with the old series grounded system, on through the metallic self-restoring drop period, and then into common-battery systems. Each and every commercial common-battery system is discussed and analyzed in the class room and in the laboratory, the various relays, impedancies and lamps are arranged on tables not only to show accuracy of connection and transmission but to enable the student to observe the methods and rules of operation.

After the "A" circuits are well understood, the "B" circuit of each system with the accompanying order wire arrangement, busy-test method, and manual and automatic ringing is taken up. The laboratory is divided so that the "A" and "B" operators are in separate rooms, thereby making the student appreciate fully the usage of the order wire, the method of disconnection and the general rule of operation.

After the "B" circuit, with its free inter-office service and its charge for interurban service, is investigated the toll business is studied. The many phases of operation, the methods of switching and recording, and the auxiliary uses of the toll line are given as much attention as is possible outside of regular business.

Upon this foundation the second year begins the details of the various systems and a study of the appliances and circuits connected with the chief operator's, chief inspector's, supervisor's and manager's desks. Complete specifications and drawings of entire systems are made. Also a mathematical investigation of the loaded line is made, in association with experimental conditions made practical as possible, operating cable being used for that purpose. The limitations of common-battery systems as regards distance of a subscriber from the exchange affecting transmission and operation of relays, the effects of induction from one, two, or three-phase alternating currents from 104 to 9,000-volts pressure, or from continuous currents of from 110 to 300 volts, or from series-arc systems; quick and efficient methods of cable testing, finding wet spots, open places, and crosses under actual working conditions; considerations of patent law; specifications and estimates upon overhead and underground construction—these are among the features of the course.

Is such a course valuable? In the first place it must be understood that a technical school does not pretend to teach a man a trade or a profession. It only teaches him how to begin; it prepares him as a skilled apprentice and not as a journeyman. Failure on the part of the student to realize this has frequently put him in a somewhat disagreeable light.

As to the necessity of the course, the experience of electrical engineering may be recalled. Time has disproved the early claims of the futility of such a course, for all the graduates of the technical schools are hired by the electrical interests before they leave the institutions. Upon this evolutionary ground we hope for the ultimate appreciation of the necessity of telephony having its proper place in the technical schools.

These schools can be of benefit to the telephone field by giving the results of research to the telephone public. And if they are given knowledge of the various conditions of service the schools will help to evolve if not a standardization at least a more general understanding of the rules and laws of design and operation. Schools have time in which to collect facts together and look into details and reasons, while the busy commercial man has not.

And if a school can do this, it is certainly an important factor in the progress of the open telephone field, and should be approved of and encouraged by every worker in the telephone industry. The authorities of Purdue are fully convinced that it can do all that has been claimed and are well satisfied with the results of one year's experience with the telephone. We feel certain of the approval of every one interested in telephony and of ultimate co-operation of every technical school in investigating, classifying and simplifying the various parts of this many-featured industry.

1. Paper read before the Independent Telephone Association of the United States in Chicago on June 24, 1903. The author is professor of telephone engineering in Purdue University, Lafayette, Ind.

Chicago Street-railway Situation.

There was a discussion upon the 99-year act before Judge Grosscup on June 18th, but the city was not officially represented. Representatives of the street-railway companies presented their arguments in defense of their rights under the act. Judge Grosscup announced that he may not make known his decision as to the course to be pursued under the provisions of the 99-year act before July 30th, the date on which the city asserts that the trunk-line franchises expire.

A report has been in circulation that within 30 days Mayor Harrison will ask the council to advertise for bids for the traction privileges of the entire city of Chicago, unless the improbable happens and a franchise settlement is made with the old companies before that time. The new franchise rights, it is stated, will contemplate the paralleling of the existing street-car lines and will include all additional rights necessary to a modern system.

Some Benefits of Telephone Traffic and Their Effect on Service.[1]

By J. G. Wray.

Consider first the part the subscriber plays in telephone traffic and in making for either good or bad service. I am perhaps open to criticism from the laymen when I say that the subscriber's part is an important one and often militates against good service. Who has not called for a number, and, after waiting for a few minutes, hung up the receiver with imprecations against the telephone service? In the meantime the telephone apparatus has perhaps performed its functions properly, and the operator is in a fair way to get the called subscriber. When the latter answers, he may not have answered promptly, and finds no one on the line, he, and not the calling subscriber, is certainly the aggrieved party. False calls are a frequent and annoying source of complaint against the service and are caused in many ways in addition to the one just named.

I recently noticed a curious fact in observing traffic from ten-party line subscribers in a city not 1,000 miles from Chicago. I noted the extreme smoothness and accuracy of the service, the apparent absence of any hitches or complaints and was surprised when I learned that the operator's load was practically 30 per cent. higher than operators' loads in similar service in Chicago. I can explain this condition only by assuming that the operator had the intelligent and courteous co-operation of the subscribers and this was apparent from such observations as I was able to make during a two hours' visit in the office.

Practically 20 per cent. of all calls made are never completed because the line called for is busy. About four calls out of every five are completed properly. This feature of telephone traffic is one of the most aggravating to the subscriber, but unfortunately is almost beyond the control of the telephone company. Other things being equal, the busy reports that may be expected from telephone lines will become more numerous and will increase with the number of conversations carried on over that line. In actual practice, however, other factors enter in. The New York city telephones, for example, are reported busy about as often as the Chicago telephones, practically 20 per cent. The number of conversations per line on New York telephone lines, however, is much less than on the Chicago lines. We would, therefore, ordinarily expect fewer busy reports from the New York lines. The other factors entering in this particular case are undoubtedly shorter conversations by Chicago telephone users and a disposition to rent additional telephone wires where circumstances seem to warrant it. Another factor which has even greater bearing is the fact that the New York city telephone calls are crowded into a shorter day and that, hour for hour, the lines are nearly as busy as in Chicago.

Uniform answering with rapid and accurate service can only be accomplished by giving an operator enough calls to keep her busy and not any more than she can handle properly, and by minimizing the work on each call. The service may be considered as being good when the average answering is in six or seven seconds and when, say, 95 per cent. of all calls are answered within 10 seconds. This grade of service is obtained only under favorable conditions. The operator must be continuously under a competent supervising operator. The practice is to have a supervisor for every eight or 10 operators. This supervisor should work under the direction of a chief operator.

A second requisite of good service mentioned above is that the time and operations required of an operator on each individual call shall be a minimum. Obviously the operator has no time for discussions with the subscribers on the merits of a complaint. These are turned over to the supervising operator for adjustment. It is the aim of the operating manager to so control the two factors just named that good service will result. By the proper manipulation of the intermediate distributing board, he may by increasing or decreasing the number of lines that an operator must answer, keep the operator's load uniform under the fluctuations of traffic experienced in telephone exchange. He must also minimize the work and time required of an operator on each particular call. This is done by paring down phrases that the operator must use, by machinery to eliminate certain manual operations, by easily-read and interpreted signals to keep her informed as to the condition of the line called for, whether busy or out of order, or of the various phases of the connection; and charts to indicate changes of number of service, etc.

In a typical telephone exchange the load curve indicating the volume of traffic shows during the midnight hours a value of from one-tenth of one per cent. to perhaps five per cent. of the maximum hourly load. This period of light load will vary from seven to 14 hours, depending upon the location of the exchange and the habits of the telephone users. In the offices of the business district of a city like Chicago very few calls are made between the hours of seven p. m. and seven a. m. Between the hours of 10 p. m. and seven a. m. the calls per hour will vary from one-tenth of one per cent. to perhaps one per cent. of the maximum. Between the hours of seven and eight in the morning traffic will rise to perhaps five per cent. of the maximum. The rise will be extremely rapid until the maximum load of the exchange is reached between 10 and 11 in the morning. About the noon hour there is a cessation of business and the telephone traffic curve shows a drop of perhaps 40 per cent. below the maximum. After the lunch hour, when business has been resumed, the traffic curve rises to an afternoon maximum between two and three o'clock. This maximum will be less than the maximum in the morning and will in a typical office approximate 80 per cent. of the maximum traffic of the day. From three o'clock until five or 5:30 p. m. there will be a rapid decrease in the traffic load with an almost complete cessation of business at six o'clock.

In a residence district the slump of traffic at noontime is not very well marked. There is, however, a decrease in the number of calls made late in the afternoon and a corresponding increase in the number of calls for the telephones of a residence district, the latter arising from the fact that the head of the house wishes to explain why he cannot come home for dinner, or to announce that he wishes to bring a friend. The evening traffic is also a feature of the residence district. Social calls are made, appointments for the theater, invitations, etc. Evening traffic of a residence district often continues heavy until nine or 10 o'clock; indeed, in one of the Chicago offices the evening traffic runs from 30 to 60 per cent. of the maximum and heavy traffic is maintained until midnight. The curve of traffic indicates in a measure the habits of the people in the district.

In the Main office district here in Chicago the business day may be said to have begun at 8:30 in the morning. There is a partial cessation of business for luncheon between 12:30 and 1:30 o'clock, and the business day closes at about 5:30 p. m. For Central office, also in the down-town district, the business day is from 8:30 in the morning until 5:30 in the afternoon with scarcely any let-up for lunch. Lawyers predominate in the Central district. In Harrison office the day is the same for Central and Main, but there is a marked reduction in the traffic between 12:30 and 1:30 o'clock.

The South office business day is practically from eight o'clock in the morning until nine o'clock in the evening, and even later, with no indications of a luncheon hour. North office telephone users are satisfied with a shorter day than the people of South office district, the limits being from eight o'clock in the morning until eight o'clock in the evening. For West office the limits are from 8:30 in the morning until nine in the evening. For Monroe office the traffic shows heavy business from 7:30 in the morning to six o'clock in the evening, with a distinctly marked lunch hour between 12 and one. Monroe district is a manufacturing district. Canal office traffic is largely like Monroe, extending from eight in the morning until 5:30 p. m., with noon hour between 12 and one. Yards office telephone users, like those of Monroe office, begin the day early, and business is in full swing about 7:30 and continues until 5:30, with noon hour between 12 and one.

In Wentworth district, out in Englewood, the business of the day is done between eight a. m. and six p. m., with some indication that the people have lunch between 11:30 and one o'clock. Hyde Park and Oakland offices, both in residence districts of similar character, show heavy traffic between eight a. m. and eight p. m., with no trace of an hour for luncheon. Lake View office, also in a residence district, shows the work day beginning at 7:30 a. m. and extending until 8:30 p. m. The habit of early rising was evidently formed before the advent of the Northwestern Elevated.

A similar comparison of traffic load curves of other cities will be of interest. In Philadelphia, for example, we find the heavy traffic between nine a. m. and five p. m., with lunch between 12 and 1:30. In Boston the traffic shows a work day from nine a. m. to five p. m., with time for luncheon in different offices varying from 1½ to two hours between 12 and two o'clock. New York telephone users seem to take life even more serenely than those of Philadelphia or Boston, and we find the work day beginning as late as 9:30 in the morning and ending at about 4:30 in the afternoon, with two hours for lunch between 12 and two o'clock.

Telephone traffic varies with the seasons as well as with the time of day. Canal office district of the Chicago exchange shows a fluctuation of 50 per cent. between summer and winter traffic. This is caused by the vast lumber interests of the district, which practically close down during the winter months. There is a heavy rush of traffic in April and May, followed by a 40 per cent. reduction in traffic during July and August. In the fall business increases to a maximum in September. This is followed by a 50 per cent. reduction in traffic, culminating in January. A change in the character of the traffic from Canal district, however, has been noticed within recent years, and the wide variations of traffic with the seasons are less marked. This is undoubtedly due to the change in the character of the district, with the gradual building up of vacant prairie with residences, small shops, saloons, etc. The traffic of all offices slumps decidedly during the summer months. There is a reduction of perhaps 30 per cent. during July and August, the vacation period.

The volume of traffic of a telephone exchange is also an unfailing index of general business conditions. This is shown by the fact that during 1894, 1895 and 1896 there was a very slight increase in traffic. With the return of prosperity, however, the traffic has increased by leaps and bounds until now it will approximate four times as heavy as during 1895 and 1896.

In passing it will be of interest to note that for 10 hours per day the traffic of Chicago exchanges ranges above the average hourly traffic figured on a 24-hour basis. For the other 14 hours per day the traffic is much lower than the average hourly traffic. The average traffic for the maximum hour is about 2½ times the average traffic of the day, and perhaps 200 or 300 times the traffic of the hour of minimum traffic. The percentages and ratios of traffic given herein take no account of rushes of traffic for short intervals due possibly to the news of a prize fight, a fire, a panic or a football game. These and the tremendous rushes of traffic always preceding or following every important holiday make a severe test of the resources of the operating plant.

The traffic of Saturday forenoon is always the heaviest of the week and is taken as a basis for the adjustment of operators' loads and the loads on trunk lines. The adjustment of the operators' load must be made with a view of handling the traffic well during the busiest hour of the day. Experience has shown that approximately one-eighth of the business of the entire 24 hours must be handled during the busiest hour.

From the above it can be readily seen that the capacity of the operators and the physical telephone plant must be extremely flexible to take care efficiently of the rapid and extremely wide fluctuations in loads just described. To the advantage of the telephone manager be it said that the human machine is extremely well adapted to the handling of this fluctuating load. A well trained operator will frequently take three or four calls in rapid succession and complete them almost simultaneously.

Just a word on the efficiency of the telephone plant. Assuming an efficiency of 100 per cent. when all the subscribers' lines are in use all the time, we find that in actual practice they are working under an efficiency of only two or three per cent. Assuming 100 per cent. efficiency when the apparatus used by an operator is in use all the time, we find that in actual practice it is working under an efficiency of 25 per cent. Thousands of dollars worth of multiple jacks lie in the switchboard practically idle. Some are perhaps never used.

The traffic of a telephone exchange determines the capacity and design of a telephone central-station equipment and the size of its operating force. Changes in traffic, whether a decrease due to business depression, a change of contracts to a message-rate basis or to any other cause, or an increase caused by new telephone subscribers, by better business conditions or perhaps by a change of policy in the matter of party lines or private branch exchanges, must be met promptly by a corresponding readjustment of facilities and operating force to enable the business to be carried on economically and well.

1. Abstract of a paper read before the special telephone meeting of the American Institute of Electrical Engineers, held in Chicago on May 19, 1903. Mr. Wray is connected with the Chicago Telephone Company.

Air-cooled Transformer Case.

Judge H. H. Wheeler of the United States Circuit Court for the Southern District of New York, in the case of the General Electric Company against the Wagner Electric Manufacturing Company and A. H. Mustard, has issued a permanent injunction restraining the defendants from infringing claims 4, 5, 6, 7 and 11 of United States patent No. 591,869, issued to Walter S. Moody on October 19, 1897, and assigned to the complainant.

In his opinion the court says: "The distinguishing features of this invention seem to be the separation of the primary and secondary coils and the core, and arranging the chambers for cooling ventilation from below perpendicular through the coils, and transversely between the layers of the core, instead of immersing the coils and core in a case filled around them with oil to take off the generated heat. Many prior patents and structures have some, and, together, perhaps all, of these parts with oil as a cooling medium; but none of them has this arrangement for the separation of the coils and core and the use of air for that purpose; nor any arrangement in which air could be substituted for oil so as to constitute the combination of the patent. This new arrangement by which air can be successfully used, and this new use of air in this combination for this purpose, was a useful improvement involving invention. These claims covering these features do not appear to have been anticipated, and the patent for them to the plaintiff is accordingly held to be valid."

Columbus Consolidation.

The stockholders of the Columbus (Ohio) Railway Company have voted to lease its property, franchises and privileges to the Columbus Railway and Light Company, which has been organized with a capital stock of $5,000,000, to take over the properties of the Columbus Railway Company and the Columbus Edison Company. The leasing company guarantees dividends on the stock of both the railway and light companies. The stockholders of the Columbus Edison are expected to ratify the lease of their property later.

Union Engineering Building.

A formal organization of the joint committee representing the various bodies which have taken action with respect to the gift of $1,000,000 of Mr. Andrew Carnegie for a Union Engineering Building was effected on the evening of June 18th. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Engineers' Club have taken final action and appointed their representatives upon a joint committee for accepting the gift. The American Institute of Mining Engineers has likewise taken action in so far as its rules permit. Its council has appointed representatives subject to changes in the rules of the organization which have been proposed by the council for adoption at the next general meeting. At the present time a letter ballot for ascertaining the attitude of the members is being taken, which shows an overwhelming majority in favor of the plans proposed by the council.

The American Society of Civil Engineers, at its recent meeting in Asheville, referred the matter to its board of directors for recommendation and directed that the matter be then presented to the members of the society for letter ballot.

At the meeting on the 18th instant the following-named gentlemen were announced as representatives of the several bodies upon the joint committee:

American Institute of Mechanical Engineers—James M. Dodge, F. R. Hutton, Charles Wallace Hunt.

American Institute of Electrical Engineers—Charles F. Scott, B. J. Arnold, S. S. Wheeler.

American Institute of Mining Engineers—A. R. Ledoux, Charles Kirchoff, Timothy Dwight.

Engineers' Club—John C. Kafer, W. H. Fletcher, W. A. Redding.

Representatives of the American Society of Civil Engineers are requested to meet with the joint committee and take part in deliberations with regard to the plans to be adopted. The representatives who have served upon the conference committee are Alfred Noble, W. J. Wilgus, and George N. Pegram.

The joint committee was organized by the election of the following-named officers: Chairman, Charles F. Scott; secretary, Professor F. R. Hutton. The chairman was directed to indicate to Mr. Carnegie the acceptance of his gift by the joint committee representing the several organizations.

The joint committee placed the immediate work of developing plans upon an executive committee of five, consisting of one member from each of the five organizations named in Mr. Carnegie's letter as follows: American Society of Civil Engineers, Mr. Alfred Noble; American Society of Mechanical Engineers, Professor F. R. Hutton; American Institute of Mining Engineers, Mr. A. R. Ledoux; American Institute of Electrical Engineers, Mr. Charles F. Scott; Engineers' Club, Mr. W. N. Fletcher.

This executive committee met on May 19th and organized by the election of Charles F. Scott, chairman, and F. R. Hutton, secretary. The committee laid out certain work to be undertaken by its several members, and will have meetings from time to time during the summer.

The following cablegram has been sent to Mr. Carnegie: "Joint committee four organizations formally accepts generous gift Union Building. Executive committee, in session, sends greeting and reports progress. Scott."

Miller Electro-pneumatic Burglar Alarm.

C. O. Miller of Estherville, Iowa, has had on exhibition in Chicago a working model of a burglar alarm for vaults and safes, which he has lately patented. The system consists of an air jacket formed of two sheets of steel, riveted in separated relation at close intervals to provide air-tight chambers in which is confined air under pressure. The vault jacket and door are made in sections connected to each other by communicating pipes. The pressure of air contained in the jacket operates a diaphragm when the air is released. To this diaphragm is attached a circuit-closer. The system has a closed electrical circuit in which there is included a battery. A device is located in the vault or safe to be protected and is so adjusted that a slight change in the strength of the current flowing through it will cause an open circuit to be closed within the vault, thus causing a large gong, located outside of the vault, to be rung continuously. The main circuit which is contained in the vault is connected in such a manner that if the door of the vault is opened the alarm will be made to ring, except when shunted by a clock. It is also arranged that if the door is not closed, drawbolts thrown in place and the combination thrown off, when the clock goes on at the closing hour the alarm will be turned in, indicating that the vault has not been properly locked. This clock is connected in such a way that, during certain hours, which may be predetermined, the door may be opened without ringing the bells. The main circuit operating the device within the vault is brought out and may be carried to any distant place and connected at that place to a similar device, which will operate so as to ring a gong continuously in the same manner and at the same time as that in which the gong is operated at the vault. If a hole is drilled in the air lining, the pressure will be released, thus ringing the gong at the vault and the distant station. The system has been tested by electrical experts of the Chicago Edison Company. Mr. H. B. Gear, general inspector of that company, says: "We believe that it would be impossible to burglarize the safe or vault protected by this device without operating the alarm at the vault as well as at the distant station."

Superheated Steam.

[From the Question Box of the National Electric Light Association.]

QUESTIONS.

What are the advantages and disadvantages of superheating steam? What is the necessary equipment per horsepower, and can it be readily applied to existing boilers?

ANSWERS.

W. S. Barstow, New York city: The cost of necessary equipment per horsepower for superheaters should be about $3. There are makes of superheaters that can be applied to existing boilers. The advantages are in economy of steam consumption in an engine by securing perfectly dry steam in cylinder by superheating 150 degrees Fahrenheit. The disadvantages are in the additional quality of pipe-covering, for preventing loss of the superheat, and well-made valves, etc.

Boston Edison Company: The advantages are all those due to absolutely dry steam and, in general, the advantages of doing away entirely with cylinder condensation, if the superheat is high enough. This company is using 100 degrees superheat with 160 pounds pressure on gridiron valves, and is having absolutely no trouble. We know of no disadvantage. We are using 0.9 of a foot of superheating surface per horsepower of boiler. This is the Babcock & Wilcox superheater and can be applied to any Babcock & Wilcox boiler.

Prof. W. F. Durand, Cornell University: The advantage to be derived from the use of superheated steam is increased economy in the heat and hence in the coal required per indicated horsepower per hour. Economy is the central idea involved in the use of superheated steam. This gain arises through an improvement in the conditions that limit the economy of the steam engine. They are chiefly the following: (1) The so-called limiting thermodynamic efficiency, and (2) the partial condensation of the steam as it enters the cylinder. According to the first of these, it appears that even in an ideally perfect engine only a portion of the heat that comes to the cylinder can be transformed into useful work, and this fraction will be the larger as the temperature range through which the steam is worked is the wider; that is, as the temperature at admission is higher and the temperature at exhaust lower. The usual condenser pressures furnish a natural limit to the lower temperature, but there is no such barrier to the elevation of the upper temperature and to a gain in economy in this way. Superheating is, then, a method of raising the temperature of the steam at admission, and hence improving the possible ideal efficiency without at the same time too extreme corresponding rise in pressure.

The second limitation, as a consequence of which a considerable part of the steam may be condensed on its first admission to the cylinder, is one that prevents the operation of steam under any high degree of expansion in any one cylinder. It is chiefly to decrease this loss that the expansion is carried on in compound, triple or quadruple expansion engines, as in the best modern practice with saturated and moist steam. Superheated steam, however, is not in part condensed by the abstraction of a small quantity of heat as is the case with saturated steam. If, indeed, the degree of superheat can be made sufficient to prevent the steam from falling to the saturated condition at any time during its passage through the engine, condensation will be prevented and the serious loss due to the interaction between the walls of the cylinder and the steam will be very much decreased.

A third possible source of gain may be mentioned; this is the increased tightness of piston and valves and the decreased amount of leakage with superheated as compared with saturated steam.

It may be accepted as demonstrated by numerous tests during the past few years with steam superheated from 200 to 250 or 300 degrees above the temperature of saturated steam, that the gain in economy should be from 12 to 15 and even 20 per cent., varying with the special conditions.

One or two consequences of these general principles may be noted: First, if the degree of superheat were sufficient, the simple engine could be made the equal in economy of the multiple expansion and the complication and greater cost of the latter type might be avoided. Actually, this is more than could be expected, but it may be fair to expect that with a full realization of the possibilities of superheated steam there will be little need to go beyond the compound type, at least so far as economy is concerned.

Second, it should not be forgotten that in the results of trials of engines using superheated steam as compared with those using saturated steam, the number of pounds of steam is not a fair basis of comparison, since there is much more heat in a pound of superheated steam than in a pound of saturated steam. The only fair basis of comparison in such, as in all cases, in fact, is the reduction to heat units per indicated horsepower per hour.

The chief difficulties or disadvantages that have arisen are of two kinds: the corrosion or burning out of the superheaters, and trouble with the lubrication and general operation of an engine with superheated steam. These troubles are, however, mechanical, and they are being met and overcome in highly satisfactory manner in various systems before the engineering public, and in particular as developed within the past few years in continental Europe.

A description of the necessary equipment and its application to boilers of varying types would require space exceeding the proper limits of a brief discussion such as the present. The engineering press during the past three years is rich in matter relating to the generation and use of superheated steam. The number of types of superheaters is exceedingly large. Some are independent of the boiler, and may therefore be readily used in connection with existing boilers of whatever type. Others are intended to operate with the boiler, and in some cases could be adapted only with difficulty to boilers already installed. In other cases such adaptation could be made without undue expense, and the gain from superheated steam thus be obtained with a minimum of disturbance to the existing plant.

W. B. Bloxham, Atlanta, Ga.: The advantage is mainly increased economy; different boilers require different equipment. They can be placed outside of boiler and separately fixed. They can be applied to existing boilers, but I don't think it is good engineering.

The High-speed Turbine as an Air Compressor.

The most important of the later developments of the turbine is the discovery that the high-speed steam turbine may itself be used as an air compressor, with results that are comparable in point of efficiency and general utility with those obtained in the best types of steam turbines. The air turbine, as it may very properly be called, is constructed much in the same way as the steam turbine. On a prolongation of the shaft of the steam turbine is fixed a series of moving blades, which are placed alternately with rings of stationary blades, or "guide blades," as they are called, which extend inwardly from the walls of the air-turbine cylinder. The action of the air turbine is, of course, the reverse of that of the steam turbine, the first ring of the blades forcing the air forward parallel with the axis of the turbine at a low pressure, and the succeeding circles of blades increasing its pressure, until, at the exit, it issues at the maximum designed pressure in a continuous, steady blast. These machines are of the Parsons type, and bear their inventor's name. It is not necessary, of course, that the air turbine should be driven by the steam turbine, as described above, and, indeed, there is now at work in a lead works on the Tyne, England, an air turbine which is driven by an electric motor and supplies 3,500 cubic feet of air per minute under a pressure of four inches of mercury. According to Parsons, this plant showed an increase of 30 per cent. in output of the furnace, due to the installment of the turbine blower, an increase which was probably due to the increased steadiness of the blast. All the advantages of economy and convenience which are present in the steam turbine are shown in the air turbine. The repair bill is as light in the one case as in the other, and the compressor is in every respect as efficient. There is now nearing completion for a mine at Johannesburg, a turbine, high-pressure, two-stage air compressor, which is designed to show an output of 4,000 cubic feet of air per minute at a pressure of 80 pounds to the square inch.—Scientific American.

Power Transmission at 120,000 Volts.

At the close of the annual commencement lecture at the Worcester Polytechnic Institute, there was an interesting experiment illustrating the trend of electrical engineering. The 500,000-volt transformer of the school, located in the high-potential laboratory, about 1,000 feet distant from the lecture room, was supplied with current taken through instruments on the lecture-room switchboard. This transformer was adjusted by the lecturer so as to deliver a potential of 120,000 volts, at a frequency of 60 cycles per second to a line of iron wire leading to the lecture room, where, on wires which were so small as to be invisible to most of the audience except when the room was darkened, the current was conveyed to another transformer of the electrical-engineering department, which stood beside the lecturer. This second transformer served to reduce the pressure to a value which could be applied to the primary of a rotary converter of about 10-horsepower capacity located on the lecture table. This rotary converter was synchronized and operated from the line and ran with a load of incandescent lamps on the direct-current secondary. The experiment was especially interesting, as it was probably the first time at which power has actually been transmitted at so high a pressure as 120,000 volts.

CORRESPONDENCE.

London Letter.

[illegible], June 13.—It is expected that the monorail railway between Manchester and Liverpool will [illegible]nced in a few months, all the surveys having been completed. It will be remembered that this railway was sanctioned by Parliament three or four years ago, but, as has been the case with many much less speculative electrical ventures, some difficulty has been experienced in obtaining the capital. The Manchester and Liverpool Electric Express Railway Company was formed, but it has now been found necessary to register the Mono Rail Construction Company, the avowed object of which will be to enter into an agreement with the original company to undertake the issue of its capital, and incidentally to finance any other scheme it may choose to. The signatories to the new company are, for the most part, Stock Exchange gentlemen.

The London-Brussels telephone cable was officially opened a couple of days ago, after a rather abnormal number of delays. The charge is eight shillings for a three-minute conversation, and besides being available to all subscribers to the Postoffice telephone service, the cable may also be used by the public at the public telephone call offices.

The continued financial and engineering success of trolley railways has been further exemplified by the publication of some figures concerning the systems of the Glasgow corporation and the London United Tramways Company. During the financial year of the latter, which has just been completed, the receipts of the former have shown an increase of over $200,000, over a million and a quarter car-miles having been run in excess of those of the previous year. Indeed, so satisfied is the tramways committee with these figures, that five additional lengths of line are to be equipped. With regard to the London United Tramways Company, this concern has now nearly 30 miles of route working, and on the Whitsuntide holiday carried 100,000 persons above the number carried on the Easter bank holiday. On the County Council's conduit system the earnings have been doubled, but the percentage profit will not be so large when the heavy capital expenditure is taken into account. A commencement is being made with the conversion of the North London tramways to electric traction, but some difference of opinion has hitherto existed as to which system should be adopted. A sort of compromise was arrived at.

As a consequence of the conversion to electric traction of the Mersey Railway, the British Westinghouse company has just signed a contract for the "electrifaction" of the Wirral railway upon a similar system. In fact, it is possible that the power house of the Mersey Railway Company will supply the electrical energy for the Wirral lines. These latter, it may be mentioned, serve districts beyond the termini of the Mersey Railway, over which it has running powers, so that it is only an inevitable consequence that electric working has had to be applied to it.

The occasion of voting a large amount of money for the postal telegraph service was taken advantage of, in the House of Commons a few days ago, for calling attention to a large number of grievances in connection with that public department. First, came the question of the large deficit last year—some $5,000,000—then reference was made to the great necessity there is for a reduction in submarine-cable rates, and, the most important of all, to the unhappy relations which exist between the Postoffice and the Marconi company. Explanations were asked for apropos of all these matters, but, as usual, the government would give no definite promises. As regards the first matter, it was explained as being due to the exorbitant price paid by the government when it took over the telegraphs, and to the great increase of late years of postoffice employes' salaries. On the question of cable rates, it was pointed out that, although the rate per word seemed high, yet, by the code, one word meant almost as much as five minutes' conversation. Dealing with space telegraphy, the postmaster-general said that having the example of the monopoly obtained by the National Telephone Company, the government was very chary of granting any such terms to the Marconi company, which had asked for better arrangements than had been granted to the cable companies. It preferred to err on the side of overcaution rather than make a mistake in this matter.

W.

New York Notes.

New York, June 20.—At a recent meeting of the Meter Association of the New York Edison Company, Mr. Thomas W. Varley gave a special illustrated lecture on testing and locating faults in insulated lines and cables. Mr. Varley is an authority on testing and an electrical inventor of note. He began his lecture by describing the conductivity test given the copper wire as it enters the factory, and then thoroughly explained the methods employed in testing and locating faults in the insulation after the wire has received its coating. When the wire is covered it is immersed in water for about 60 hours and then given a galvanometer test. The soaking in water is very effective in showing any slight imperfection in the insulation. The test consists in sending current through a galvanometer to the ends of the conductor or coil, as it is termed, which have been left out of the water. This charges up the coil, and if the covering is perfect no current, that is, comparatively no current, will escape to the water and so back to the testing battery. The galvanometer is so sensitive that even if the millionth part of an ampere of current escapes it will be recorded on the instrument.

The suit brought by Isidor Wormser to annul the lease of the Metropolitan Street Railway Company to the Interurban Street Railway Company has been dismissed by Justice Scott in the Supreme Court. The case has attracted considerable interest in street-railway circles, such prominent men as William C. Whitney being called to testify. The judge said the granting of the decree would result in confusion and loss to the stockholders; that the lease was legally executed, and an overwhelming proportion of the stockholders had consented to it. He also stated that he was unable to find any fraud or intentional moral wrong-doing.

It has been announced at the office of John B. McDonald, general contractor for the subway, that an arrangement has now been reached through the joint committee of the Central Federated Union and the rapid-transit contractors covering all the work in the subway until it is completed, which will put an end to the labor troubles. It was agreed that the men will be given to July 10th to show that the wages asked are the prevailing rates. If they can do so, then the advanced wages will be paid. Within the next two weeks the officials of the Interborough Company will open for public inspection the completed subway station at Central Park West and Fifty-ninth Street, at Columbus Circle. By that time it is expected that all the work on this station, which is the most important on the line, will be finished and the debris removed. Then it is desired that the general public be given an opportunity to see what arrangements have been made for the convenience and comfort of the patrons of the system.

New England News.

Boston, June 19.—The Stanley Electric Company has obtained contracts for building a direct-current generator with a capacity of 1,600 lights, to cost $6,000 for the Pontoosuc Woolen Company of Pittsfield, Mass., and three alternating-current generators, switchboard and other equipment, costing $30,000, for the Atlanta (Ga.) Electric Railway Company.

The Pittsfield Electric Street Railway Company and the municipality of Pittsfield, Mass., have settled their controversy over the paving of certain streets, by the company's paying $5,000 to the city and giving up the granite blocks now in use on a portion of the streets. It will cost the company about $23,000 to do the work necessary to carry out the agreement.

The International Electric Company has been incorporated in Maine. It has a capital of $100,000 and proposes to deal in electrical appliances. C. C. Smith of Kittery, Maine, is president, and C. M. Prince of Kittery, Maine, is treasurer.

The Imperial Finance and Construction Company, with a capital of $250,000, has been incorporated in Maine. It proposes to operate telegraph and telephone lines. Its president is J. Williamson of Augusta, Maine, and its treasurer is L. A. Burleigh of Augusta, Maine.

The town of Mansfield, Mass., has voted to install a municipal electric-light plant at a cost not exceeding $40,000.

The Russell & Erwin branch of the American Hardware Company is arranging to discard electricity as a motive power at its plant, on the ground that it is practically useless for the company's purposes. Steam will be installed in its place.

Governor Chamberlain of Connecticut has signed resolutions chartering the Glenville Power and Water Company of Greenwich and the Scotland Electric Company. The former has a maximum capitalization of $10,000,000 and is authorized to develop the watershed on the east and middle branches of the Byram River near Riversville and the generation and distribution of electric power. The Scotland company has a capital of $100,000 and it proposes to develop large water privileges on the Shetucket River in the towns of Canterbury and Scotland. It is authorized to distribute electricity for light, power and heat in Windham and New London Counties.

Three electric traveling cranes, with a lifting capacity of over 10,000 pounds each, have been installed in the new shipfitters and metal workers' shops at Charlestown navy yard.

The Massachusetts Electric Companies has accepted the order of the railroad commissioners fixing the price of $120 for $2,000,000 Boston and Northern stock and $105 for $1,009,500 of Old Colony stock and, being practically the only stockholder in these companies, has acquired the above stock for its treasury.

The Nahant and Lynn Street Railway Company is in process of organization, with Walter H. Southwick, A. R. Searles, Charles J. Johnson, Bernard F. Carahar, Rinaldo D. Potter, James A. Carahar and Frank A. Kollock as directors. The company will have a capital of $12,500, and it proposes to build and operate an electric railway between Lynn and Nahant, Mass., a distance of 4½ miles.

The New York railroad commissioners have authorized the issue of a construction mortgage for $500,000 by the Danbury and Harlem Traction Company, which proposes to build an electric railway between Danbury, Conn., and Golden's Bridge, N. Y.

B.

Canadian Intelligence.

Winnipeg, Man., June 19.—City Clerk C. J. Brown of Winnipeg is asking for proposals for the supply of electric power to be delivered in the city. The initial development of the power is to be 10,000 horsepower, and the works are to be completed in two years.

The town of Red Deer, Northwest Territory, has concluded an agreement with the Western Telephone Company to install a system of the most up-to-date character. An agreement has also been made for the erection of a modern power house and electric plant. These important plants, with outside construction, will involve some $30,000 outlay and are to be ready for operation by December 1st.

The Winnipeg electric street railway carried 50,000 passengers on Victoria Day, and kept 49 cars in trains of four cars running to Elm and River parks all day. Superintendent Phillips states that six large new cars are now on the way from Toronto, and the company is building a number in its own barns.

It is the intention of the St. Johns (N. B.) Street Railway Company to have its line running through Lancaster and the whole of Carleton early in the fall. Owing to the delay in getting rails from England, the work has been greatly delayed, but it now has 16,000 ties and the rails will be on hand in a day or two, and work will then be rushed.

Mr. John Smithers is asking for proposals for an up-to-date system of electric lighting for Moosemin, N. W. T., a town of 1,200 inhabitants, situated on the Canadian Pacific Railway, and about 219 miles west of the city of Winnipeg.

H.

Information from Indiana.

Indianapolis, June 22.—The City Council of Logansport has ordered the city clerk to advertise for bids for the furnishing of two high-pressure boilers for the city electric-lighting plant, each having a capacity of not less than 350 horsepower.

The City Council of Butler has purchased the local electric-lighting plant of H. W. McIntyre for $9,500. In consequence of the sale the injunction suit brought by McIntyre to prevent interference with his plant has been dismissed. The plant will be improved, new machinery installed and operated as a municipal venture.

A stock company with a capital of $25,000 has been organized at Converse to purchase the local electric-light plant. The price is $6,000. The company will build a new power house and operate the plant in connection with the local telephone plant, which the new company has also acquired.

The report of the municipal electric-light plant of Richmond for the year ending May 31st shows receipts in excess of expenses, notwithstanding the temporary loan made for its betterment. Mayor Zimmerman opposes the employment of a general manager, on the ground it will add another expense and make it that much harder to show a profit. The commissioners are capable of handling the plant, he says.

The Terre Haute Electric Traction Company, recently reincorporated with a million dollars capital, has elected the following-named officers: President, B. V. Martin; vice-president, Finley McNutt; secretary, G. W. Wells. All are Terre Haute men who hold nominal stock and act for the Stone-Webster syndicate of Boston.

The Townsend-Reed Company, building the Indianapolis and Northwestern company's line between Crawfordsville and Lebanon, has made another attempt to lay track in the streets of Crawfordsville. Nearly two squares of ties and rails were planted before the work was stopped by the court. Public sentiment is strongly in favor of letting the company in.

The stockholders of the Indianapolis-Cincinnati Traction Company will, on July 1st, vote to increase the capital stock from $1,500,000 to $2,000,000, and a bond issue of $4,000,000 will be authorized. The contract to construct a double-track road between Indianapolis and Rushville has been let to the Omaha Construction Company, under plans made by Sargent & Lundy, electrical and mechanical engineers of Chicago. The power house will be built at Rushville, where the power will be partly generated by waterpower.

The St. Joseph Valley Traction Company, the Angolia and Goshen Traction Company and other traction companies in the plan of a line from Toledo to Chicago have been merged into the Northern Indiana Railway Company, and this company has executed a mortgage for $3,000,000 to the Colonial Trust Company of Pittsburg to finance the project and complete the links, some of which are now building.

The Ohio Valley Electric Railway Company filed articles of incorporation to build and operate an interurban road between Jeffersonville and Madison, by way of Sellersburg and other intermediate points. The line will touch the new state forestry reserve in Clark County. The preliminary capital of $10,000 will be increased later on. The principal stockholders and promoters are E. G. Connett, H. H. Voight, Louis Schneek, William C. Holbrook and G. H. Holzbog.

The Southern Indiana Traction Company announces having let the contract to build its line between Vincennes and Jasper, a distance of 43 miles.

There has been a revival of the movement to build a second traction line between Indianapolis and Martinsville. The company is known as the Indianapolis, Martinsville and Southwestern, and the line is 28 miles in length, with much of the right-of-way procured. An interesting feature of the revival of this road is the part a woman is taking in the enterprise. Mrs. Jean Brudi, a woman bond broker of Chicago, is now in Indianapolis lending valuable aid to the project. Mrs. Brudi has Chicago capitalists back of her, who will handle the bonds and finance the road. This is the first instance in Indiana traction history where a woman has taken a prominent part as a promoter of an electric-railroad enterprise. F.

From the Buckeye State.

Cleveland, Ohio, June 19.—The Cincinnati, Georgetown and Portsmouth Railway Company is negotiating for freight locomotives with electric power to take the place of the steam locomotives now in use. The locomotives will have a capacity of 600 or 700 horsepower and will haul 25 or 30 cars over any part of the line. The freight business is increasing and the passenger business is three or four times what it was a year ago.

The Cleveland Electric Railway Company has made arrangements to grant transfers on transfers where it is necessary to make two changes in order for a passenger to reach his destination.

The Mahoning Valley Railway Company has agreed to sell 24 tickets for one dollar in Youngstown on condition that it is granted the franchises desired, and it is said that the city has accepted the offer.

The interurban railway companies will build a freight station, 40 by 160 feet and one story high, in Cleveland. It will be situated west of Erie Street, between Eagle and Bolivar Streets, and all the roads will use it.

The Union Electric Railway Company of Delaware has sold its rights and franchises to the Delaware and Magnetic Springs Railway Company.

The Zanesville Railway, Light and Power Company is now engaged in changing its tracks to standard gauge, in order to allow the interurban lines to enter the city.

It is said that the Cincinnati, Lawrenceburg and Aurora Street Railway Company will shortly commence the construction of an extension from Aurora to Rising Sun, Ind.

There is said to be a movement on foot to introduce a bill before the next Legislature looking to the creation of a state railroad commission which would have charge of electric as well as steam roads. It would be modeled after that of New York, and it would be necessary to secure the consent of the commission for every road built. In fact, such a commission would be sole judge as to whether new roads are necessary in any territory where promoters might wish to build them.

City Engineer Carter of Cleveland has notified all railway, lighting, telephone and telegraph companies that they must label their poles, so that in case of accident or damage it will be known where the fault lies.

J. B. Foraker, Jr., and George B. Cox of Cincinnati have been elected members of the board of directors of the Cincinnati, Dayton and Toledo Traction Company, to fill vacancies caused by the resignation of two members recently. It is thought that the recent misunderstanding betwen the Cincinnati and Cleveland interests in that company have been adjusted through the election of these gentlemen to the board.

The Claypool Electric Company of Columbus has been incorporated under the laws of West Virginia with a capital stock of $15,000, to manufacture and deal in electrical appliances. John Cashat, F. H. Schoedinger and other Columbus men are interested.

The city and interurban roads of Cleveland have arranged to build a shelter house at the southwest corner of the Public Square for the convenience of passengers. Large waiting rooms, toilet rooms and a heating plant will be located below the level of the street and a handsome shelter will be constructed above, with stairways leading to the rooms below. One side of the shelter will be open in the summer, but in winter will be closed and heated. O. M. C.

Michigan.

Detroit, June 20.—The Detroit United Railway is having a siege with the state tax commission for raising its assessment by about $4,000,000 and assessing the fixed machinery of the company as real estate.

The opening of the Grand Haven branch of the Grand Rapids, Grand Haven and Muskegon Railway and its completion into that city was celebrated on June 18th.

The Detroit United Railway is to make extensive repairs to its Woodward Avenue tracks. A new rail nine inches in height and weighing 90 pounds to the yard is being substituted for the old 77-pound rail.

A deal has been completed by which, as soon as it can be carried out, Alpena will be equipped with one of the finest power stations in the state. George P. Smith of Syracuse, N. Y., assisted by eastern capitalists, is back of the project. The power plant will be built on Thunder Bay River. The new concern will have a capital stock of $1,500,000 or $2,000,000, and expects to spend $500,000 before the end of the year. The promoters have made arrangements to take over the waterworks system and the electric-light and gas plants and place them under the control of the new company.

Work will be begun at once on the Kalamazoo and Lake Michigan Electric Railway. It is understood that the whole right-of-way betwen Kalamazoo and Benton Harbor has been granted, excepting one or two townships. The cost of the road will be about $1,300,000, and it will be about 50 miles in length, connecting with the city lines in both cities. C. G. W.

West Virginia and Kentucky.

Lexington, Ky., June 19.—The directors of the Louisville Railway Company, as individuals, have approved the articles of incorporation of the Louisville Traction Company, the holding company formed to take over the property of the old company. It is believed that the organization of the new company will be completed within a short time.

C. A. Smith of Pittsburg and W. L. Smith and J. E. McDonald of East Liverpool, Ohio, have been granted a franchise to build an electric line from Chester, W. Va., to Congo, opposite Wellsville, Ohio.

The Louisville and Southwestern Indiana Railway Company has been incorporated under the laws of New Jersey, with a nominal capital of $2,000, by Louis B. Dailey, Joseph M. Mitchell and Kenneth K. McLarren. C.

Northwestern Notations.

Minneapolis, June 20.—The Watab Rapids Power Company of Sauk Rapids, Minn., has been incorporated with a capital stock of $100,000. The company proposes to develop electric power from the Mississippi River there.

The Davenport and Suburban Company has let a contract for the construction of a line from Davenport, Iowa, to Oakdale.

The Diamond Match Company is installing an electric-light plant for its hoists on the Ontonagon River at and near Ontonagon, Mich., in order that night crews may be employed.

Ralph Maxwell, who was granted a franchise for an electric-light plant at Lidgerwood, N. D., will install it as rapidly as possible, and has started work on the arrangements.

An electric-railway line is projected from Pequaming to Baraga, L'Anse and Keeweenaw Bay, Mich.

Mayor Dotson of Spearfish, S. D., states that work is to be started on an electric road for the Black Hills and Spearfish Valley Electric Railway Company.

The Sioux City Traction Company of Sioux City, Iowa, seeks a franchise into Dakota City, Neb., across the river.

The Street Railway Company of Sheboygan, Wis., has received a new generator of 400 horsepower to furnish power for the line to Plymouth.

It is reported that a new street-railway company is projected at Superior, Wis., to build a line from Itasca to West Duluth. R.

PERSONAL.

President Gunsaulus of the Armour Institute, Chicago, announces a new gift of $150,000 to the school from J. Ogden Armour.

Harvard University has conferred upon Edwin Wilbur Rice, Jr., technical director of the General Electric Company, Schenectady, the honorary degree of master of arts.

Charles A. Denman, formerly superintendent of the Cleveland and Maumee Traction Company, has succeeded E. B. Gunn as superintendent of the Richmond (Ind.) street and interurban line.

J. M. Fair, manager of the Western Union Telegraph Company, at Saginaw, Mich., has been promoted to the management of the Grand Rapids office. F. P. Duckett of Mansfield, Ohio, succeeds Mr. Fair at Saginaw.

At the recent commencement exercises of the University of Illinois the honorary degree of doctor of engineering was conferred upon Samuel Wesley Stratton of the National Bureau of Standards, Washington, D. C.

President H. J. McGowan of the Indianapolis Terminal and Traction Company is in Chicago superintending the letting of the contract for the construction of the million-dollar terminal station in Indianapolis. The report that all bids had been rejected is denied.

Duncan McDonald, formerly superintendent of the Montreal Street Railway, and who for the last few years has been attached to one of the traction companies of Paris, France, is about to leave the French capital to take the post of general superintendent of the Montreal system.

James Ross of Montreal has resigned from the vice-presidency of the Montreal Street Railway and will be succeeded by F. L. Wanklyn. It is also stated that Mr. Ross will sever his connection with the Toronto Street Railway, having considerable interest in street-railway matters at Birmingham, England.

Dr. Karl E. Guthe, assistant professor of physics at the University of Michigan, has resigned his position in the university to become assistant physicist in the National Bureau of Standards at Washington, D. C. Dr. Guthe is considered an able physicist and his services will add strength to the National Bureau.

Otto Thornet, an electrical expert from Germany, was killed at Philadelphia, Pa., on June 19th, by touching a live wire while inspecting a new switchboard for the Germantown Electric Light Company. Mr. Thornet was an authority on electrical construction and was sent here as an agent of Siemens & Halske of Berlin.

Morgan Brooks, professor of electrical engineering in the University of Illinois, was in Chicago last week on his way to Minneapolis, where he will spend part of his vacation. Professor Brooks declares that the recent appropriations of the Legislature will be a great help to the engineering department of the state university, and that the number of students is annually increasing.

Herbert Wilmerding, secretary of the Philadelphia Fire Underwriters' Association, has been appointed a delegate to the International Fire Prevention Congress to be held in London on July 7th to 10th. Mr. Wilmerding will take the place of W. H. Merrill, Jr., of Chicago, who has withdrawn in order to take up his new duties as secretary of the National Fire Protection Association.

Hillsdale College, at its annual commencement on June 18th, ordered engrossed a diploma in favor of Bion J. Arnold for distinguished learning and achievements in invention and mechanical and electrical engineering. Mr. Arnold had previously received all the degrees that this institution was warranted in conferring, and it took this method of recognizing his work at the present time.

R. S. Kelsch has resigned as general superintendent and engineer of the Lachine Rapids Hydraulic and Land Company, Montreal, Quebec. Mr. Kelsch had been with the company since 1897 and was also consulting engineer for the Standard Light and Power Company and the Citizens' Light and Power Company. For a number of years previous to his connection with the Montreal company, Mr. Kelsch held a responsible position with the Chicago Edison Company.

Mrs. Grace Searing, wife of George A. Searing of Chicago, western manager of the Hart & Hegeman Manufacturing Company, died on June 19th. The friends of Mr. and Mrs. Searing will learn with great regret of the death of this estimable lady, whose beauty of character and gentleness of disposition endeared her to all with whom she came in contact. The funeral services were at the family apartments at the Plaza, Chicago, on Sunday evening, June 21st.

Edwin C. Faeber, it is reported, will be the new general manager of the Aurora, Elgin and Chicago Railway Company, to succeed Warren Bicknell, who becomes president of the Lake Shore Electric. Mr. Faeber at present is the general manager of the Elgin, Aurora and Southern Traction Company. Previously he had been with the Big Consolidated company and later with the New York Central. He has also had charge of important construction work for the General Electric Company. Mr. Faeber will assume his duties about August 1st.

William Burlingham has accepted an appointment as chief engine designer with the B. F. Sturtevant Company of Hyde Park, Mass., resigning a position in the United States Inspection Office with the William R. Triggs Company of Richmond, Va. Mr. Burlingham had previously been associated with the Bath Iron Works, the General Electric Company, the Southwark Machine and Foundry Company, and the Newport News Shipbuilding and Drydock Company. He has also served on Mr. T. A. Edison's staff at the East Orange laboratory, and is a graduate of the Worcester Polytechnic Institute.

Otto E. Osthoff has resigned his position as engineer in the Chicago office of the Electric Storage Battery Company to accept a position on the engineering staff of Mr. H. M. Byllesby. Mr. Byllesby has a large business in consulting engineering, but the greater part of his time is given to the operating and improving of local properties. Mr. Byllesby is very well known in the electrical world, having been for a long time general manager of the Westinghouse company. Mr. Osthoff is a young engineer of ability and originality, and he will undoubtedly prove a valuable addition to Mr. Byllesby's force.

The Massachusetts Street Railway Association gave a dinner to Elwin C. Foster, who has recently resigned the general managership of the companies controlled by the Massachusetts Electric Companies to accept the presidency of the New Orleans Street Railway Company. Mr. Foster's removal to New Orleans also necessitated his resigning the presidency of the association. President F. H. Dewey of the Worcester Consolidated Street Railway Company acted as toastmaster, and presented a massive silver loving cup to Mr. Foster. These words were engraved on the cup: "In appreciation of one who never failed in any duty assigned to him, whose

[illegible] for the profit of his employers and the satisfaction of the public, the Massachusetts Street Railway Association presents Elwin Carter Foster, its president, this token of esteem." About 70 persons attended the dinner, at which remarks were made by George W. Bishop of the Railroad Commission, Charles Odell, E. P. Shaw, W. H. Cunningham, Prentiss Cummings, John R. Graham, S. H. Marks, Julius E. Rugg, E. Francis Oliver, Charles D. Wyman and R. S. Brown.

ELECTRIC LIGHTING.

An electric-light plant will soon be built at Bangor, Wis.

Ozark, Ala., will install an electric plant. Marion McDonald will superintend the construction.

The town of Dixon, Tenn., has appropriated $30,000 for the equipment of waterworks and an electric-light plant.

The Lancaster (Wis.) Electric Light Company has been incorporated with capital of $30,000 by H. W. Brown and others.

Griffin, Ga., has voted affirmatively to issue $100,000 of bonds for an electric-light plant, water works and sewerage.

It is stated that an electric-lighting and power system is to be installed at Port Elizabeth, South Africa, at a cost of $500,000.

Bonds to the amount of $40,000 will soon be issued by the city of Mansfield, Mass., for the installation of an electric-light plant.

The Sioux Falls Meridian Arc Light Company of Sioux Falls, S. D., has been incorporated with a capital stock of $25,000.

Citizens of Guthrie Center, Iowa, have subscribed the necessary $15,000 for the installation of an electric-lighting system, and the plant will soon be constructed.

Edwin C. Steward and others have organized the Ithaca (N. Y.) Electric Light and Power Company, which has been incorporated with a capital stock of $500,000.

On July 2d the city of Pensacola, Fla., will vote on a proposition to issue $750,000 of bonds for public improvements to include waterworks, electric-light plant, sewerage system, etc. I. C. M. Jones is mayor.

The Lexington Water and Light Company of Lexington, N. C. (capital $75,000), has been chartered by F. W. Subert of Waterbury, Conn., W. G. Penry and others. The company is empowered to furnish water and light.

The Citizens' Light, Heat and Power Company, incorporated with a capital of $30,000, has been granted a franchise to operate a plant at Montgomery, Ala. The company is ready to purchase machinery.

The officials of Guthrie, Ky., propose to furnish a franchise and a free site for 25 years, to release the plant from taxation for five years, and to donate $1,000 in cash, it is said, to any company which will establish an electric-light plant in the town.

The Brooklyn Edison says: "A noticeable feature of the Edison company's business for the month of May was the opening of Luna Park at Coney Island, a magnificent exposition of high-class spectacle and amusements in which the lavish and artistic use of electric light is the distinctive, original attraction and the bright, particular drawing card. The Edison company supplies all this light, its contract with Thompson & Dundy being without doubt the largest ever made by a lighting company with any private firm or corporation in the world." How about the Chicago Edison contract with Marshall Field & Co.?

ELECTRIC RAILWAYS.

The Salem Terminal Traction Company, Clarksburg, W. Va., has been incorporated and purposes to construct an electric railway and to erect and operate an electric-power plant for public and private use. J. E. Law of Clarksburg, W. Va., is among the incorporators. The capital of the company is $260,000.

A new company has been incorporated to operate an electric street railway between Sixty-third Street, Chicago, and West Pullman. The company will be known as the South Side Suburban Railroad and has a capital stock of $50,000. Charles C. Heisen, Cornelius J. Ton, Frederick C. Bendle, Clayton R. Taylor and Gustav Nelson constitute the first board of directors.

The resumption of street-car traffic at Dubuque, Iowa, recently with non-union men caused a demonstration, and a squad of police and company of militia were necessary to disperse a mob of strike sympathizers, who broke all the windows at the street-car company's power house and partially wrecked the cars at the car barns. The sheriff has called for more troops to maintain order.

The report of the Chicago and Milwaukee Electric Railroad for May shows a gain in net earnings of $3,798 over May of last year. The increased equipment and faster schedule are responsible for the increase. Gross earnings for May of this year amounted to $20,042, as compared with $16,440 for the corresponding month last year, and the net earnings were $12,886 for May, 1903, and $9,088 for May, 1902.

Articles of incorporation have been filed with the secretary of state of Michigan by the Chicago, Michigan and Indiana Railway Company, capitalized at $3,000,000. The object is stated to be the construction of an electric railway, 110 miles long, to form connection with Chicago from Michigan and northern Indiana points. W. S. Kitmer and Charles G. Davis of Benton Harbor, Mich., are interested in the enterprise. The bonds have all been sold, largely to eastern capitalists.

The Colonial Street Railway Company and the Penn Park Street Railway Company of York, Pa., which were chartered under an act of 1901, will apply to the council for privilege to make extensions to the present street-railway system. The companies are composed of the same capitalists who make up the York Street Railway Company, and will cooperate with it. A line will be built by the Penn Park company from Penn Park to the suburbs of Fairmount. The Colonial Street Railway Company proposes building lines east and west in the city.

POWER TRANSMISSION.

The Dan River Power and Manufacturing Company will equip its cotton mill at Danville, Va., with electrical machinery throughout, and for this purpose has recently ordered from the Westinghouse Electric and Manufacturing Company two 750-kilowatt and one 500-kilowatt, 6,600-volt generators, each generator to be direct-connected to an independent waterwheel. The current so generated is to be transmitted a distance of 3,000 feet to a step-down transformer station, in which will be located four 600-kilowatt, Westinghouse, oil and water-cooled transformers, which will step down the 6,600 volts to approximately 500 volts for transmission to the various buildings where it will be used for driving numerous induction motors.

The bringing of electric power into the Coeur d'Alene mining district of Idaho by the Washington Water Power Company of Spokane, Wash., is expected to greatly facilitate the mining industry of that district. The greatest feature will be the reduction made in the price of operating the mines. The power will be sold to the different mines at $50 per horsepower per year. This price is less than one-half what the mining companies are paying now per horsepower under the use of steam. The mine owners say that with steam it costs them $110 to furnish one horsepower per year. It is estimated that the cost of building the line will be about $650,000. Fred Phair, a Spokane contractor, is now at work superintending the construction of stations.

AUTOMOBILES.

In regard to recent announcements that persons touring Canada in automobiles would be subject to a customs duty on their machines, the Canadian department of customs has announced that automobiles (not new) in use by tourists coming temporarily into Canada and not domiciled in Canada may be passed upon deposit of an amount equal to the duty, subject to refund upon exportation within the time prescribed by the collector, not exceeding six months from date of arrival. The automobile is not to be used for gain or hire in Canada.

SPACE TELEGRAPHY.

The steamship Deutschland of the Hamburg-American Line has been equipped with Marconi wireless telegraph apparatus. Four other ships of this line are to be similarly equipped, which will enable them to keep in communication with 21 transatlantic liners already using Marconi apparatus, and with the shore stations of the Marconi system in Europe and America.

Austen Chamberlain, postmaster-general of Great Britain, in explaining his attitude toward Marconi's enterprise in that country, said recently that he did not desire to hamper a new invention, but the postoffice did not intend to throw away its right of monopoly in public communications as it did in the early days of the telephone. The company has asked for a permanent exclusive right to use space telegraphy in Great Britain.

The Berlin Tageblatt publishes a message sent by its correspondent from a moving railroad train between Rangsdorf and Zossen, Germany, stating that wireless experiments of that kind were made by the Association for Wireless Telegraphy (Braun-Siemens system). During the journey communication was held between the moving train and the stations of Marienfelde and Rangsdorf. The reliability of the messages transmitted was proven.

SOCIETIES AND SCHOOLS

At the thirty-third annual commencement of the Worcester Polytechnic Institute the degree of bachelor of science was conferred upon 42 seniors, including 13 who took the electrical-engineering course. The degree of master of science was conferred upon four persons, including Electrical Engineer Ellis E. Brown of Reading, Pa. Carl D. Knight of the electrical-engineering class, was one of the first six members of the class who received a prize of $75 each.

The Year Book for 1903-04 of the Armour Institute of Technology shows that Chicago's technical school is in a prosperous condition. The institution was founded in 1892 by the late Philip D. Armour, and the courses in mechanical engineering, electrical engineering, civil engineering, chemical engineering and architecture lead to the degree of bachelor of science. Dr. Gunsaulus is president of the Institute and Professor Alderson is dean of the College of Engineering. Other members of the faculty are G. B. Gebhardt, professor of mechanical engineering; C. E. Freeman, professor of electrical engineering; G. M. Wilcox, professor of physics, and J. E. Snow, associate professor of electrical engineering.

PUBLICATIONS.

Bulletins Nos. six and seven of the Thos. E. Clark Wireless Telegraph-Telephone Company, Detroit, Mich., are out and will be mailed to any one desiring copies.

The Chicago and Alton Railway, in view of the National Educational Association convention to be held at Boston July 6th to 10th, has published, in convenient form, a "Guide to Boston."

The latest catalogue of the Bates Machine Company, Joliet, Ill., is an exceptionally fine specimen of the art of printer and engraver, and is quite in keeping with the excellence of the products of this company, which manufactures a complete line of power-transmitting machinery, as well as the Bates Corliss engine, air and gas-compressing machinery, etc.

Coal-handling machinery of every description for power stations, boiler rooms, coaling stations, gas companies, coal yards, shipping docks, manufactories, etc., is treated in detail and profusely illustrated in Catalogue 035, published by the C. W. Hunt Company, Staten Island, N. Y., manufacturer of electric and steam hoisting machinery, coal-handling machinery, electric locomotives, etc.

"Automatic Circuit Breakers for Direct Current" is the title of a new booklet issued by the Western Electric Company. It contains well illustrated descriptions of the company's latest circuit-breakers and also several pages devoted to the mounting of these devices. The same company is also distributing a bulletin devoted exclusively to its line of sewing-machine motors, showing the method of attachment of the motor to the machine.

The Canadian Electrical News published a neat eight-page daily during the convention period of the Canadian Electrical Association at Toronto, June 10th to 12th. The first issue contained facts concerning the city of Toronto and a greeting to the members, while subsequent numbers were devoted to a report of the doings of the association. The daily was interesting to those in attendance and greatly appreciated by absentees, to whom copies were sent.

The Western Electrician has received a handsome engraving of the Warren yacht Wemco II. The Wemco, it is believed, is the first yacht to be named after an electrical manufacturing company, the letters of the name in this case being the initials of the Warren Electric Manufacturing Company. Incidentally, it should be mentioned also that the Wemco was Commodore Warren's flagship at last year's Put-in-Bay yacht races, as readers of the Western Electrician will remember. It was at this time that the Wemco carried off the prize as winner of the race for vessels of its class.

MISCELLANEOUS.

In the new edition of the Encyclopedia Britannica in the article on "Electricity" there is this interesting definition: "The electric conductivity of a substance is that property in virtue of which all its parts come spontaneously to the same electric potential if the substance is kept free from the operation of electric force."

A new air-brake valve mechanism has been devised by Edward G. Shortt of Carthage, N. Y. The invention comprises a graduation and an auxiliary reservoir. Pressure from the auxiliary reservoir is only used in case of emergency. The graduation reservoir is supplied with air at train-pipe pressure, its supply being fed by an intermittent feed from the train pipe and also from the brake cylinder during release after emergency action.

Among the United States patents issued on June 9th is one for a rotary engine invented by Michael E. Sullivan, Poughkeepsie, N. Y. The engine consists of a casing having an annular chamber. A shaft mounted in the casing carries a toothed disk. The casing has also a series of chambers arranged upon opposite sides of the disk. Pistons carried by the disk are movable transversely through it and into the second-named chambers. Inlet and exhaust ports communicate from the casing to the piston chambers. Connected to the inlet ports are ports in the steam chest. These ports intersect a plug valve arranged within the steam chest at the point of intersection of the ports. This valve is provided with a main and auxiliary port.

TRADE NEWS.

The formation of a Canadian Westinghouse company, as outlined in the Western Electrician of May 23d, is now assured, except that it has not been definitely decided to locate the works at Hamilton.

The Zahn Electric Company, St. Louis, Mo., has been incorporated by W. G. Zahn, W. E. Howard and J. B. Carroll. The company, which is capitalized at $5,000, will deal in electric machinery and supplies.

Government officials of Germany are being petitioned by German electrical interests to arrange in making a new commercial treaty with Russia for lower duties upon German electrical supplies. At the present time about $4,760,000 worth of electrical goods is exported to Russia from Germany annually, and the amount is increasing from year to year.

Silvanus F. Van Choate, formerly president of the Van Choate Electric Company, which went into the hands of a receiver in 1900, has brought suit against the General Electric Company for no less than $50,000,000 damages, alleging infringement of patents covering multipolar generators and motors, metallic fastenings for electric motors and various resistance switches or controllers used in the operation of street cars. The entire circumstances incident to the litigation will not become known until the declaration of the plaintiff is filed in October. The General Electric Company does not take the suit seriously.

The regulations promulgated by the Treasury Department on July 25, 1891, in the matter of drawback on insulated electric-lighting cables manufactured by the Norwich Insulating Wire Company of Brooklyn, in part from imported lead, have been amended so as to provide for drawback on galvanized wire produced from imported steel billets used in armoring cables, manufactured and exported by the National Conduit and Cable Company of New York city, successor of the Norwich Insulating Wire Company.

BUSINESS.

The Duluth Stoker Company, Duluth, Minn., manufacturer of the Duluth stoker, announces that it has closed a contract with the American Steel and Wire Company for eight Duluth stokers of 320 horsepower each, with an option of 14 additional stokers of the same size, which will probably also be used. The Duluth Stoker Company says that its stokers are being installed at Detroit, South Chicago, Cleveland, Madison, Me., and West Superior, Wis. The company also states that it is its intention to manufacture its stokers in Chicago hereafter.

The Wilmington City Electric Company placed an order with the Willard Storage Battery Company of Cleveland last week for elements to enlarge its battery from 2,000 ampere-hours to 3,400. The original battery has been in use five years without renewals. During this time it has carried a load every day. On account of its good performance the present order for enlargement was given.

All the steel work in the new piers, sheds and warehouses of the North German Lloyd steamship line in Hoboken on the site of those destroyed by the disastrous fire of June, 1900, is protected with the silica-graphite paint made by the Joseph Dixon Crucible Company. The paint is applied to prevent possible electrolysis and the corrosive action of sulphurous discharges from the steamships.

The Electric Appliance Company of Chicago has secured the exclusive sales agency for the new enclosed fuses known by the name of McBride "Arkless" fuses, and recently described in the Western Electrician. The fuse consists of a cartridge, extending from each end of which is a copper wire sufficiently long to fit any link connection. These fuses are made for 125 volts, also for 250 volts, with capacities running from three to 30 amperes.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 16, 1903.

730,858. Telegraph Instrument. Martin Armstrong, Kenney, Texas. Application filed February 28, 1902.

A telegraph transmitting instrument comprising a board of insulation provided with recesses filled with metal is supplied with a set of parallel grooves cut in the flush surfaces of the metal and insulation, numerals and letters of the alphabet being arranged opposite the starting points of the grooves, and the metal being so distributed as to provide each groove with one or more contacts corresponding to the letter or numeral allotted to it. The board has another set of parallel grooves extending at right angles to the first-mentioned set of grooves, each of the last-mentioned grooves being provided with contacts corresponding to a word or sentence. Means are provided for electrically connecting all of the contacts, and a stylus is adapted to be drawn along the grooves.

730,860. Electric-motor System. George O. Baker, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 10, 1901.

In combination with an electric motor is an automatic circuit-breaker provided with contacts so arranged as to close a local circuit through the motor and convert it into a breaking-generator immediately upon operation of the circuit-breaker. Means are furnished for tripping the circuit-breaker by a tripping coil in series with the motor fields.

730,864. Automatic Fire Alarm. Damase Beaulieu, St. Ulric, Canada. Application filed December 29, 1902.

A pair of contact-pieces forming terminals are secured to a base-block at opposite sides of a recess on the under side and within the latter. By this means the conductors can be led to the terminals without defacing the wall. The block has a hole through it opposite the ends of the contact pieces. A stud reciprocally mounted in the hole, a compression spring mounted on the stud and tending to force the latter into contact with the contact-pieces, a pair of projections on the base on opposite sides of the stud, and a cord of combustible material attached to the projections and passing through an eye in the stud are provided.

730,869. Electric Railway. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company, Johnstown, Pa. Application filed July 29, 1902.

Disturbing effects of short-circuits due to temporary connections which may be made by a car between one or more of the surface contacts and an adjacent object are obviated by a subfeeder to which the contact adjacent to such objects are connected, and which has its ohmic resistance so proportioned as to supply the contacts with sufficent current to enable the car to be moved past the objects, but not sufficient to disturb the system should such current be short-circuited. (See cut, next page.)

730,891. Means for Operating Alternating-current Electric Motors. Rudolph Eickemeyer, Yonkers, N. Y. Application filed July 6, 1894.

An alternating-current motor is supplied with a rotative motor-starting switch coupled to the field-coil sections of the power-motor. A second or governing alternating current motor is attached to and operates the motor-starting switch, causing its armature to initially rotate. The organization is such that the working of the hand-starting switch will set the governing-motor in operation, and the latter will then rapidly operate the motor-starting switch, and cause the power-motor to commence its initial rotation under normal load, and to increase its rotation until maximum speed has been reached.

730,893. Electrical Transformer. Augustine R. Everest, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 8, 1902.

The cover for the casing of the transformer is removably secured to it so as to permit access to the interior of the casing. A covered opening in the cover permits access to a connecting board mounted within.

730,898. Electric Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 22, 1902.

An arc-lamp with several movable electrodes, means for supplying phase-displaced current to the electrodes, and a common actuating means for the movable electrodes influenced by current passing through them are the principal features.

730,899. Multiphase Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 22, 1902.

A multiphase arc-lamp having an electrode in each branch of a multiphase system is supplied with an induction motor for feeding the electrodes. The motor is comprised of a rotary member and a stationary member, and means for producing a magnetic flux in the stationary member rotating in one direction upon an increase in current flowing through the electrodes, and rotation in the opposite direction upon a decrease in the current flowing through the electrodes are supplied.

730,906. Fuse Terminal. William R. Goodman, Chicago, Ill., assignor to the Chicago Fuse Wire and Manufacturing Company, Chicago, Ill. Application filed April 3, 1902.

The essential features are a flat piece of fuse material with two end pieces, each consisting of a flat portion and a forwardly projecting raised lip, the end of the fuse being placed under the lip and abutting against the body of the terminal.

730,955. Electric Hoist. Frank Nather, Johnstown, Pa. Application filed September 19, 1902.

Combined with an electric motor is the hoist proper suspended from the motor-frame and geared to the motor-armature. The armature-shaft is provided with a pivoted brake-block for engagement with the wheel, a spring normally maintaining such engagement. A rock-shaft journaled to the motor-frame and operatively connected with the brake-block, and means for manually operating the rock-shaft are also supplied.

730,967. Dynamo-electric Machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 27, 1897.

A revolving member is combined with a frame secured to lugs upon it. Resistance-grids carried by the frame engage with brushes mounted on a sliding support. A rod extends through a hole in the armature-shaft and is secured to the sliding support for moving the brushes. (See cut, next page.)

730,975. Contact Device. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 31, 1900.

A plug-shaped insulating part abuts against the bottom of a lamp-carrying insulating part. The plug has a center contact engaging the bottom of the lamp-carrying part. A conducting-screw extends through the plug. An opening in the side of the lamp-carrying part communicates through the bottom with the interior for the passage of lead-wires.

730,985. Electric Motor for Ceiling Fans. Peter Swan, Calcutta, India. Application filed January 13, 1903.

A drum-armature mounted on a spindle revolving about a vertical axis bears on a fixed conoidal bearing on a part through which the spindle passes freely. The conoidal bearing surfaces are so constituted as to pump oil through ducts communicating with them.

731,000. Controlling Electric Boosters. Merle J. Wightman, West New Brighton, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 5, 1901.

A booster is provided with a separately excited field, and is driven by an electric motor supplied by the circuit provided with a compound field-winding, the series coil of which is in circuit with the booster field-winding. (See cut, next page.)

731,005. Plug Fuse. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 24 1902.

A hollow base of insulating material, closed at one end is held in place by a contact-bolt extending through the closed end. A metallic shell or casing surrounds the base and is provided with end flanges adapted to engage the edges or corners at the ends of the base, and a cover for the open end of the base adapted to engage the sleeve or shell are provided.

731,016. Insulated Joint for Railway-rail Joints. Bancroft G. Braine, New York, N. Y., assignor to the Continuous Rail Joint Company of America. Application filed October 22, 1900.

Fish-plates each comprised of an upright portion having at its upper and lower edges inclined bearings adapted to be wedged between the head and base flange of the rails are clamped about the rail ends. Insulating strips are placed in between the fish-plates and the rails.

731,025. Electric Arc Lamp. John L. Davies, London, England. Application filed February 11, 1902.

The framework of an electric-arc lamp is described, consisting of a crown-plate, a coil-plate fixed to, but insulated from, the crown-plate, and provided with a depending bracket, coils suspended from the coil plate in a main or central tube fixed in the bracket, and the lower yoke and globe plate.

731,029. Method of Utilizing the Energy of Waves. Reginald A. Fessenden, Pittsburg, Pa. Application filed May 4, 1903.

As an improvement in the art of signaling by waves the method described consists in transforming the energy of currents derived from electromagnetic waves to energy of a different form in a body of liquid, localizing such transformed energy in the body and causing it to act cumulatively.

731,035. Diamagnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 1, 1900.

A diamagnetic separator is described comprising an electromagnet, having pole-pieces separated by a long, narrow interpolar space, and means for feeding the material into the space in close proximity to the pole-faces. There is a central zone of lesser magnetic intensity into which the particles of higher diamagnetic susceptibility pass. Inclined planes spanning the interpolar space, and separate hoppers for the heads and tailings are provided.

731,036. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 1, 1900.

A new method of separating diamagnetic particles from a mixture containing them is described. It consists in feeding the mixture into a magnetic field having a central zone of lesser magnetic intensity than that into which the mixture is fed, continuing it in and subjecting it to the action of the field until the diamagnetic particles to be separated have gradually moved out from the mixture toward the central zone of lesser magnetic intensity, and then collecting the particles.

731,037. Diamagnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed January 13, 1903.

The essential features are a downwardly inclined pole-piece together with means for feeding the material to be separated upon the upper portion of the incline, the incline crossing the path of gravital descent of the material. Pockets are provided in the pole-pieces.

731,038. Diamagnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 1, 1900. Renewed January 13, 1903.

The material to be separated is fed between pole-pieces which are inclined from the vertical transversely to the path of the falling material.

731,040. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 19, 1900. Renewed January 13, 1903.

A method of separating diamagnetic particles from a mixture containing them consists in feeding the mixture into a relatively intense part of a magnetic field, causing the field to be traversed by a retarding flow of liquid moving in opposition to the movement of the material treated, and thus detaining the material in subjecting it to the action of the magnetic field until the diamagnetic particles to be separated have gradually moved out from the mixture into a relatively weak part of the field collecting the particles as heads, and then increasing the retarding current to carry off the spent tailings.

731,041. Diamagnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 19, 1900. Renewed January 13, 1903.

A diamagnetic separator is described comprising vertically arranged magnet pole-pieces, means for feeding the material to be separated and allowing it to gravitate through the space between the pole-pieces, means for forcing a counter-current of obstructing fluid upward through the space to retard the falling material, and a receptacle for the separated diamagnetic material located beyond the vertical planes of the interpolar space. (See cut, next page.)

731,042. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed March 19, 1900. Renewed January 13, 1903.

The mixture to be separated is fed into a relatively intense part of a magnetic field, rapidly moving the field

in a direction opposed to the feeding of the material so as to increase the number of lines of force traversed thereby. A current of liquid flows in a direction opposed to the feeding material so as to correspondingly detain the material during its movement through the field.

731,043. Separating Diamagnetic Metal from Sands, etc. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900. Renewed January 13, 1903.

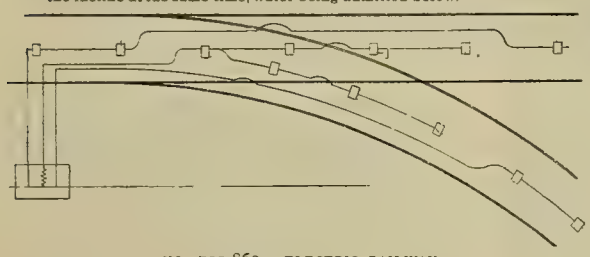
A method of separating free particles of diamagnetic metals from sand is described which consists in mixing particles of magnetic material with the mass and separating the diamagnetic and magnetic substances at once.

731,044. Diamagnetic Separation. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900.

A method of separating diamagnetic material from mixtures consists of feeding the mixture into a magnetic field and continuing it there until the particles of less susceptibility have moved into a weak part of the field. Wave-like impulses are sent through the field during the process.

731,045. Diamagnetic Separator. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed April 14, 1900.

The invention consists of a magnet having an inclined pole-piece, with a casing arranged in front of the magnet pole and permeable to water. The materials are fed onto the incline at the same time, water being admitted below.



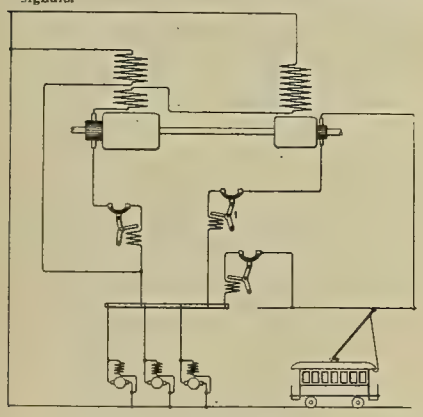
NO. 730,869.—ELECTRIC RAILWAY.

731,056. Electromagnetic Vibrating Reed. Sterns F. Jones, Brooklyn, N. Y. Application filed September 23, 1902.

A vibrating reed is combined with an electromagnetic device for maintaining the reed in vibration. Springs located upon the base upon opposite sides of the reed to cushion the impact and impart an initial return movement are provided, each spring being supported upon a sliding block or carriage. There is also a groove for each carriage and means for gradually moving the carriage on its groove to vary the position of the springs with respect to each other and to the reed.

731,108. Automatic Signaling Apparatus for Railways. John Goldsworthy, Indianapolis, Ind. Application filed January 27, 1902.

Several pairs of posts are arranged adjacent to the track on opposite sides forming a block. The blocks overlap adjacent blocks. Arms attached to the posts are provided with movable signal devices. Electric lamps are mounted on the arms. A generator, exciting electromagnets mounted on the posts, which in turn actuate movable armatures mounted near the electromagnets, operate the signals.



NO. 731,000.—BOOSTER CONTROL.

731,125. Carrier. Stuart H. Patterson, Plainfield, N. J. Application filed December 19, 1902.

The device is supported upon wheels which revolve upon a pair of rails composed of sections insulated from each other. A series of electromagnets vertically disposed beneath the rails create an electromagnetic field along the rails, and means for sequentially connecting the rail-sections with the electromagnets are provided.

731,134. Electrical Igniter for Explosive Engines. Charles E. Sargent, Chicago, Ill., assignor of three-fourths to Oliver S. Lyford, New York, N. Y., and Charles W. Hillard, trustee, Chicago, Ill. Original application filed April 27, 1900. Divided and this application filed November 3, 1900.

A beveled push-pin is mounted on a crank-arm which in turn is mounted on a rock-shaft. A disk operates the push-pin which makes the electrical connection.

731,145. Device for Handling Live Electric Wires. Burt Wilbur, Syracuse, N. Y. Application filed February 9, 1903.

An insulated handle has a lengthwise opening. A head secured to one end of the handle carries jaws pivotally mounted and having eccentric engaging faces for gripping and holding the wire.

731,166. Electric Telephone System. Hiram D. Currier, Ottawa, Ohio, assignor of one-half to Jacob M. Lorenz, Chicago, Ill. Application filed May 16, 1902.

Two line-circuits are connected in series. A central source of electric supply bridged across supplies current to both in common. Primary induction coils are in series with the respective lines. The two secondary coils are bridged one across the legs of each line and arranged in inductive relation to the primary coils of the opposite line. (See cut.)

731,195. Watertight Union for Lead Cables. George L. Martin, New York, N. Y. Application filed March 4, 1903.

A tubular piece is provided with exterior screw-threads at each end with an intermediate unthreaded portion. A second tubular piece abuts against the first piece, forming a channel for the cable. The second piece is provided with an annular collar which fits the collar of the second piece.

731,209. Resistance Set. Edwin F. Northrup, Philadelphia, Pa., assignor to Morris E. Leeds & Co., Philadelphia, Pa. Application filed March 20, 1903.

A plurality of series-connected electrical resistances are arranged so as to secure a series of regularly increasing resistance values greater in number than the resistances employed. Means are supplied for establishing short-circuits around the end resistances independently and in combination with the intermediate resistances, and around intermediate resistances alone.

731,210. Resistance Set. Edwin F. Northrup, Philadelphia, Pa., assignor to Morris E. Leeds & Co., Philadelphia, Pa. Application filed March 31, 1903.

In combination with a number of electrical resistances are contact-pieces of greater number than that of the resistances and connected to the resistances in prearranged combinations so as to give a series of ratio values of resistance greater in number than the resistances employed. Also a pair of terminal contacts adapted to make contact successively.

731,239. Telephone Circuit. Fredrich W. Sorg, Englewood, N. J. Application filed August 14, 1902.

The new feature is that the wire or conductor is supported in sections by the insulators. At the end of each section it is bent back and secured upon itself to form a loop engaging an insulator, the bent-back portion being carried across to another insulator in the same group.

731,279. Electric Clock. Joseph A. Carruthers, St. James, Victoria, Australia. Application filed October 10, 1902.

Upon the base of the pendulum is an armature. An electromagnet is set beneath the armature. A hinged plate supported directly by the pendulum is prevented from swinging on its axis during movement of the pendulum in one direction. Spring contact plates are so placed that one is adapted to be depressed by the spring-plate in one direction of travel of the pendulum and to pass idly over the plate on the return movement, circuit connections being established between the spring plates and the magnet.

731,280. Electric Clock. Joseph A. Carruthers, St. James, Victoria, Australia. Application filed October 10, 1902.

In combination are a pendulum with an armature at its base, an electromagnet beneath the armature, two brackets carrying spring plates, and a hinge plate adjustably supported from the pendulum so as to bear on one of the plates at intervals, making electrical connection.

731,284. Trolley Arm. Judson T. Cousins, Norwich, Conn., assignor of one-half to Fred W. Estabrook, Norwich, Conn. Application filed May 12, 1902.

To a trolley arm angular in cross-section is attached a trolley head having a shank slidingly and non-rotatably held within the arm.

731,298. Electric Controller. George W. Gilmore and David Kendall, Alliance, Ohio, assignors to the Alliance Machine Company, Alliance, Ohio. Application filed March 12, 1903.

Contact-pieces are mounted on a support. A movable arm having fixed to it a frame with a blow magnet and a pair of independently movable brush holders, each having several brushes, are so arranged that the brush holders are connected respectively to the ends of the blow-magnet winding. The brushes engage the contacts on the fixed support while they are movable independently of the magnets.

731,301. Combined Track Switch and Block Signal. Harry Hollis, Wilmington, Del. Application filed August 15, 1902.

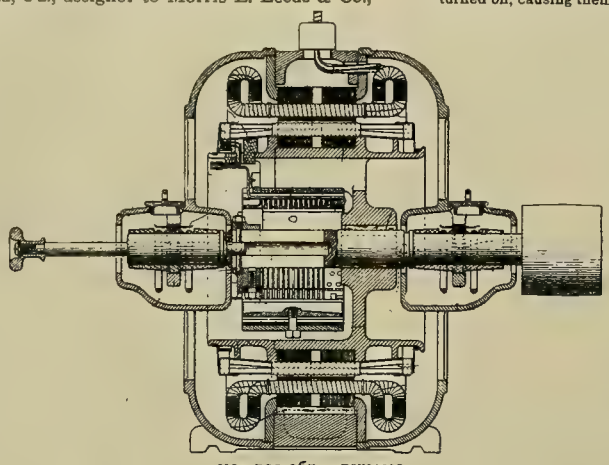
A block signal comprising a number of magnetic members with means for energizing the same independently from separate movable cars, the magnetic members being provided with movable armatures, is built so that a plurality of contacts are opened and closed by movements of the armatures, and local electric signals connected with the contacts are operated.

731,308. Method of Producing Electrodes for Electric Accumulators. Ernst W. Jungner, Stockholm, Sweden. Application filed August 5, 1901.

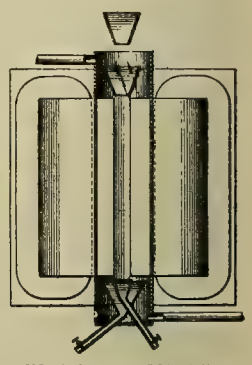
A new method of making carriers for active masses of accumulator-electrodes that are chemically indifferent to alkaline solutions is described, which consists in placing a cathode having regularly disposed conducting-points opposite a plate of suitable metal as anode in a solution of an alkali-metal hydrate containing a salt capable of forming a combination with the metal that is soluble in the solution with less rapidity than the formation of the salt.

731,364. Electromagnetic Traction-increasing Appliance. Albert A. Honey, Tacoma, Wash., assignor to the Magnetic Equipment Company, Chicago, Ill. Application filed December 28, 1901. Renewed November 25, 1902.

A helix-shaped conductor is mounted upon each wheel. Current can be sent through the helix. The two sets of wheels on each truck are electrically connected so as to make horse-shoe magnets of them when current is turned on, causing them to hug the track.



NO. 730,967.—DYNAMO.



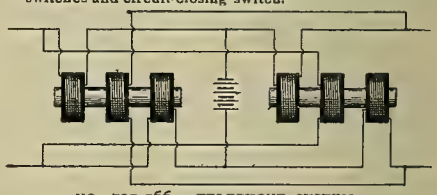
NO. 731,041.—DIAMAGNETIC SEPARATOR.

731,365. Electromagnetic Traction-increasing Apparatus. Albert A. Honey, Tacoma, Wash., assignor to the Magnetic Equipment Company, Chicago, Ill. Application filed December 28, 1901. Renewed November 25, 1902.

Intermediate idle wheels and axles are situated in front of each pair of truck wheels. A helix is mounted upon each axle. A connecting bridge or bridges of magnetizable material connect the truck axles and idle ones, and wires, by means of which the magnets are connected in a common circuit, are provided. Horse-shoe magnets will be formed, each having two coils, one of which is that which energizes the idle wheels.

731,375. Electric Controller for Electric Motors. William K. Liggett, Columbus, Ohio, assignor to the Kinkade and Liggett Company, Columbus, Ohio. Application filed December 22, 1902.

In combination are a series of switches constituting a reversing-switch and a circuit-closing switch. A two-section shaft carries cams which operate the reversing switches and circuit-closing switch.



NO. 731,166.—TELEPHONE SYSTEM.

731,382. Device for Attaching Dynamos to Railway Cars. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed January 11, 1900.

An adjustable suspension for the dynamo is provided beneath the car. The dynamo is belted to the car axle with means for adjusting the belt tension.

731,400. Terminal Tip for Electric Wires. Harry L. Worthington, New York, N. Y., assignor of one-half to Valentine E. Kennedy, New York, N. Y. Application filed February 27, 1903.

The invention consists of a metallic terminal tip for electric wires having a pair of wings around which the end of the wire is fitted, and separate means for clamping the wire and its end to the tip.

EXPIRING PATENTS.

Following is a list of electrical patents that expired on June 23, 1903:

344,099. Electric-railway Signal. Burton H. Gedge, Covington, Ky.

344,100. Electric Signal for Railroad Switches. Burton H. Gedge, Covington, Ky.

344,153. Telephone. Jules Joas Barrier and Ferdinand Tourvielle De Lavernede, Paris, France.

344,188. Arc Lamp. Norman McCarty, Hoosick, N. Y.

344,252. Electric Lamp. Joseph R. Dales, Philadelphia, and Wyllis H. Markland, Altoona, assignors to Monroe K. Reeves, Philadelphia, Pa.

344,260. Apparatus for Transmitting Power from Electric Motors. Chaimsonvitz P. Elieson, London, England, assignor to the Electric Locomotive and Power Company, London.

344,318. Induction Coil. Francis W. Jones, New York, N. Y.

344,333. Telephone Receiver. William C. Turnbull, Baltimore, Md.

344,262. Electric Motor. James E. Emley, Weatherford, Tex.

NEW YEAR'S NUMBER

1903

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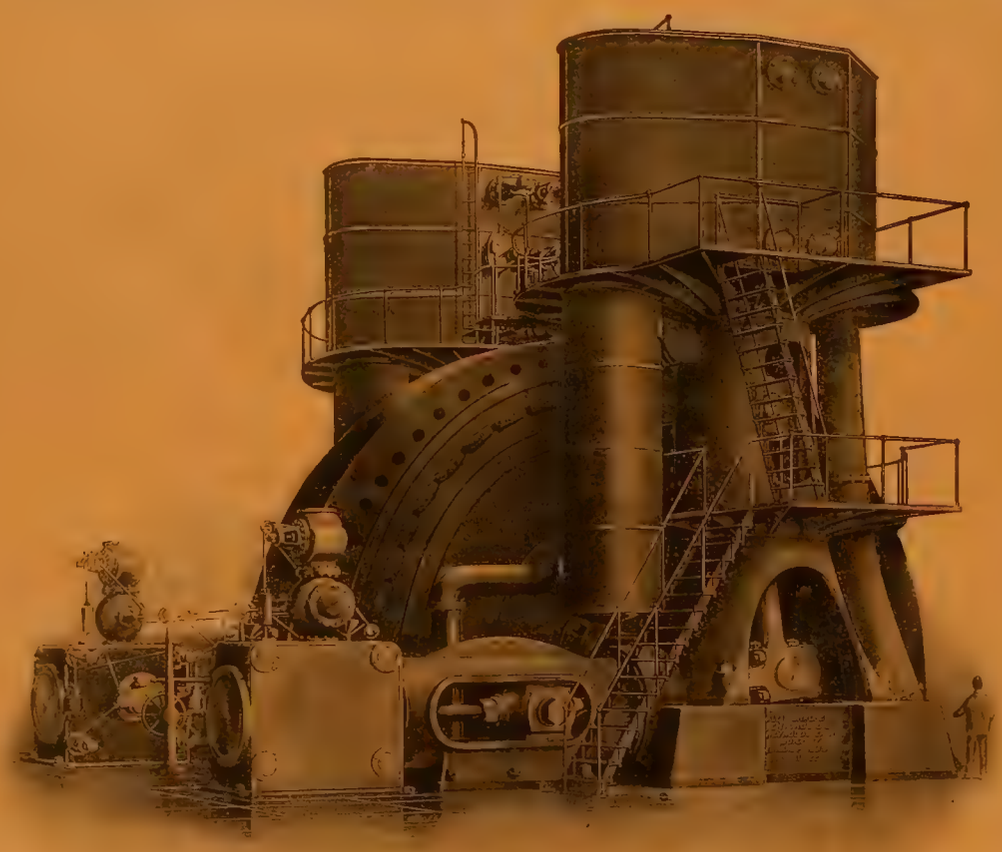

This cut is an illustration of a "REYNOLDS' ENGINE," built for the Manhattan Railway Co., New York, also for the New York Rapid Transit R. R. The (Subway). There are to be eight of these engines in each of the powerhouses. Each engine is rated at 8,000 H. P. for its most efficient load, and is to be capable of operating continuously under a load of 1,200 H. P.

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Western Electrician

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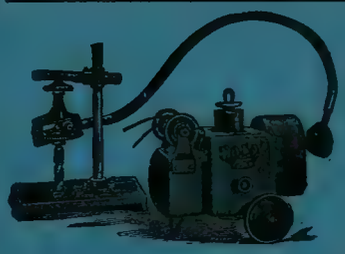

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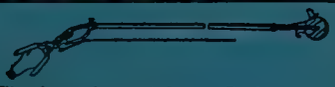

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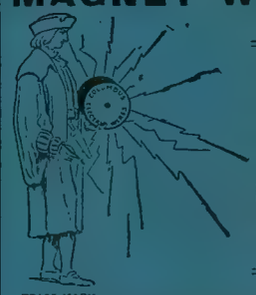

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If you want light to see objects below the lamp

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are unequaled for driving all classes of machine tools.

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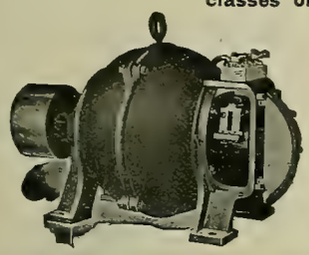

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Permit the Electric Light to be instantly placed where it is needed. Made for shop, factory, store, office, residence—in fact wherever the incandescent lamp is used.

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Portables, Chandeliers, Brackets, Desk Lamps, Clusters, Canopies and All Sizes and Styles of Shades and Reflectors.

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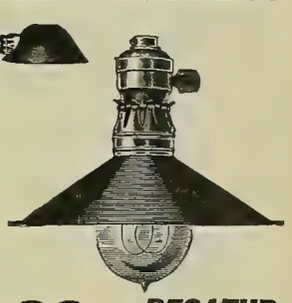

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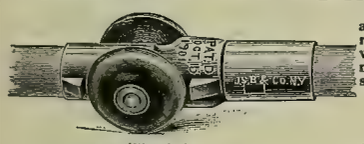
VILLARD AUTOMATIC DUCT RODS ARE THE BEST RODS—THEY STAND THE TEST.



These rods are coupled and uncoupled instantly and with ease. They will not buckle or form a zigzag line and are very light running. They are perfectly rigid when pushed, and become flexible when pulled. They cannot be uncoupled in the ducts, the rear end of a rod having to be raised to an angle of forty-five degrees to detach it. One man can push it with ease 600 feet and a hard blow can be struck with telling effect without the slightest injury to the rods. The wheels serve as duct cleaners as well as obviate friction. The castings are made of solid bronze and malleable iron as desired, with wheels of chilled iron. The rods are made of hickory well seasoned in oil to prevent decay. They are put up in sets of 200 rods or 600 feet.

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Wheeled. Discount upon application. Other lengths to order. Send for descriptive circular.

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Complete stock of all sizes constantly on hand and for sale at lowest market prices by

CHICAGO EDISON COMPANY,

WRITE FOR PRICES. 139 ADAMS STREET, CHICAGO.

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CONSTRUCTION:

Inner lining of heavy fireproof canvas.

Weather-proof coating.

Cable cord, hard twisted and fireproof.

All intersects filled with special fireproof compound and coated with weather proofing.

Outer jacket fireproofed.

Outer coating protection against weather and abrasion.

Finished Conduit.

ALPHADUCT FLEXIBLE CONDUIT TRADE MARK FIRE PROOF

Alphaduct Mfg. Co.

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Acknowledged by Architects, Engineers, Contractors and Inspectors to be the BEST.

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Impossible to tear out any part.

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We guarantee LOWEST FIRST COST, HIGHEST EFFICIENCY, MOST CONSERVATIVE RATING and CHEAPEST MAINTENANCE.

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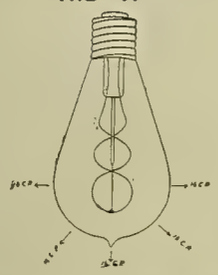
DON'T WASTE YOUR MONEY YOU MAY WANT IT.

THE "IT"



Patented Feb. 1, 1902.

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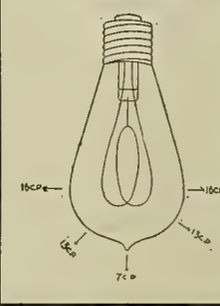
Side	16	Candle Power
Angle	16	" "
Tip	16	" "
Average	16	" "

Write

"Sterling Special"

on your orders for incandescent lamps. Study the cuts and see WHY you use the SAME current and you get 128% MORE LIGHT.

THE "HAS BEEN"



THE OTHER KIND.

Side	16	Candle Power
Angle	13	" "
Tip	7	" "
Average	12	" "

STERLING SPECIAL
AVERAGES 16 CANDLE POWER.

THE OTHER KIND
AVERAGES 12 CANDLE POWER.

SEND FOR PRICES AND SAMPLES

STERLING ELECTRICAL MFG. CO., Warren, Ohio.

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DRY CELL.

If kept out of the sun, in a cool dry place, this cell will not run down on the shelf in two years, and at the end of that time will be as good as other makes fresh from the factory. To maintain its superiority to all others, no expense is spared, and only the best materials and chemicals are used in its manufacture.

This cell will save the consumer money, because a fewer number will perform a given amount of work four times as long as any other cell of equal size.

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CURRENT, - 14 TO 18 AMPERES.

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QUICK,
SAFE,
CHEAP.

By pushing button a steady, brilliant, strongly reflected electric light is obtained; illuminates the darkest corner instantly; handy at bedside, and in all cases of emergency. Takes the place of lamp or candle, without need of matches, or danger of fire. Will last for years. **PRICE, PREPAID, $2.00.** Extra batteries for recharging, **35c** each. Send for booklet, with further information and illustrations of other electric household articles. **Electric Gas Lighters, $1.50 each.**

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RAILROAD REGULATING, LIGHTING, POWER AND ISOLATED PLANTS.

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WORKS: DEPEW. N. Y.

Bulletin No. 2, describing "GOULD BOOSTER SYSTEMS," on application.

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Buffalo Forge Co.
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Lagonda Mfg. Co.
Mechanical BoilerCleaner Co.

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Dearborn Drug & Chem. Wks.

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Central Electric Co.
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Holmes Fibre-Graphite Co.
Western Electric Company.

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Consumers Carbon Co.
Electric Appliance Co.
Reisinger, Hugo.
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Chains.
Jeffrey Mfg. Co.

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Osburn Flexible Conduit Co.
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Conduit Rods.
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Construction & Repairs.
Chicago Edison Co.
Parsell & Weed.
Spies Electric Company.
Western Electric Co.

Contractors and Electric Light Plants.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
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Int. Correspond. Schools.

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Anderson & Sons, W. H.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Central Manufacturing Co.
Standard Pole & Tie Co.
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Bossert Elec. Const. Co.
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General Electric Co.
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Schureman & Hayden.
Sprague Electric Co.
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Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
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Simplex Elec. Heating Co.
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Crocker-Wheeler Company.
General Electric Co.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

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Federal Electric Company.
Goltz Engineering Co.

Electrical and Mechanical Engineers.
Brown & Leasure.
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Kohler Brothers.
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Schott, W. H.
Stanton, Le Roy W.

Electrical Instruments.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
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Norton Elec'l Instrument Co.
Pignolet, L. M.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Plating Mach'y.
Crocker-Wheeler Company.
General Electric Co.

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Lowell Model Co.
Marinette Iron Wks. Mfg. Co.
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Allis-Chalmers Company.
Buffalo Forge Co.
N. Y. Safety Steam Power Co.
Sturtevant Co., B. F.
Whitehead Machinery Co.

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Buffalo Forge Co.
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Crocker-Wheeler Company.
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Edison Mfg. Co.
General Electric Co.
General Inc. Arc Light Co.
Sprague Electric Co.
Sturtevant Co., B. F.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Monarch Fire Appliance Co.

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Stow Mfg. Co.

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Buffalo Forge Co.
Sturtevant Co., B. F.

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D. & W. Fuse Company.
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Western Electric Company.
Western Elect. Supply Co.

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Commercial Elec. Supply Co.
Electric Appliance Co.
Fisher Electric Company.
General Electric Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.
Wrigley, Thos.

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Sturtevant Co., B. F.

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Incandesent Electric Light Manipulator Co.

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Hartford Steam Boiler Inspection & Insurance Co.

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Electric Appliance Co.
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Kartavert Mfg. Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Standard Varnish Works.
Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
General Electric Co.
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India Rubber & Gutta Percha Insulating Co.
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New York Insulated Wire Co.
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Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Western Electric Company.

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Lamp Guards.
Wagor Mfg. Co., P. R.

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Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Globe Elec. Mfg. Co.
Gregory Electric Co.
Nernst Lamp Co.
Toerring Co., C. J.
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Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Chicago Edison Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
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Klein & Son, Mathias.

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(See Insulated Wires.)

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Duncan Electric Mfg. Co.
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General Inc. Arc Light Co.
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Mica Insulator Co.
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Klein & Son, Mathias.

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Johnston, Thomas J.
Rice, Cyrus W.

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Lindsley Bros. Co.
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Perrizo & Sons.
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Porter Cedar Company.
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Torrey Cedar Co.
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Worcester Co., C. H.

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Hoffman, Geo. W.

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Stilwell-Bierce Smith-Valle.

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Stilwell-Bierce Smith-Valle.

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Continuous Rail Joint Company of America.

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Gt.West.Sm.and Refining Co.

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McLeod, Ward & Co.
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Gen'l Inc. Arc Lt. Co.
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Illinois Electrical Mfg. Co.
Jil. Maintenance Co.
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Stewart Electric Co., John A.
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Walsh's Sons & Co.
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Maley, Martin.
McNamara Brothers.
Monson-Burmah Slate Co.

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Trumbull Elec. Co.

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Farr Tel. & Const. Supply Co.
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Metropolitan Tel. & Elec. Co.
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Stromberg-Carlson Tel.M. Co.
U. S. Electric Mfg. Co.
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Klein & Son, Mathias.
Western Electric Co.

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Christensen Engineering Co
Crocker-Wheeler Company.
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Gregory Electric Co.
Standard Electric Company,
Wagner Electric Mfg. Co.
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Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

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Replogle Governor Works.

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American Electrical Works.
American Steel & Wire Co.
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Electric Appliance Co.
General Electric Co.
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Okonite Co., The.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Western Electric Company.

Wire, Bare.
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Central Electric Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
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Western Electrical Sup. Co.

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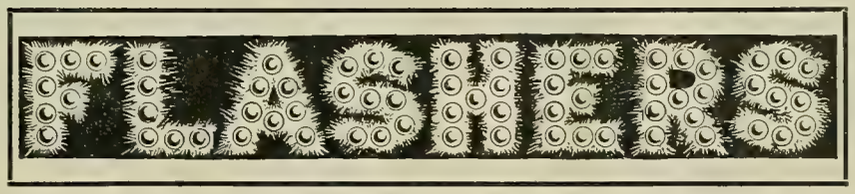
IMPROVED ELECTRIC SIGN

And get your **MERCHANTS** Interested in them.



YOU CAN Increase Your Business Materially By Advocating

Flashed Electric Signs.

REYNOLDS ELECTRIC FLASHER MFG. CO., FORMERLY REYNOLDS ELEC. CO.,

221 Fifth Avenue, Chicago, Illinois.

A LINE OF

Alternating Current "I. P." TYPE INSTRUMENTS

Has been developed and we are now ready to make deliveries. The characteristics of the instruments are those of the corresponding d. c. meters; i. e. cases are heavy polished brass, 6-inch diameter and with a 7½-inch base flange and the indications are dead beat. List price of voltmeter illustrated, $16.50.

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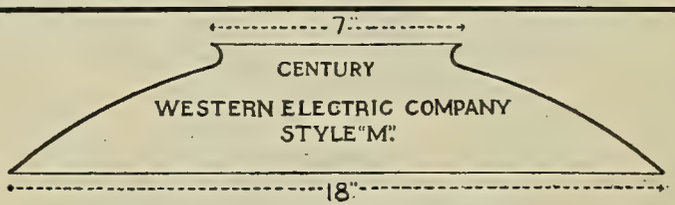
MACHADO & ROLLER, 203 BROADWAY, NEW YORK, N. Y. Or to Your Nearest Supply House.



WE CAN PLEASE YOU IN THE LINE OF

ELECTRICAL GLASSWARE

and are Prepared to Furnish you with Globes or Shades for all Types of Lamps.

OPEN AND ENCLOSED, OUTER AND INNER ARC GLOBES AND SHADES.

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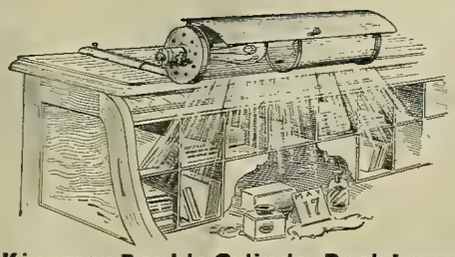
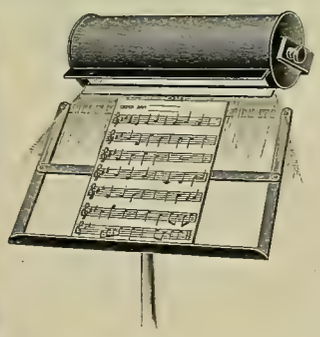
THE CENTURY GLASS CO., BELLAIRE, OHIO.

SAVE YOUR EYES!


Kinsman Double Cylinder Desk Lamp.

Portable and Piano Lamp.


Orchestra Lamp.

BY USING

THE LAMP SPECIALTIES

MANUFACTURED BY

McLEOD, WARD & COMPANY,

MANY OTHER STYLES.

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27 THAMES STREET, NEW YORK.

Western Electric Company

Chicago Saint Louis Philadelphia New York

Tuerk four-Blade Ceiling Fan for Alternating Current.

Fan Motors FOR All Circuits and Voltages

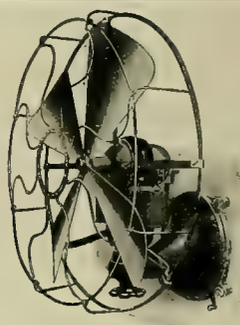
Tuerk two-Blade Ceiling Fan for Alternating Current.

Artistic Designs

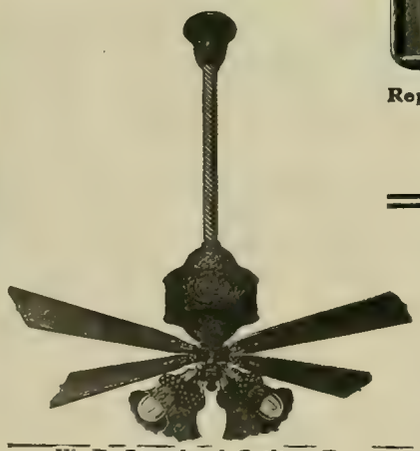
W. E. 16-in. Standard Desk Fan for Direct Current.

Reproduction of Cover of 1903 W. E. Fan Catalogue, a copy of this illustrated Catalogue sent on request.

Noiseless Operation



W. E. 16-in. Standard Bracket Fan, for Direct Current.



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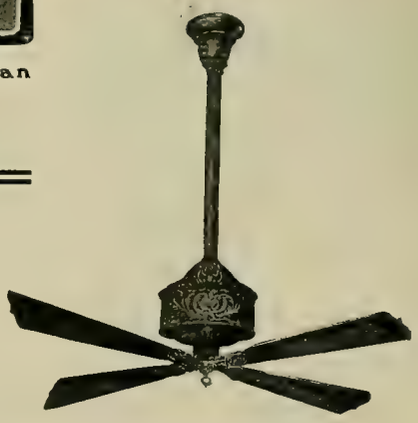
Larger and Better Stock Than Ever



W. E. Western Ceiling Fan No. 1 for Direct Current.

A

NERNST LAMP

BUYS ITSELF!

(PUT THIS PROPOSITION TO YOUR CONSUMER.)

"IT HAS THE BEAUTY OF THE INCANDESCENT AND THE EFFICIENCY OF THE ARC."

HOW?

HERE IT IS:

COMPARISON BETWEEN

Three 16 Candle-power Ordinary Incandescent Lamps (48 c. p.)

AND

One 50 Candle-power NERNST LAMP (Single Glower),

BOTH BURNING 6 HOURS PER DAY AT 14 CENTS PER 1,000 WATT HOURS.

EXAMPLE.

Three 16 Candle-power Incandescent Lamps = 165 watts x 6 hours, = 990 watt hours, at 14 cent rate . . . . . $0.13.96 cts. per day.
One 50 Candle-power Nernst Lamp = 88 watts x 6 hours, = 528 watt hours, at 14 cent rate . . . . . 0.07.39 cts. per day.
Saving . . . . $0.06.57 cts. per day.

IN 100 DAYS THIS NERNST LAMP (SAVING $6.57) PAYS FOR ITSELF AND A BIT OVER—AND REMEMBER, THAT FOR A GIVEN CANDLE POWER THE PRICE IS ABOUT THE SAME AS FOR A LIKE CANDLE POWER OF ALTERNATING ARC LAMP.

Write for Illustrated Bulletin giving full detailed information.

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1009 Market Street, ST. LOUIS, MO.

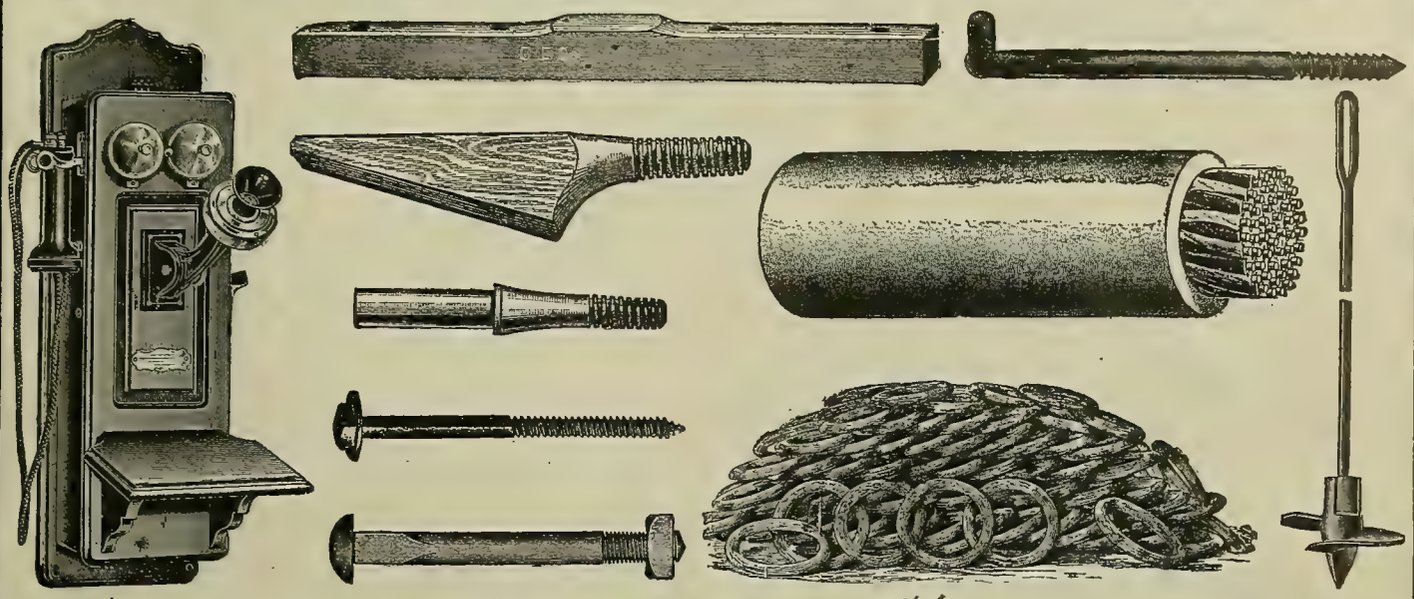
AGENTS FOR THE FOLLOWING STATES: Missouri, Iowa, Southern Illinois, Nebraska, Kansas, Arkansas, Texas, Louisiana, Mississippi, Tennessee, and the Territories.

THREE IMPORTANT TRANSFORMER PUBLICATIONS

Write for them to the

GENERAL ELECTRIC COMPANY, *Principal office*
SCHENECTADY, N.Y.

WE CAN SUPPLY YOUR EVERY WANT.



Central Electric Company,

264-266-268-270 FIFTH AVENUE

CHICAGO.

OKONITE IT NEVER DISAPPOINTS

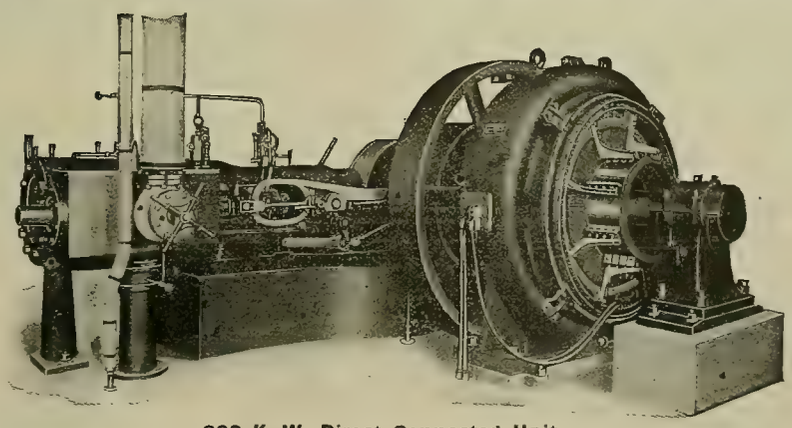
OKONITE IT NEVER DISAPPOINTS

TRIUMPH

GENERATORS AND MOTORS

FOR DIRECT CONNECTION OR BELTED PURPOSES.

HIGHEST GRADE AND EFFICIENCY.



200 K. W. Direct Connected Unit.

MECHANICALLY AND ELECTRICALLY PERFECT.

GENERATORS
1 K. W. to 400 K. W.

Send for CATALOGUE AND BULLETIN "WE"

MOTORS
½ H. P. to 500 H. P.

TRIUMPH ELECTRIC CO.

MAIN OFFICE AND WORKS:

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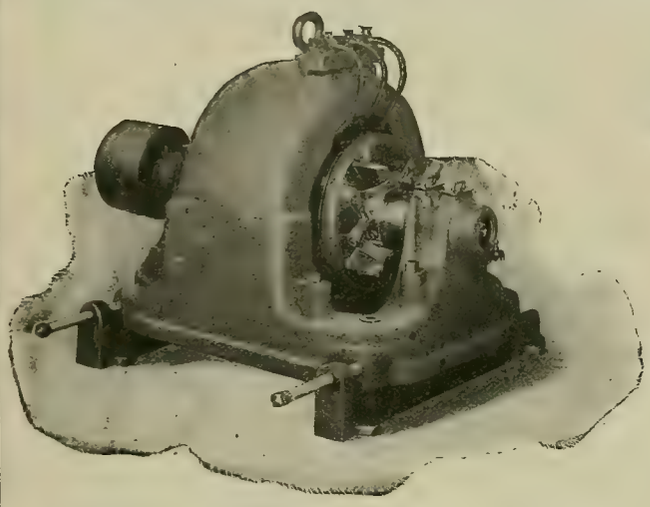
R. W. LYLE, President and Manager

B. S. BARNARD, Vice-President and Secretary.

Standard Vitrified Conduit Company

VITRIFIED SALT GLAZED UNDERGROUND CONDUITS AND INSULATORS

General Office, 39 and 41 Cortlandt Street - - - - New York



THE ONLY SUCCESSFUL

SINGLE PHASE MOTORS

THAT ARE **SELF-STARTING UNDER FULL LOAD**

By simply closing the Primary or Secondary Circuit of your system, however distant from the motor, being

ENTIRELY AUTOMATIC IN THEIR OPERATION

The most inexperienced can operate them with

PERFECT SATISFACTION

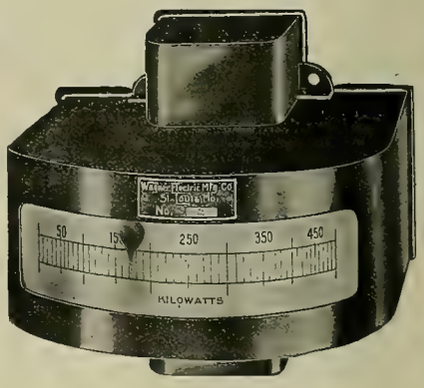
They are increasing the dividends of those who are operating them.

A POLYPHASE INDICATING WATTMETER

THAT WILL INDICATE THE LOAD ON YOUR POLYPHASE SYSTEM

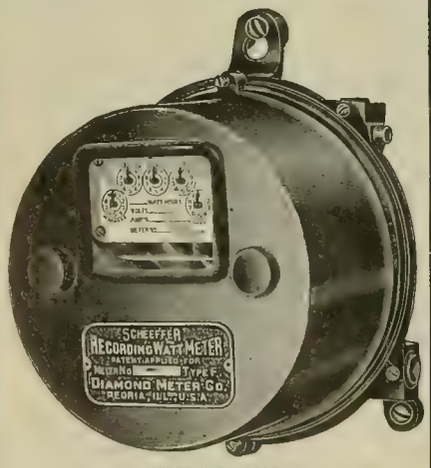
Is a great convenience and at times a necessity.
We can furnish those that are accurate and dead beat.

WE SHOULD BE PLEASED TO KNOW YOUR REQUIREMENTS.



Wagner Electric Manufacturing Co.

General Office and Works, ST. LOUIS, MO., U. S. A.



METER WITH CASE.

SCHEEFFER INTEGRATING WATT-METER.

For Direct or Alternating Currents.

DUST AND BUG PROOF.

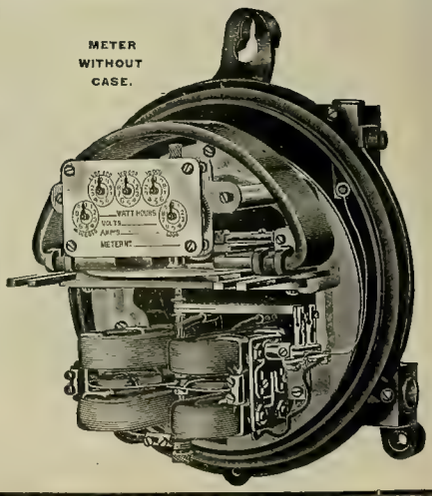
IMPROVED CONSTRUCTION.

Unaffected by Alternations or Lag in Alternating Currents.

A Highly Sensitive and Accurate Meter.

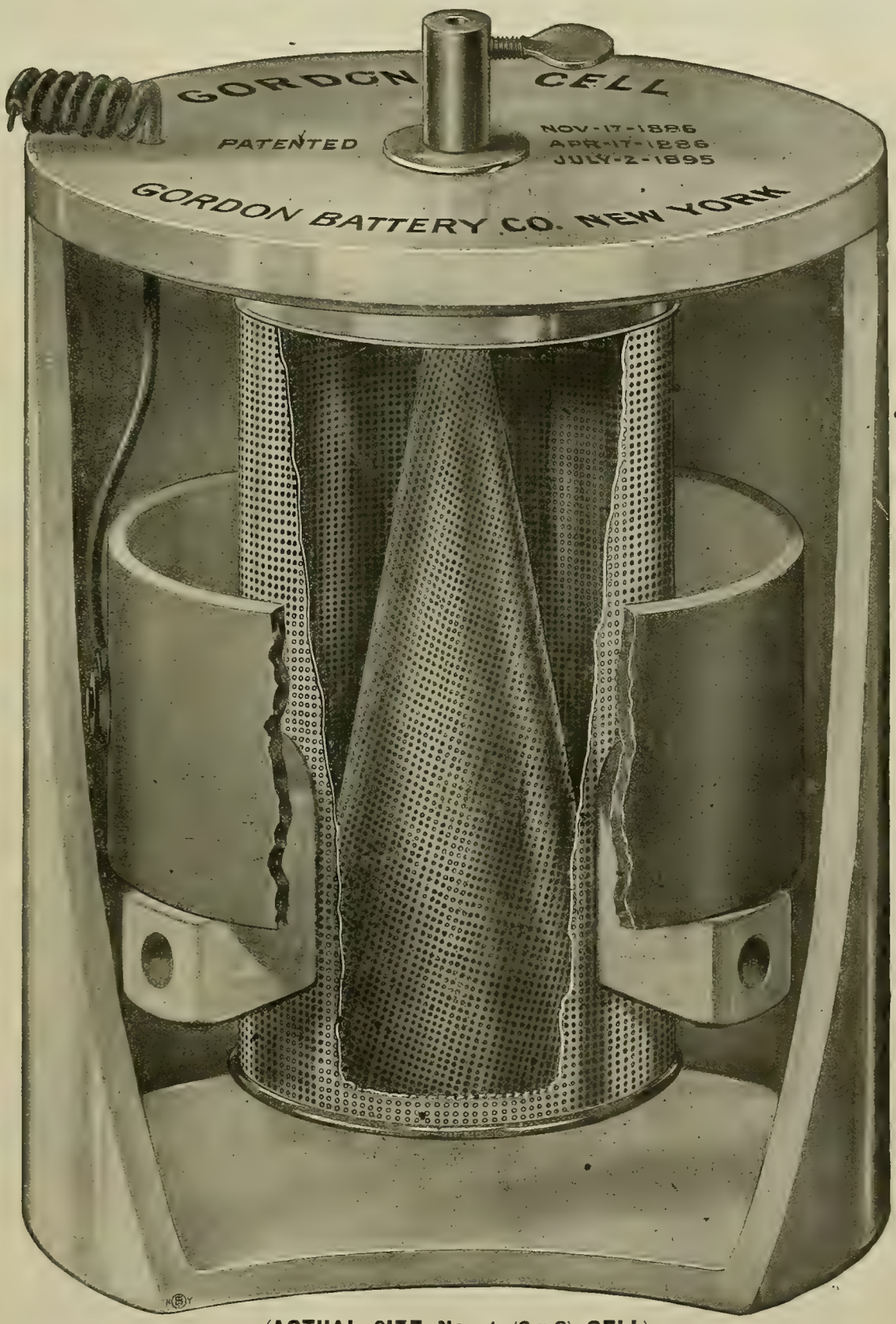
DIAMOND METER CO.,

PEORIA, ILL., U. S. A.



METER WITHOUT CASE.

GORDON CELL



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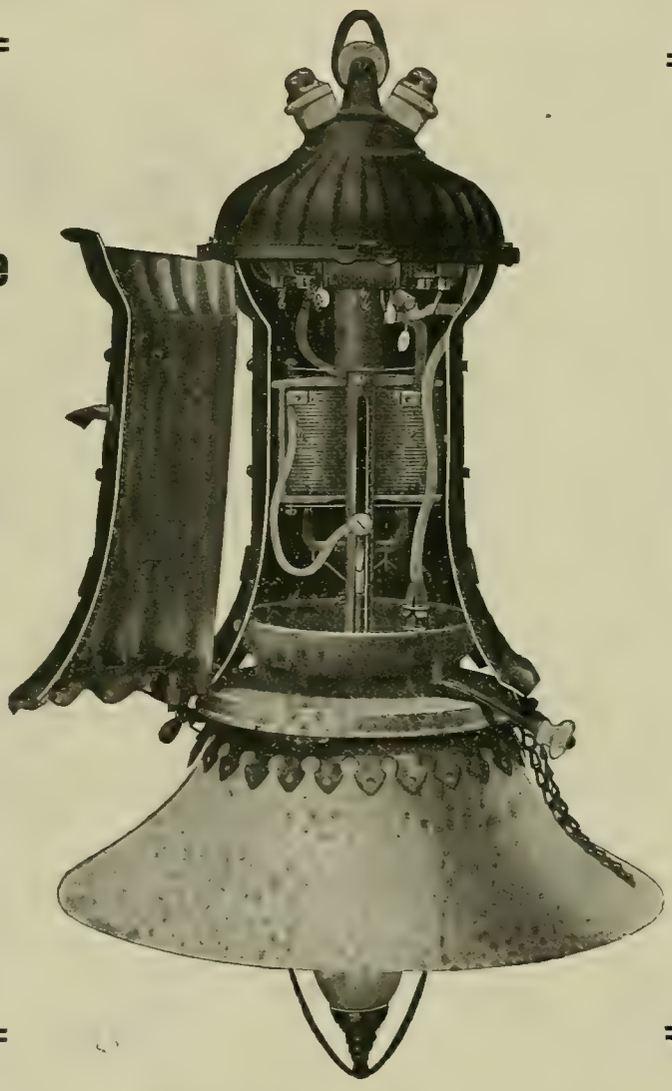
GORDON BATTERY CO.

439-445 EAST 144th STREET, NEW YORK.

THE ADAMS-BAGNALL ELECTRIC CO.

A. B. ENCLOSED ARC LAMPS.

Inside and Out, Electrically and Mechanically, the best lamp on the market. It's good to look at and built to stand the most severe service. Never has been beaten in a competitive test.



Their Efficiency and Regulation are Perfect. Easiest lamp to trim made. Made in weatherproof solid copper or pressed steel cases.

OVER 90,000 IN USE.

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WISHES ALL
AN UNBROKEN CIRCUIT FOR

1903

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TRADE MARK

THE STANDARD FOR RUBBER INSULATION

THE OKONITE COMPANY, LTD.

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CENTRAL ELECTRIC COMPANY, CHICAGO AGENTS.

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The WESTERN ELECTRICIAN is published for the purpose of assisting everyone interested in the art. It is a general electrical and scientific paper, and gives to its readers all the latest news and keeps them thoroughly informed of everything that is going on in all the different departments of the electrical and allied fields. Its technical and scientific articles cover all the latest inventions and improvements and keep the reader thoroughly informed of all that is new in the art. Its special articles, written by the most prominent authorities, as well as its general articles, are of the highest order, and no interested person can afford to be without the paper.

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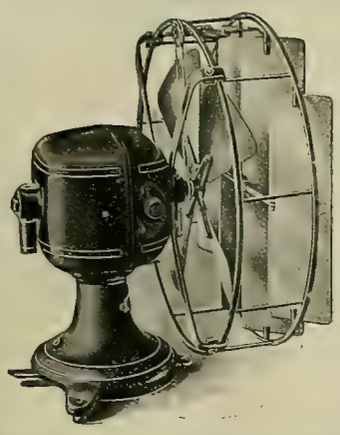

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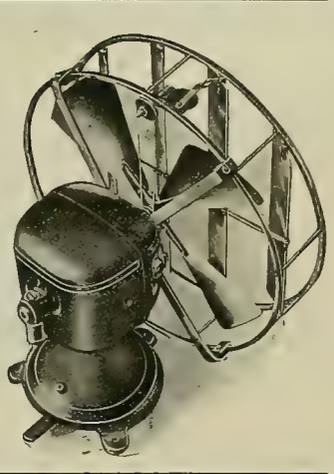

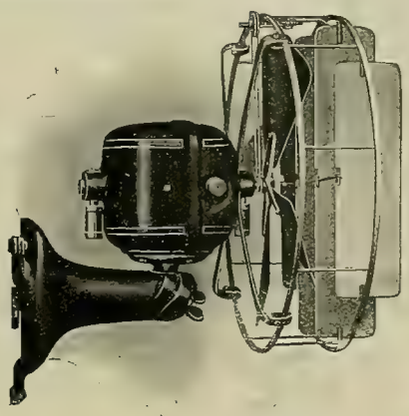

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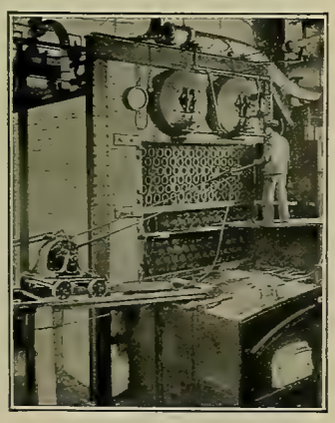

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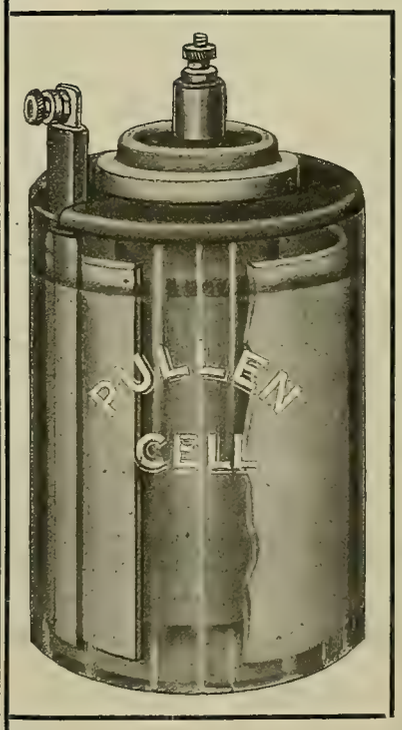

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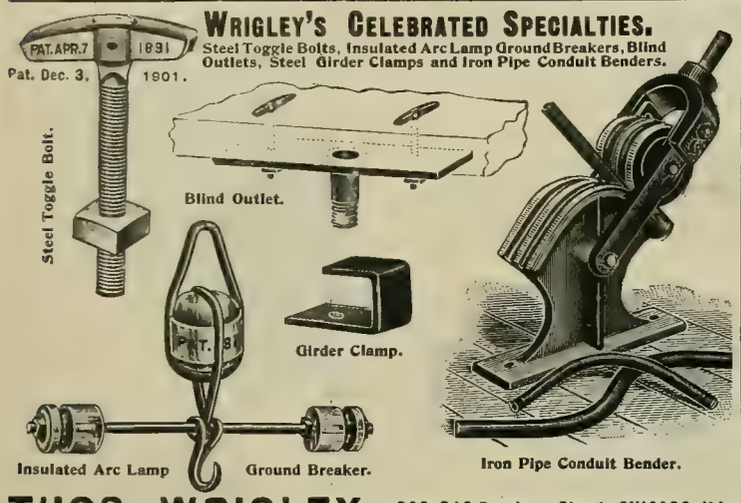

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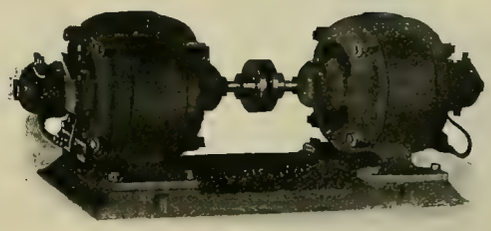

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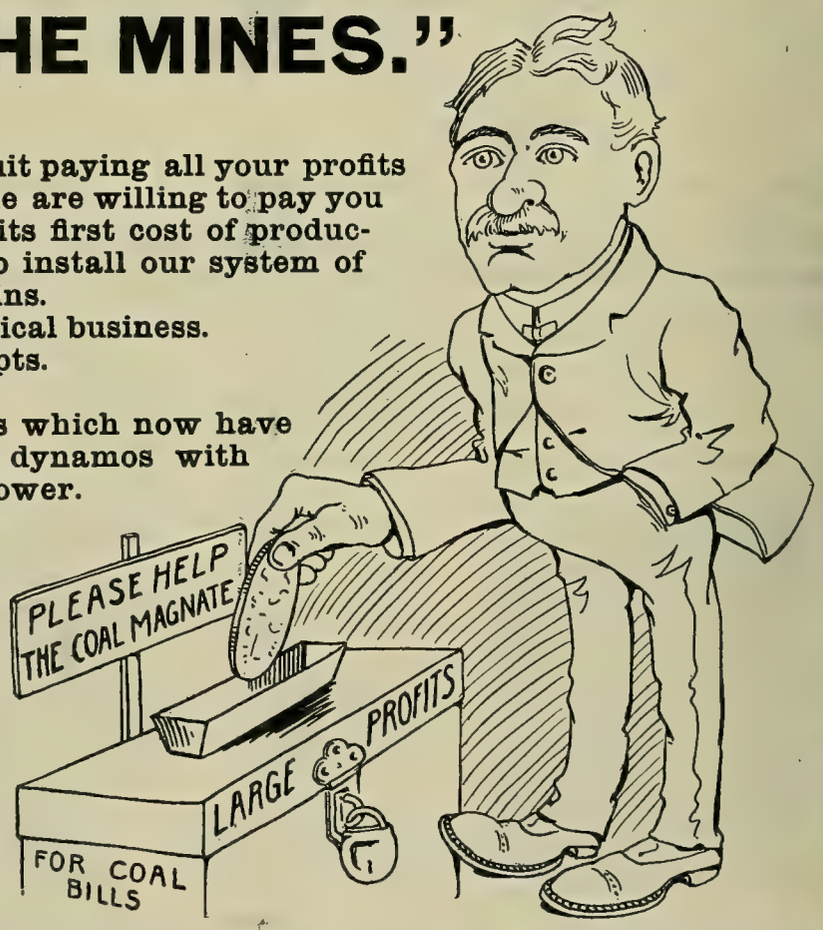

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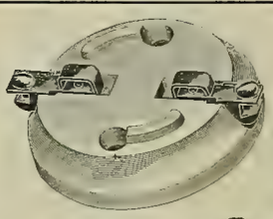

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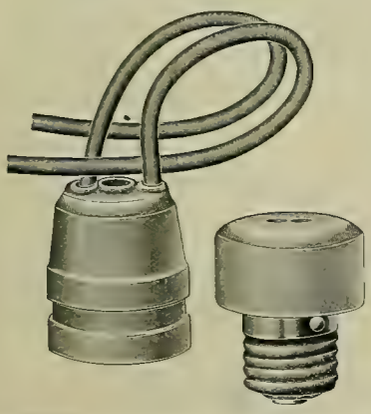

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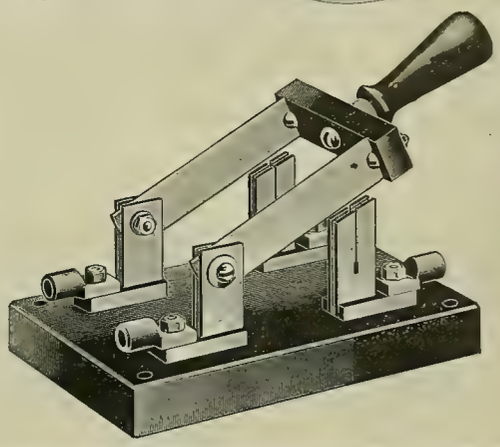

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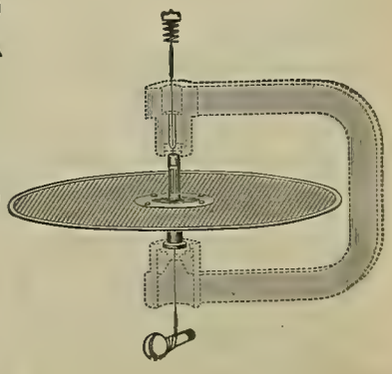

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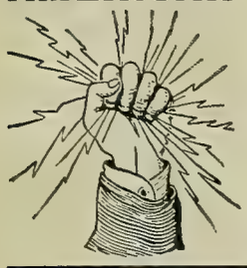

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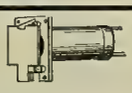

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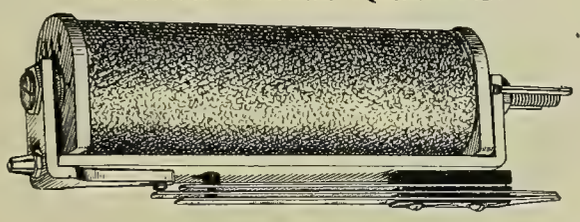

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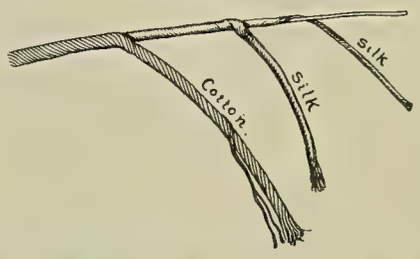

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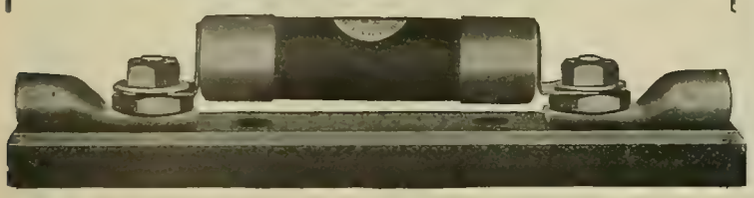

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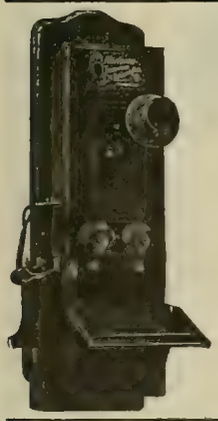

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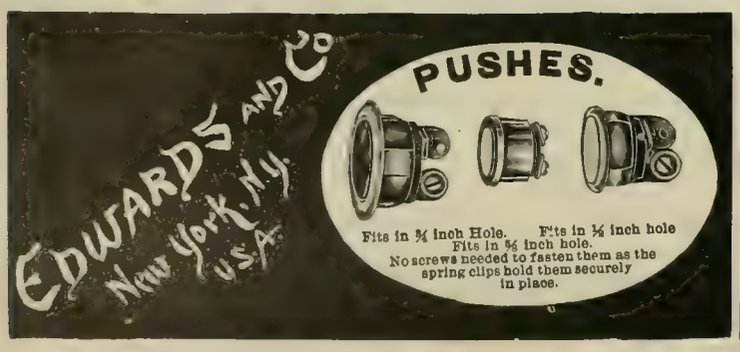

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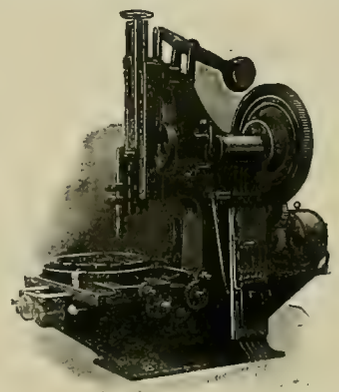

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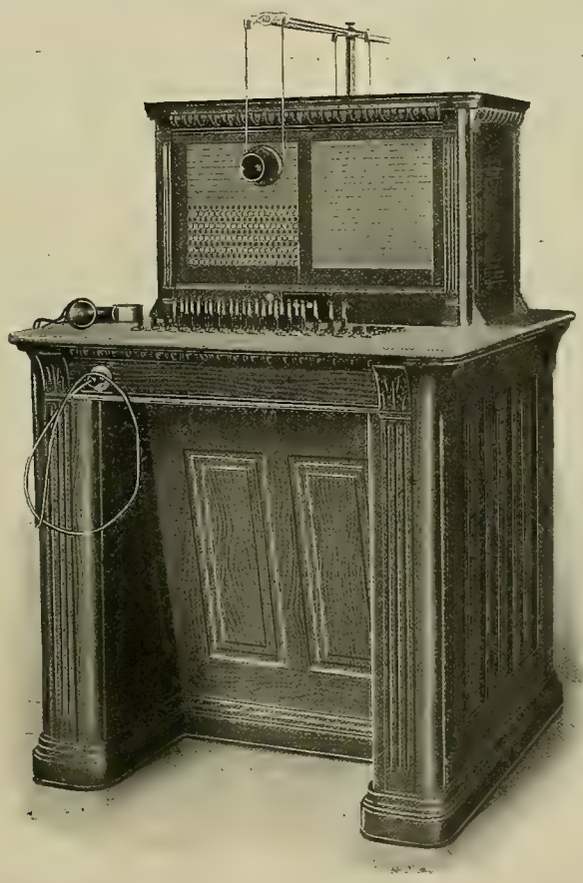

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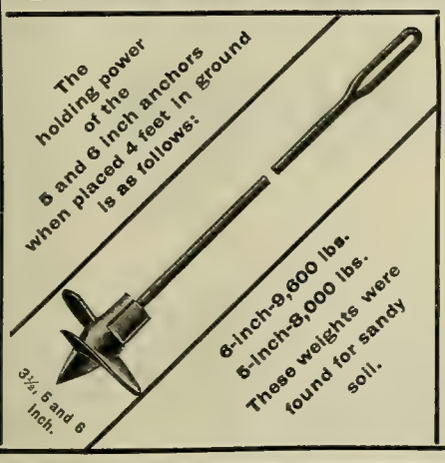

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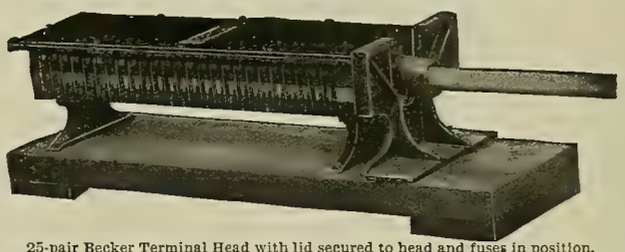

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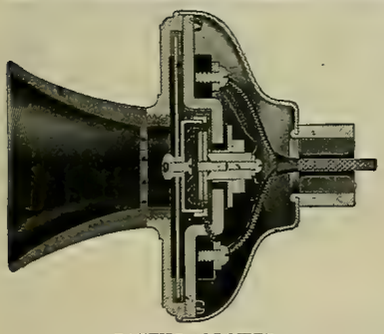

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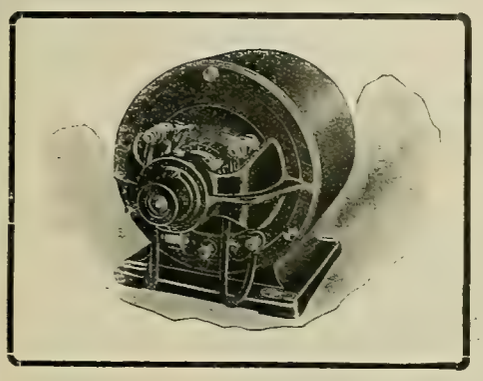

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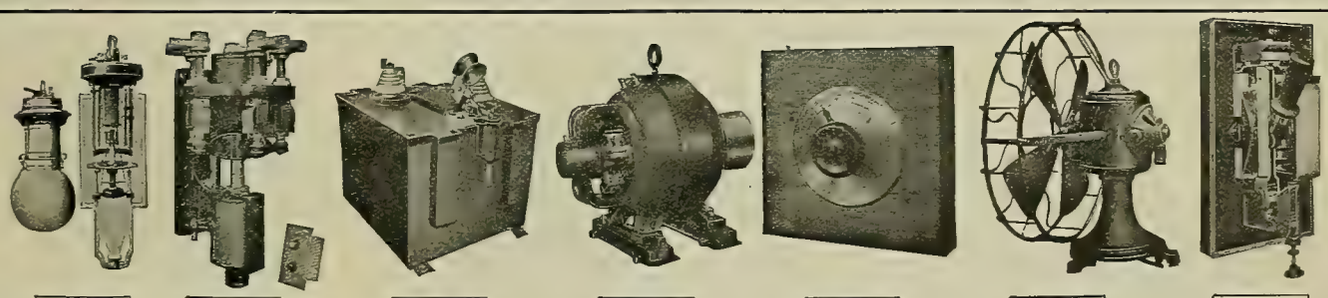

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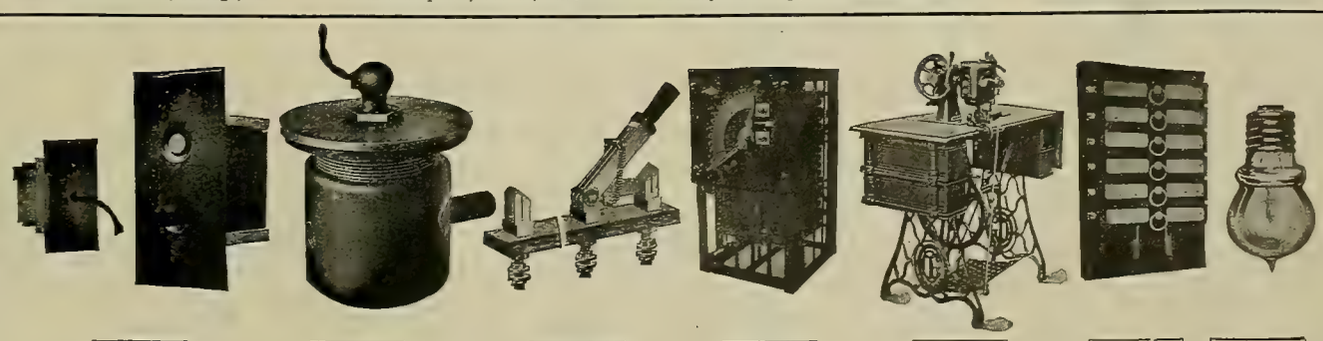

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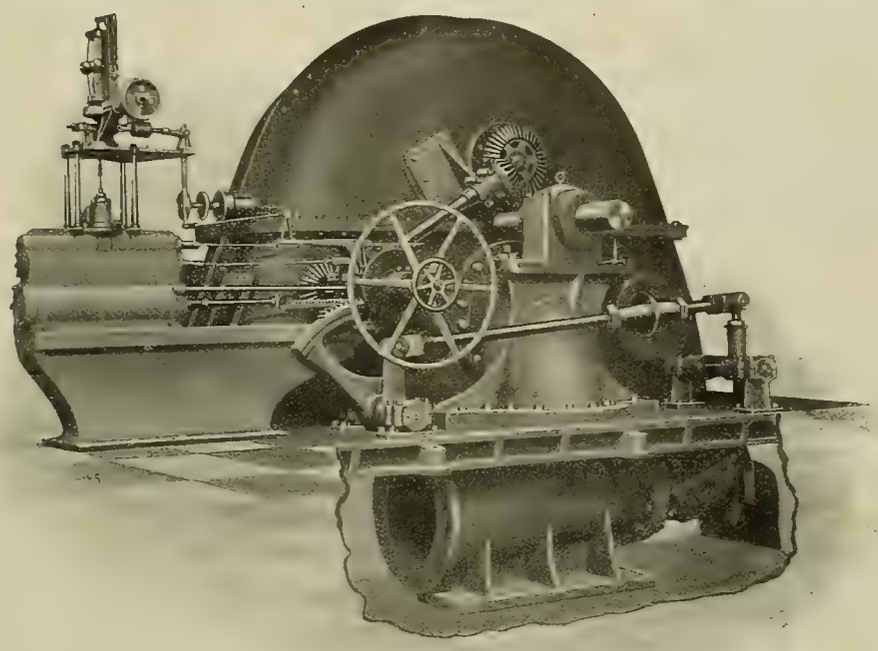

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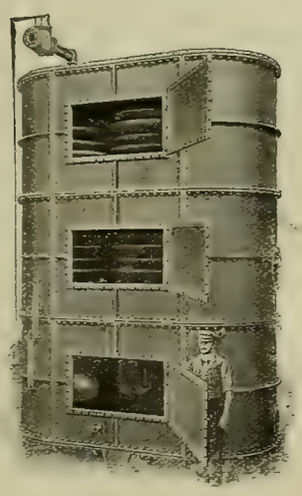

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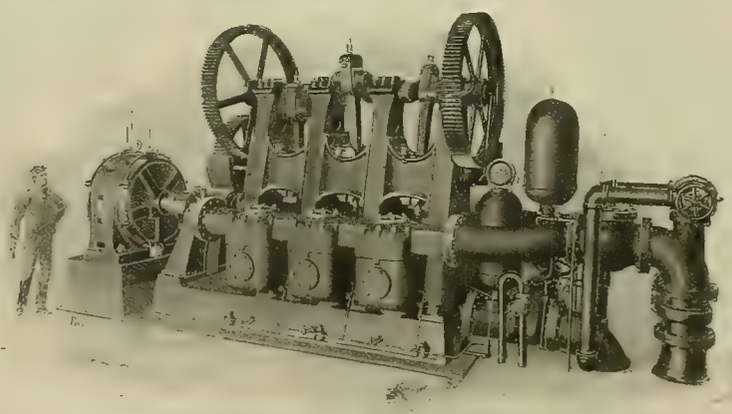

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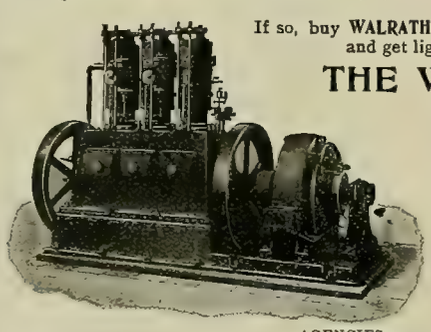

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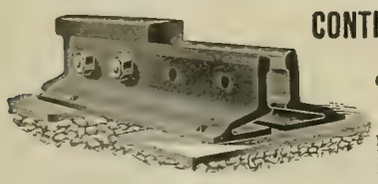

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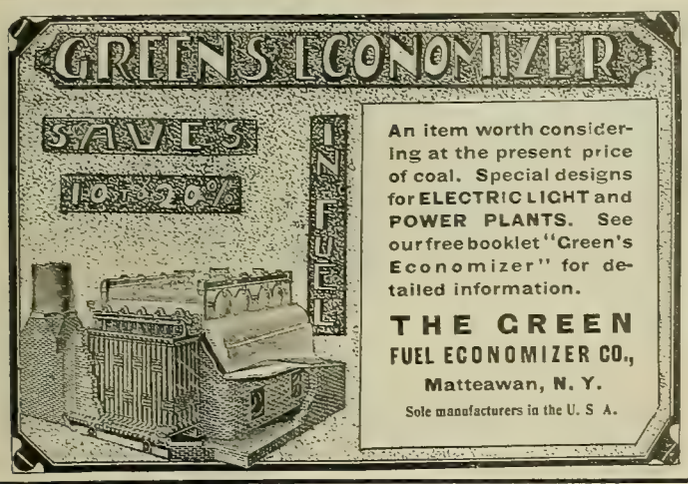

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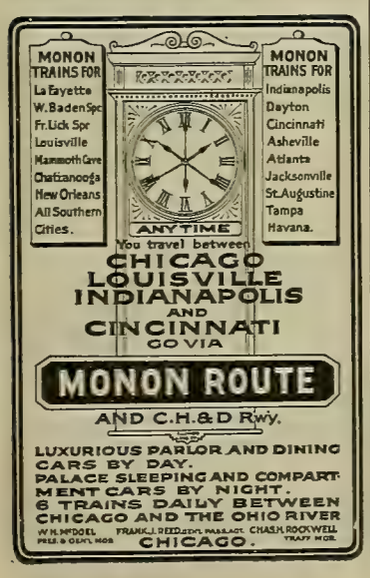

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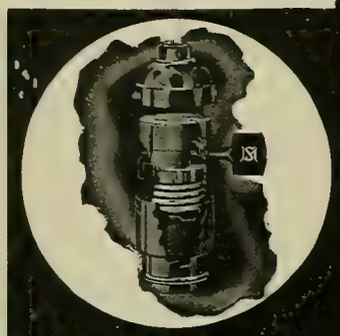
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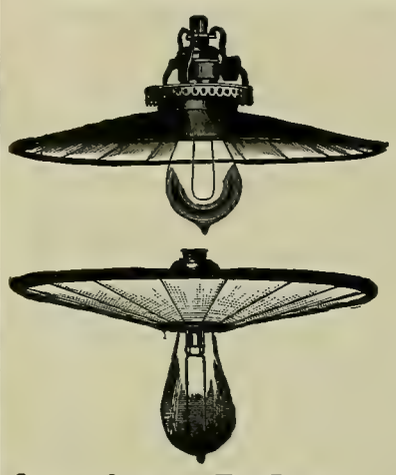

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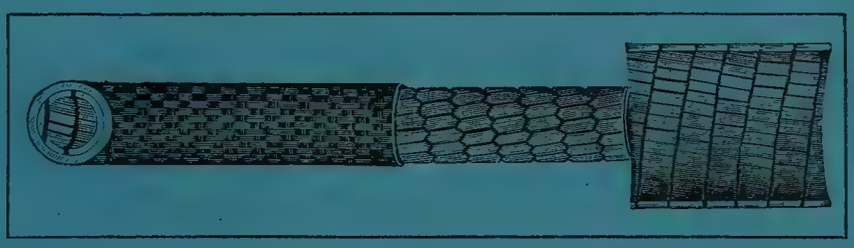

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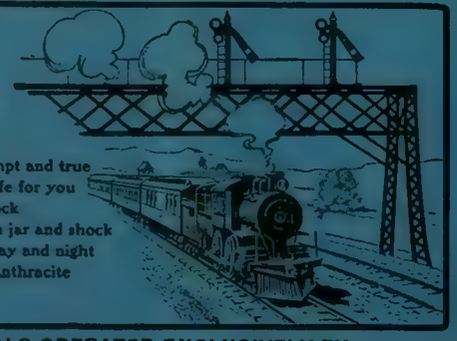

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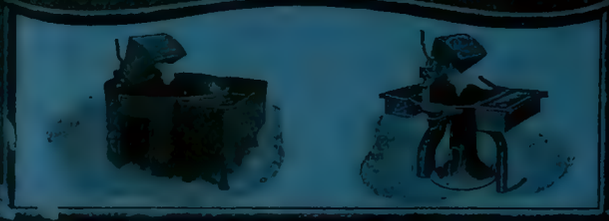

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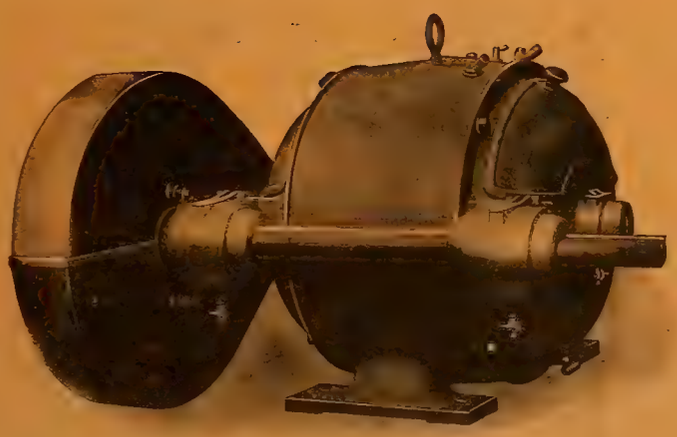

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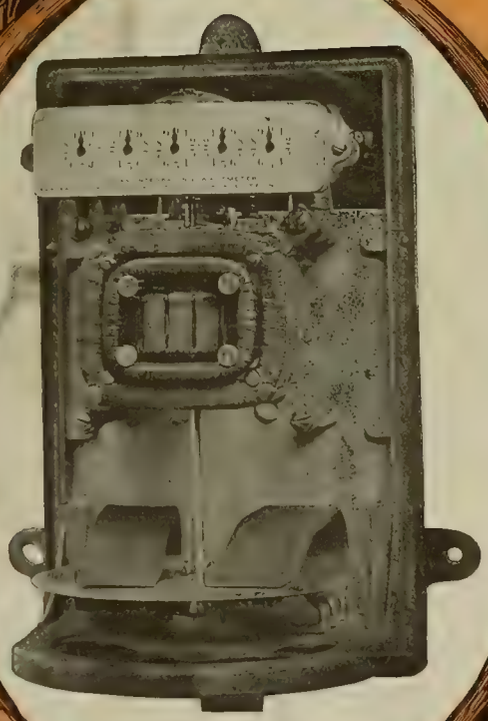

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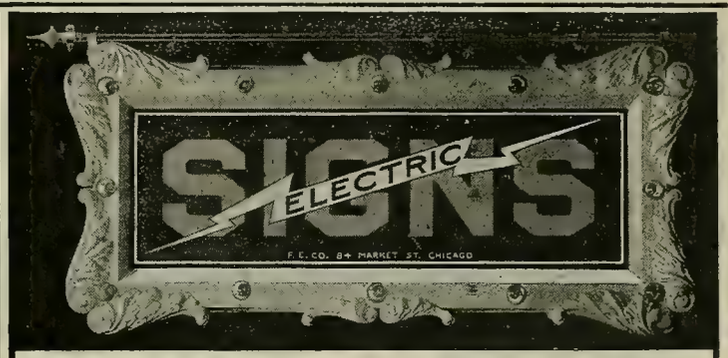

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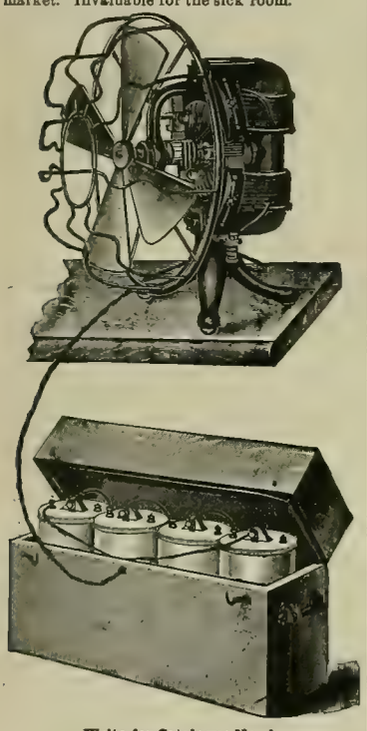

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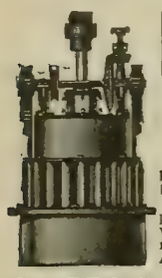

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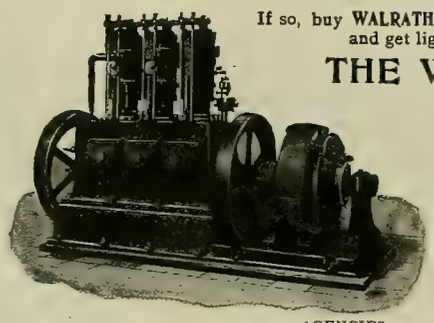

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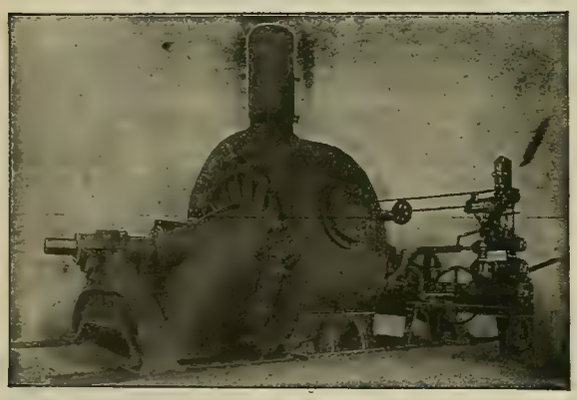

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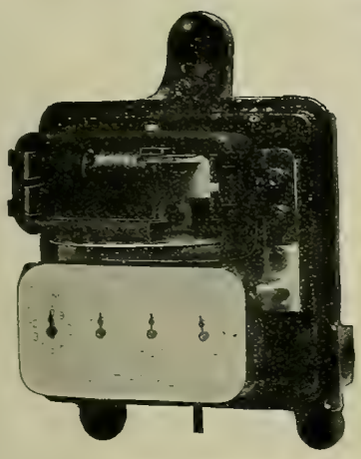

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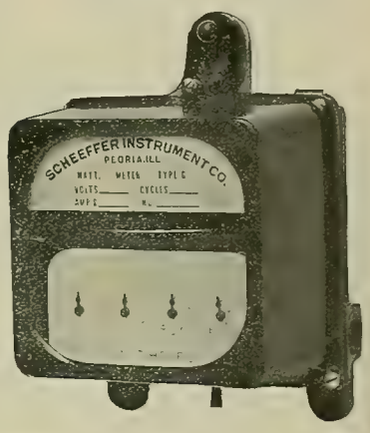

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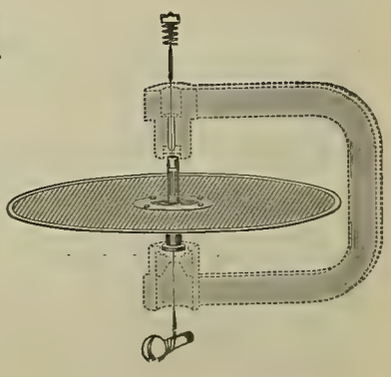

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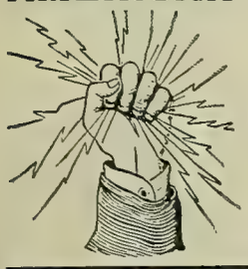

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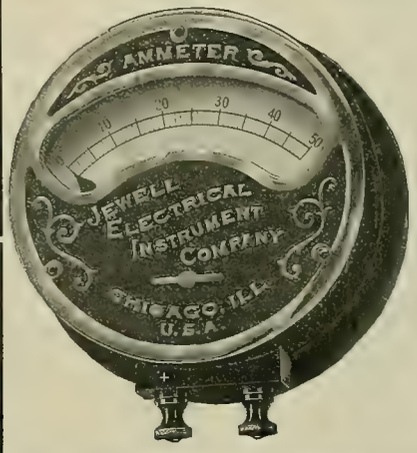

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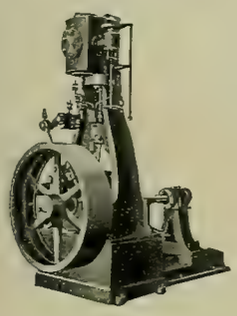

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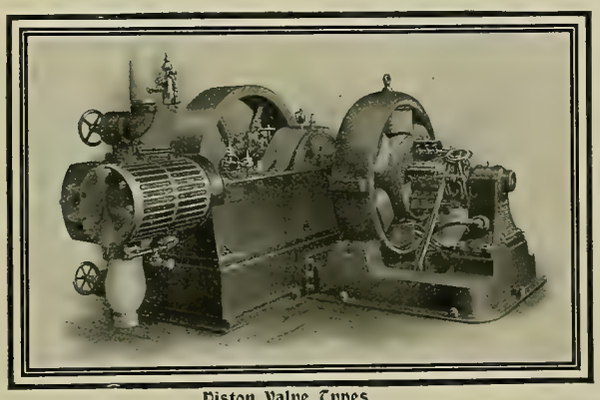

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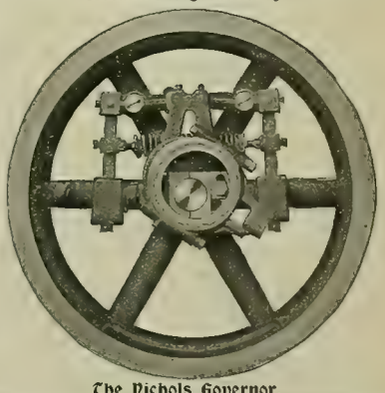

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

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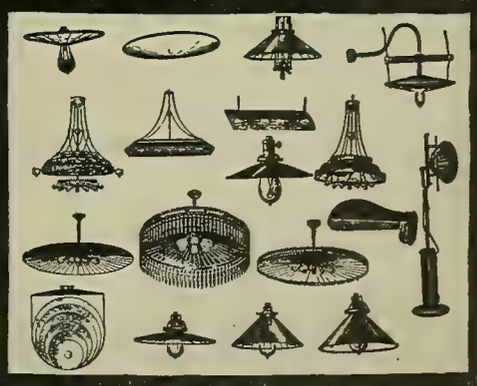

AMERICAN REFLECTOR & LIGHTING CO.
CHICAGO.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1 00 an insertion: additional words 2c each.*

POSITION WANTED.

as helper in an Electric Light or Power plant, to tend engines, dynamos and electrical machinery. State salary in first letter. Age 21. Address BOX 149, care Western Electrician.

POSITION WANTED.

as Chief Engineer in large Light Plant or Superintendent in medium. 10 years' experience with steam and electrical apparatus. Use steam indicator intelligently; do lathe work; wind armatures; have installed light plants complete; 35 years old; married; references. At present C. E. in 1,000 H. P. plant. Parties answering state compensation. Address BOX 150, in care Western Electrician.

POSITION WANTED.

Engineer-Electrician, 14 months' experience with both alternating and direct current machines, high and medium speed engines. Hold a first-class engineer's license for Minnesota. Want a position as assistant in a large power plant. Can furnish good references as to ability and character. At liberty January 15th. Address BOX 151, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

HELP WANTED.

Competent Foreman for Winding Department of large electric manufacturing company. Must be conversant with both alternating and direct current and high and low potential insulation. Communications treated confidentially. Address BOX 148, care Western Electrician, 510 Marquette Bldg., Chicago.

HELP WANTED.

First-class Foreman for Winding Department; one who is experienced, progressive and quick and who has a full knowledge of alternating and direct current work. First-class men only need apply. Applications treated confidentially. Question of salary not material for the right man. Address, BOX 152, Care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Agents wanted for our El ctrical Specialties.

J. JONES & SON,
64 Cortlandt St., New York City.

MOTORS WANTED.

500-VOLT MOTORS, FROM TWO TO FIFTEEN HORSEPOWER.

ROSE ELECTRIC CO., ST. LOUIS.

FOR SALE.—AMMETERS.

Old style Edison and U. S. Pattern.

$2 & $3 Each. Old Material and Machinery Purchased.

WALSH'S SONS & CO. 261 Washington St. Newark, N.J.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings). Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
6— 60 K. W. General Electric A. 60.
2— 60 K. W. Westinghouse.

Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

IT'S UP TO YOU.

We pay highest market prices for

SCRAP COPPER, BRASS AND PLATINUM, ALSO Incandescent Lamp Bases, Etc.

WRITE US.

We Manufacture Copper Hard Babbitt

the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.

GREAT WESTERN SMELTING AND REFINING CO., CHICAGO.

FOR SALE.

We have the following Westinghouse engines for sale cheap. Are in first-class condition and running at present time: 7 13x22x13 Cross Compound engines. 1 6½x6 Standard engine.

PITTSBURGH GAGE & SUPPLY CO., Pittsburgh, Pa.

FOR SALE.

2-100 K. W. General Electric 500-volt generators. $975 each. 1-100 K. W. 250-volt General Electric generator. $975. 1-80 K. W. 500-volt Sprague, $500. 1-75 K. W. Rae 500-volt, $400.

1 New 75 K. W. Wood alternator 125 cycle, latest type, $890. 2-1300 light Slattery alternators, $400 2-1500 light Ft. Wayne alternators, 1 Slattery type with new toothed armatures, $550 each. 1-2000 light Ft. Wayne alternator, $600.

1-60 K. W. Westinghouse new toothed armature, $475. 1-60 General Electric alternator new toothed armature. $450. 1-750 light Slattery alternator, $275.

1-20 light Wood arc dynamo, $90. 1-30 light Sperry arc dynamo, $100. 1-40 light Western Electric arc dynamo, $200. 1-40 light Wood arc dynamo, $175.

1-40 light Edison arc Dynamo, $150. 3-50 light 1200 C. P. T. H. (Ring armatures), $250 each. 1-75 light 1200 C. P. Wood, $325. T. H. M 2, M 12, K 2 and K 12 arc lamps in good condition, $3 75 each. Wood arc lamps, $5.00 each. Shallenberger and Schaefer meters, $3.25 each. Duncan meters, $4.50 each. Thomson meters, $3.75 each. General Electric Type F transformers, $5.00 each up. Send for complete list.

NATIONAL STAMPING WORKS,
Cor. Michigan St. and La Salle Ave., Chicago, Ill

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

BUY YOUR BOOKS

FROM THE

Electrician Pub. Co., 510 Marquette Bldg., Chicago.

The Pioneer Limited. **Famous Train of the World.**

Chicago—St. Paul—Minneapolis

VIA

THE ST. PAUL ROAD.

(Chicago, Milwaukee & St. Paul Ry.)

Equipment and Service Unequaled.

Time tables, maps and information furnished on application to

F. A. MILLER, General Passenger Agent, Chicago, Ill.

ENGINES.
1-30x56x60 Corliss cross comp.
1-16x30x36 Slater cross comp.
3-18x30x16 Westinghouse.
2-15x24x18 Armington & Sims
2-15x23x17 Mc I. & Seymour.
1-16x27x16 Westinghouse.
1-8x14½x10½ Mc I. & Seymour
2-22x33 Buckeye (new).
1-22x42 Slater.
1-14x36 Allis Corliss.
1-15x15 Erie Ball.
2-13x12 Erie Ball.
1-11x14 Straightline.
1-9x9 New York Safety.
1-8x10 Atlas automatic.

BOILERS.
4-376 H. P. National watertube
3-267 H. P. Abendroth & Root.
2-114 H. P. Heine watertube.
1-80 H. P. Heine watertube
2-100 H. P. Horizontal tubular.
2-60 H. P. Horizontal tubular.

DIRECT CONNECTED.
1-100 K.W. G. E. 250 volts, d. c. McIntosh & Seymour.
1-80 K. W. Jenny, 115 volts, d. c. Russell, 4 valve
4-75 K.W. G. E. 110 volts, d. c. Ames, tandem engines.
1-50 K W. Western Electric 110 volts, d. c. Ball & Wood.
1-50 K. W. Walker 110 volts d c. Russell engine (new).
1-43 K.W. Westinghouse 110 volts, d. c. Russell engine
1-30 K. W. C. & C. 110 volts, d. c. Atlas engine.
1-5 K.W. Perritt 110 volts, d. c. double Sturtevant engine.
1-4 K- W. Northern Elec., 110 volts, d. c., vert. eng. (new).

RY. GENERATORS.
2-500 K. W. Gen'l E., M P.
2-150 K.W. West'house M.P.
1-120 K. W. C. & C. M. P.
2-100 K. W. C. & C. M. P.

ALTERNATORS.
1-150 K. W. Stanley, 2 phase, 125 cycle.
2-120 K. W. Westinghouse, s. phase, 125 cycle.
2-75 K. W. Fort Wayne, s. phase, 125 cycle.
1-60 K. W. Stanley, 2 p. 60 c.
2-60 K. W. Stanley 2 p. 125 c.
4-60 K. W. G. E., s. p. 125 c.
1-35 K. W. West'house, 60 c.
2-30 K. W. Westinghouse, 125 cycle.
Motors, 110 & 220 & 500 v.
Dyna's, 110 & 220 & 500 v.

ARMATURES.

THOMPSON, SON & CO., 114-118 Liberty Street, NEW YORK.

Kilfyre DRY POWDER COMPOUND

IDEAL FIRE PROTECTION FOR ALL ELECTRICAL APPARATUS.

Highest Awards at National Export, Central Canadian, Pan-American and Charleston Expositions.

MONARCH FIRE APPLIANCE CO.,
247-249 Pearl St., New York City.

ENGINES.
34x60 International Power Corliss.
26x48 Dickson Corliss.
22x42 Hamilton Corliss.
20x48 Wheelock Corliss.
20x48 Harris Corliss.
18x42 Hamilton Corliss.
12x36 Hamilton Corliss.
12x24 Sioux Corliss.
24x48 Buckeye Automatic.
18x24 Atlas Heavy Duty Automatic.
13x18 Frost Center Crank Automatic.
11½x 14 Taylor-Beck Automatic.
32-in., 24-in., 22-in. Double Leather Belts.

BOILERS.
Ten 72x18 Horizontal Tubular, 125 pounds pressure.
One Geary Water Tube Boiler. 175 H. P. for 150 pounds pressure, almost new.
Two 150 Babcock & Wilcox Water Tube Boilers, 135 pounds pressure.
Two 60x18 Horizontal Tubular.
Four 60x16 Horizontal Tubular.
One 56x16 Horizontal Tubular.
One 48x16 Horizontal Tubular.
600 H. P. Berryman Heater.
200 H. P. Baragwanath Heater.
150 H. P. Kroeschell Heater.
500 H. P. Excelsior Heater.
6x4x6 and 5¼x3¼x5 Worthington Pumps, Full line Marsh Pumps, new.

WHITEHEAD MACHINERY COMPANY, DAVENPORT, IA.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE. GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.

60-CYCLE ALTERNATORS.

150 K. W. Fort Wayne wood alternator, either 1,100 or 2,200 volts, W. A. L. type, compound wound, complete with exciter and instruments.
2—150 K. W. three-phase Stanley alternators, 2,750 or 5,500 volts.
2—200 K. W. two-phase Stanley alternators, 2,750 or 5,500 volts.
1—120 K. W. General Electric, A. S. type 1,100 or 2,200 volts, December delivery.
2—120 K W. General Electric, 133-cycle, 1,100-volt, alternators.
1—175 K. W. Edison, bi-polar, railway generators.
3—100 K. W. Edison, bi-polar, 140-volt generators.
1—45 K. W. Edison, bi-polar, 140-volt generator.
1—80 K. W. Westinghouse, 110-volt, direct connected unit with engine.
1—72x16 tubular boiler, 100 pounds, Hartford.

CORLISS ENGINES.

500 H. P. Corliss Engine, 16 and 30x48 Cross compound condensing Cooper-Corliss, complete with independent air pump and condenser; heavy sectional wheel 20 feet diameter with 37-inch face. As good as new. Immediate delivery.

375 H P. 16x42 twin Cooper condensing Corliss, with Cooper condenser.

High speed automatics, from 250 H. P. down.

Write us for stock list of station equipments and accessories.

STATION EQUIPMENT COMPANY, 204 Dearborn Street, CHICAGO.

110-VOLT GENERATORS.

2—1,100-light, 65 K. W. Jenny.
2—1,100-light, 60 K. W. Thompson-Ryan, 10 pole.
1—1,000-light, 60 K. W. Siemen & Halske.
1—1,000-light, 50 K. W., T. & H.

133-CYCLE ALTERNATORS.

1—120 K. W. Slattery, 1,100 volt.
1—100 K. W. Slattery, 1,100 volt.
1—100 K. W. Westinghouse, 1,100 volt.
1—70 K. W., T. & H., 1,100 volt.
1—60 K. W. General Electric, 1,100 volt.
1—50 K. W., T. & H., 1,100 volt.

ILLINOIS MAINTENANCE COMPANY, 1625 Marquette Bldg CHICAGO.

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Secured quickly through Western Electrician "Help Wanted" ads.

Western Electrician WANT ADS Bring Results.

60-K. W. EDISON, 500-VOLT.

For Sale, four 60-K. W. Edison Generators, 500 Volts, F. O. B. Cars, Hamilton, Ohio. Each $450.

ROSE ELECTRIC CO., ST. LOUIS.

CHICAGO EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.

Machine and Carpenter Work of All Kinds Correspondence Solicited.

OPEN DAY AND NIGHT.

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

WE BUY OR SELL

Generators and Motors

Engines and Boilers

Recognized a great factor in electrical problems for twenty years.

ARMATURE FIELDS REWOUND.
We make a specialty of Drop Forged Commutator Segments.

FOR SALE.

GENERATORS—500 Volts.

6—Edison, No. 20, 60 K. W., each.....$ 400
6—T. H. D—62, each..... 500
6—Edison, No. 60, 175 K. W..... 1,200
1—General Electric, 100 K. W., 6 pole... 1,400
2—General Electric, 100 K. W., 4 pole... 1,200
1—Westinghouse, 175 K. W..... 2,000
1—General Electric, 250 K. W..... 2,250
4—T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on either side of pulley, per pair..... 5,000
2—T. H., 500 K. W., each..... 4,550
1—35 K. W. Westinghouse, with exciter and switchboard instruments, 1,100 volts..... 300
1—60 K. W. Westinghouse, without exciter and switchboard instruments, 1,100 volts..... 300
2—100 K. W. G. E. mono-cyclic, with exciter and switchboards complete, 1,100 volts, each..... 1,200
2—180 K. W. Stanley, 1,100 and 2,200 volts, with exciter and switchboard instruments, each..... 1,500

GENERATOR—220 Volts.

1—200 K. W.-Triumph, 6 pole (new).....$2,400

GENERATOR—110 Volts.

2—210 K. W., G. E. design, 14 pole, for direct connection, speed, 120 R. P. M., each.....$2,250

ARC LIGHT GENERATORS.

10—No. 10, 100-light, 9.6 amperes, Brush Arc Dynamos with oil regulators, practically new, each.....$ 900
1—750 K. W. Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.....25,000

MOTORS.

200—New 25 H. P. motors, complete with pinion gear and gear cases, each..... $250

CONTROLLERS.

100—"K" Controllers, each..... $60
25—K-2 Controllers, each..... 70

ENGINES.

1—Tandem Compound Ball, 8 and 13x12..$ 800
2—Tandem Compound Ball, 9 and 16x12, each.....$1,000
4—Russell Automatic, 15x20, each..... 700
2—Porter-Allen, 16x20, each..... 1,000
1—11 and 17x14 Cross-Compound Ideal.. 1,400
2—21x18 Armington & Sims, each..... 1,500
1—Porter-Allen, 21x36..... 1,500
1—Porter-Allen, 28x42..... 4,000
1—Hamilton-Corliss, 14x42..... 1,500
1—St. Louis Corliss, 30x54..... 5,000
1—Pennsylvania Iron Works Corliss, 28x60..... 4,500
2—Lane & Bodley, 24x60, designed for Rolling Mill work, for the pair..... 8 500
1—20x48 Wheelock..... 2,250
1—Double Wheelock, 20x48..... 4,000
1—Wheelock, 20x42..... 2,000
2—Armington & Sims, 13x12..... 400
1—Taylor-Beck, 12x14..... 300
4—Houston, Stanwood & Gamble, Cross-Compound, 16 and 22x22..... 1,250
6—Cooper Cross-Compound, Non-Condensing, 36 and 60x60, new, never having been shipped from factory..23,000
5—Tandem Compound Ball, 12 and 20x16 1,500
3—Skinner engines, 17x18, with air compressing cylinders attached, each... 750

BOILERS.

4—72 inches x 16 feet tubular boilers, with 72 4-inch tubes, each.....$ 450
4—66 inches x 18 feet, with 66 4-inch tubes, each..... 450
3—66 inches x 14 feet, with 66 4-inch tubes..... 350
1—72 inches x 18 feet, with 66 4-inch tubes, each..... 450
2—Sterling water tubes, each 350 H. P., per H. P..... 5
2—Hazelton, 500 H. P., per H. P..... 1
2—Clark, 150 H. P. water tube boilers, per H. P..... 6

TRANSFORMERS.

72 K. W. assorted sizes, type G. per light. 30c.

FERRIS WHEEL.

1—60-ft. Ferris wheel electrically driven, $1,000

SHOOT THE CHUTE.

1—Shoot the Chute, steel construction, 60 feet high and 300 feet long, complete with boats.....$5,000

WORK CAR.

Length over all, 40 ft.; length inside cab, 29 ft.; height over all, 12 ft. 2 in.; height of body, 8 ft. 10 in.; width of body inside, 7 ft. 6 in.; width of body outside, 9 ft.; width of large side door, 5 ft.; height of large side door, 5 ft. 8 in.; length wheel base, bolster to bolster, 21 ft.; trucks, lates: type Jackson & Sharpe M. C. B.; axle, 4⅜ in.; wheels, 33 in., 2¾ in. thread, ⅞ in. flange. Equipment, 4 Westinghouse No. 38 B geared to 35 miles per hour; two trolleys, double end control; Christensen air brake, double end. Gauge, standard 4 ft. 8½ in. Motors inside hung. Car equipped with M. C. B. couplers for hauling standard freight cars. Car complete in every respect and as good as new; has been in use about four months hauling gravel only and embodies every modern improvement known. Price $6,000 f. o. b., Cincinnati.

JOHN A. STEWART ELECTRIC CO.
Offices: 430 Sycamore St. Factory and Warehouse: LUDLOW, KY.
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WE BUY AND SELL ALL KINDS

Electrical and Steam MACHINERY

DIRECT-CONNECTED UNITS.

300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

187½ kw., Westinghouse, M. P. 8, 120-volt Generator, direct connected to Westinghouse Compound Engine.

50 kw., Westinghouse, 6-pole, 110-volt Compound Generator, with 13x12 Ames Automatic Engine. But little used, as good as new.

50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½-13x12 Armington & Sims Tandem Compound Engine. One year old.

50 kw., Eddy Compound Generator, 125 volts, direct connected to 13x13 Harrisburg Ideal Engine.

25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

25 kw., General Electric, 110 volts, 4-pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—300 kw., G. E., 2,000 volts, 60 cycles, 3-phase.
1—200 kw., Stanley, 2,400 volts, 60 cycles, 2-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
3—150 kw., G. E., 2,300 volts, 60 cycles, 3-phase.
2—120 kw., G. E., 2,000 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1— 60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.
1—30 H. P., Westinghouse, Ind. Motor, 200 volts, 60 cycles, 2-phase.
1—20 H. P., Westinghouse, Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—20 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—10 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—15 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.

RAILWAY GENERATORS.

2—500 kw., 6-pole General Electric.
1—270 kw., 4-pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., Thomson-Houston.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

ENGINES.

12 and 20x36 Slater Engine Tandem Compound.
14x14 Rice Automatic.
16x16 Rice Automatic.
13 and 23x17 Tandem Compound McIntosh & Seymour.
10x18x20 Payne Compound.
13x12 Armington & Sims.
12 and 20x12 Westinghouse Compound.
7x8 Payne.
18x42 Allis-Corliss.
18x48 Geo. H. Corliss.
16x42 Greene.
13x12 Erie Ball.
10½x16½x12 Cross Compound Armington & Sims.

ARC GENERATORS.

No. 12 Brush, 150 light, 9.6 amp.
No. 11 Brush, 125 light, 9.6 amp.
No. 9B Brush, 120 light, 6.6 amp.
M. D. 2 T.-H., 50 light, 9.6 amp.
L. D. 12 T.-H., 75 light, 6.6 amp.
M. 12 T.-H., 45 light, 6.6 amp.

A large assortment of Arc Lamps all in good working order, for direct and alternating currents, series and multiple circuits. Also a fine lot of Transformers, especially General Electric Type H. and Thomson-Houston Type F.

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Engineers, Contractors for Complete Electric Plants. Results Guaranteed.
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Plans, Specifications and Supervision of Installation of complete telephone plants.
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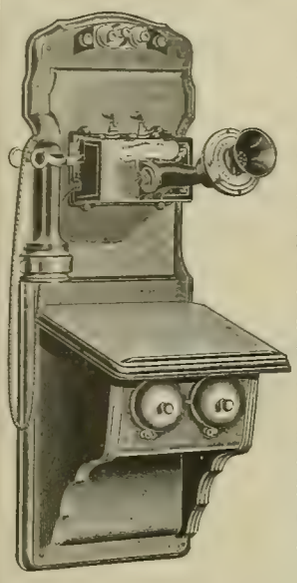

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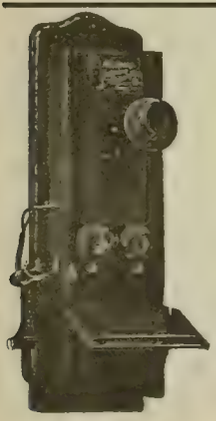

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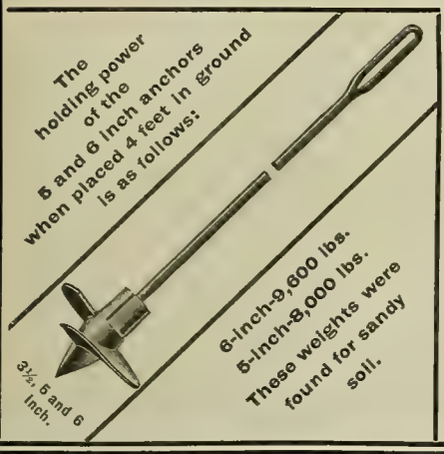

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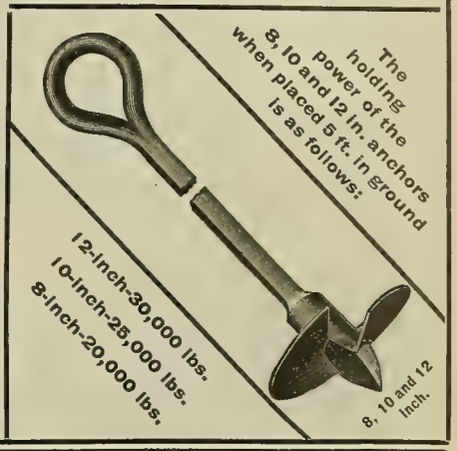

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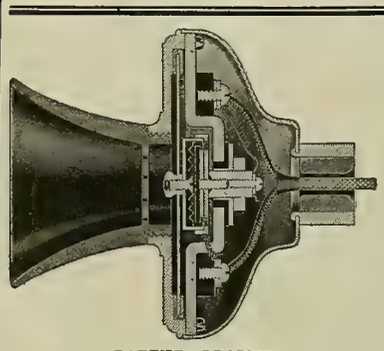

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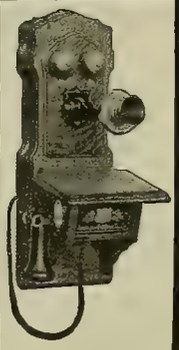

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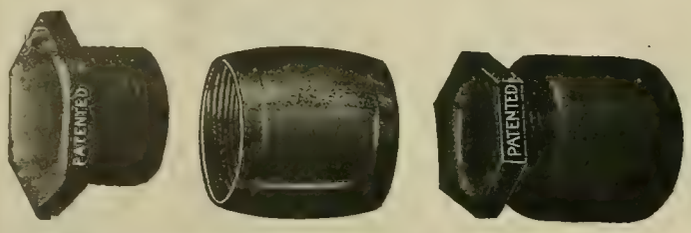

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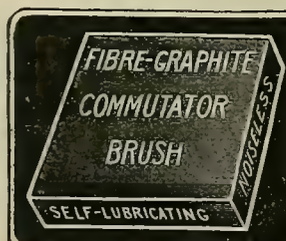

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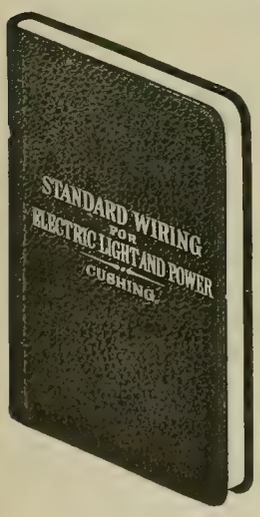

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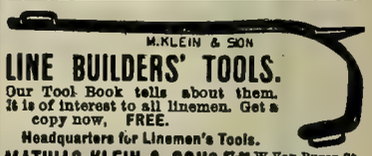

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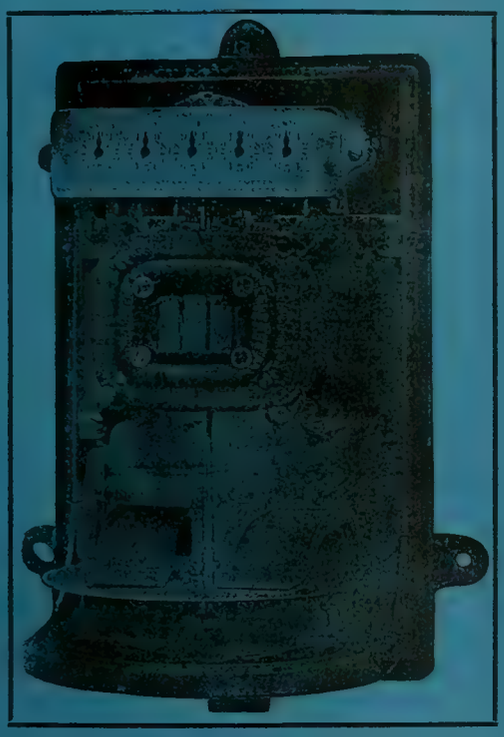

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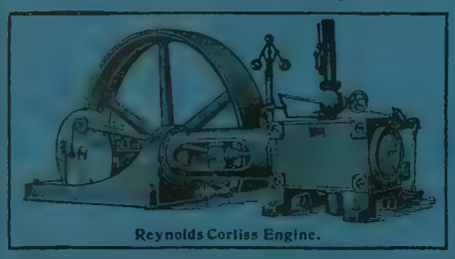
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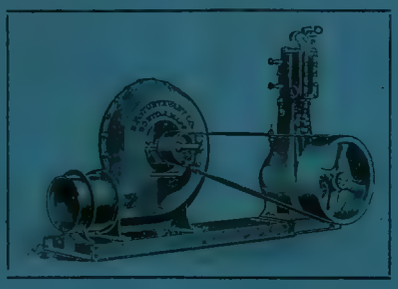

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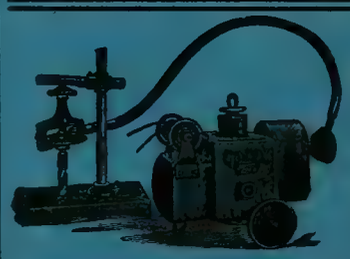
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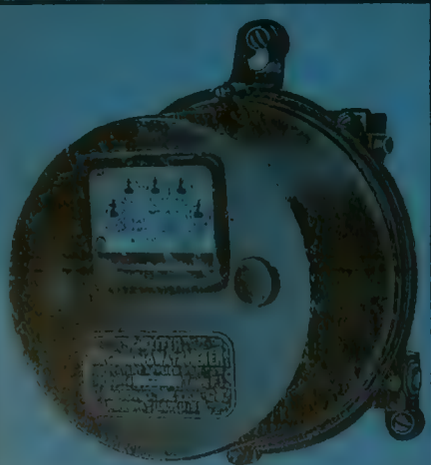

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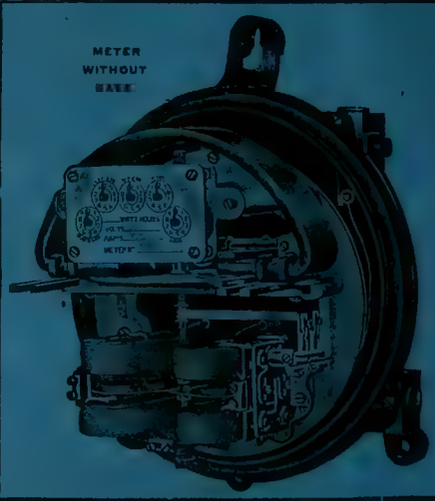

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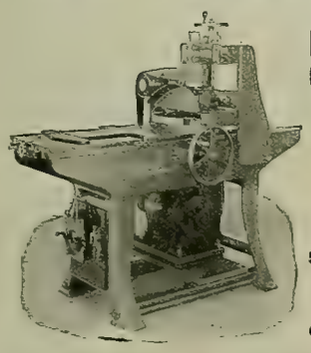

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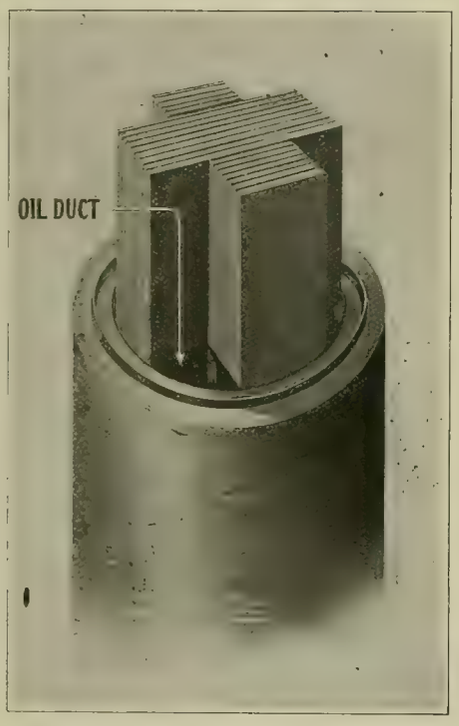

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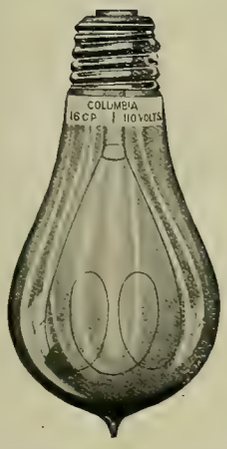

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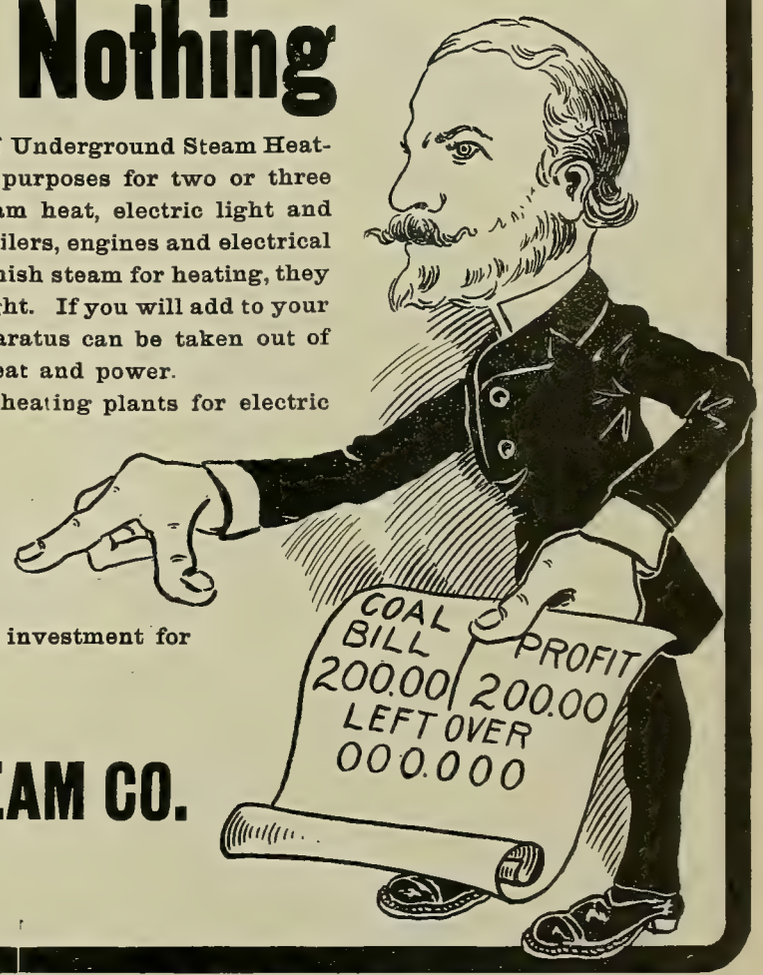

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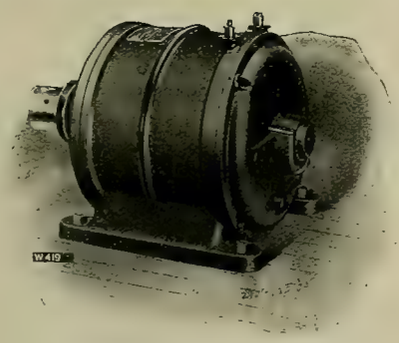

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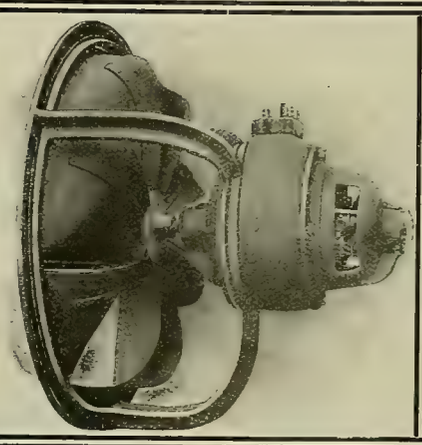

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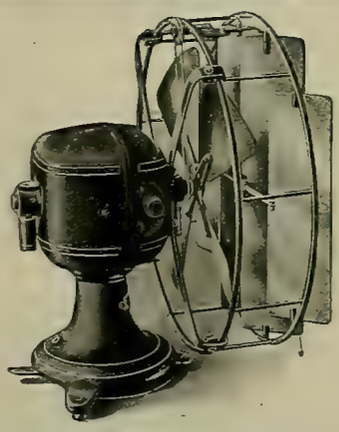

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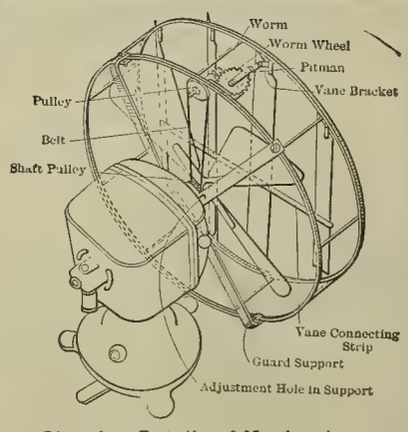

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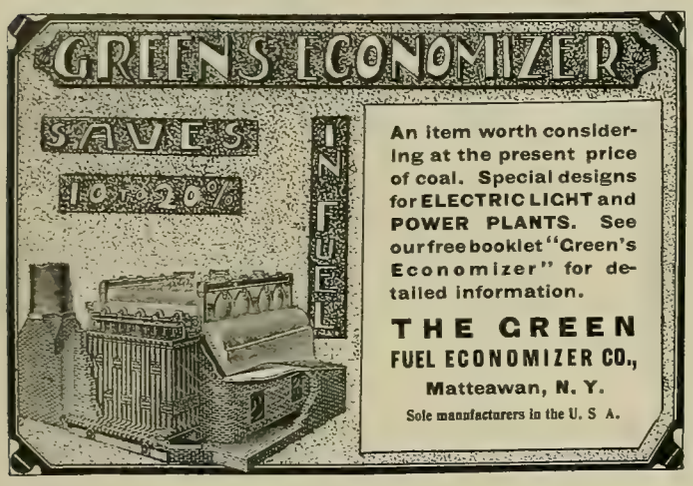

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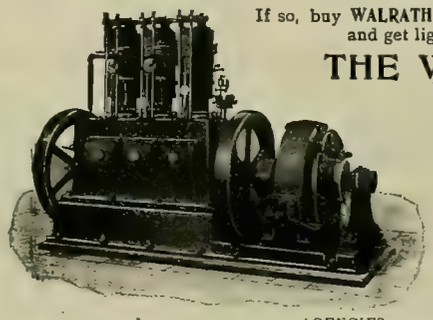

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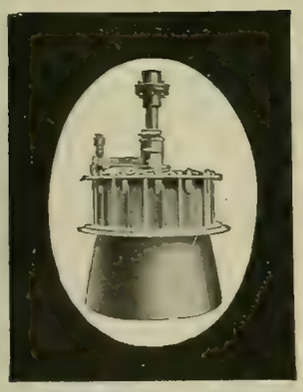

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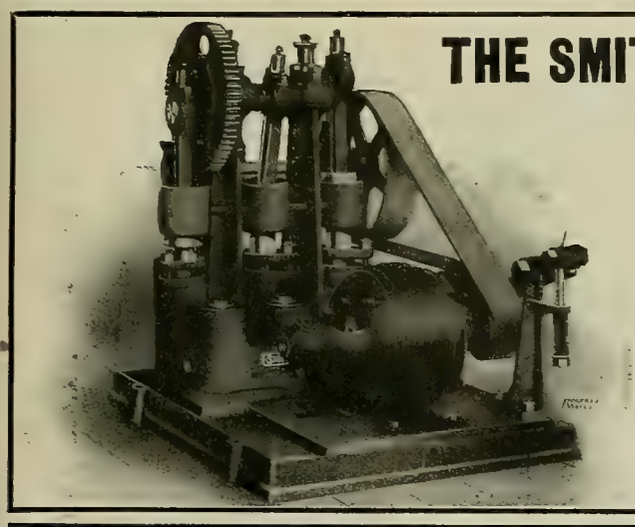

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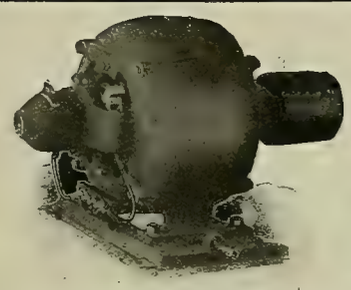

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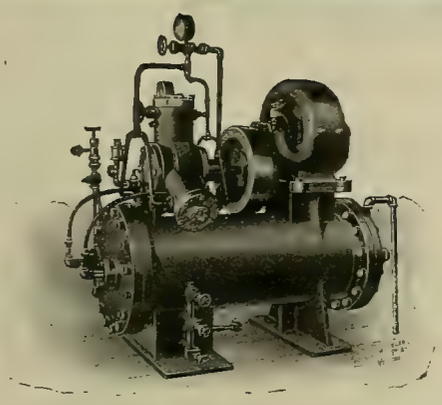

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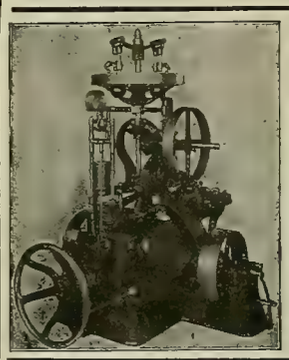

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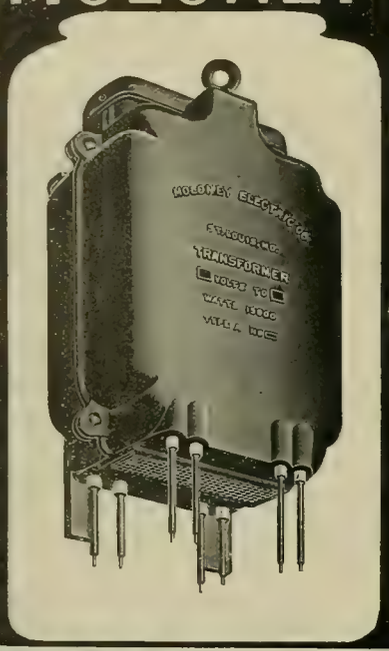

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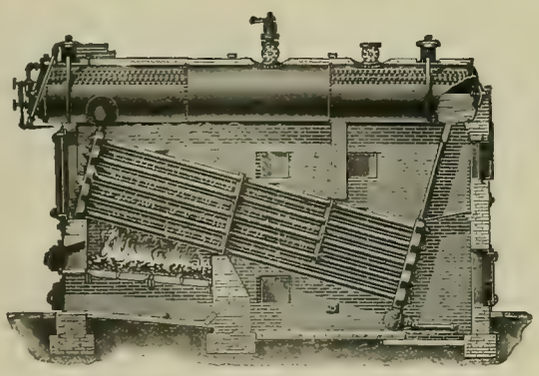

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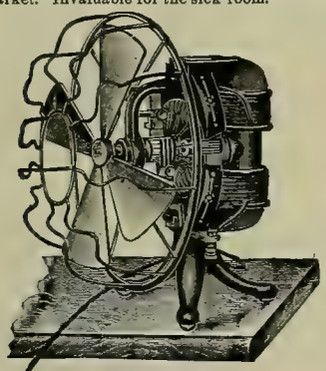

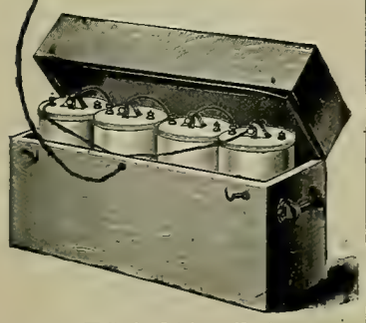

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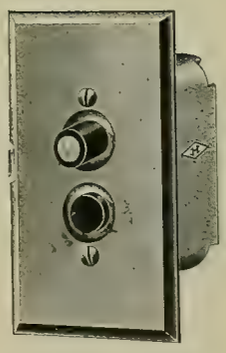

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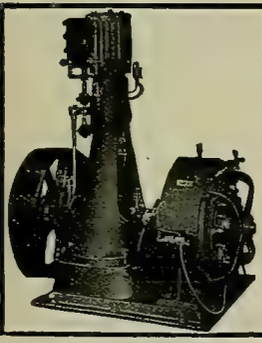

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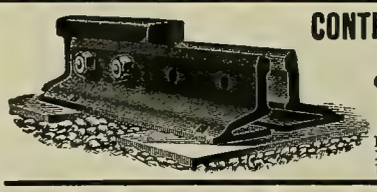

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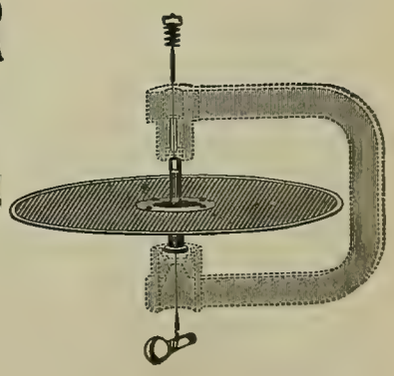

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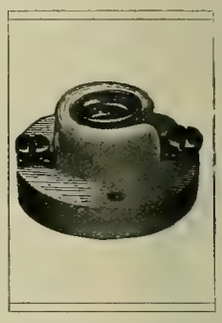

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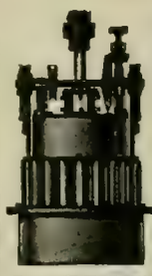

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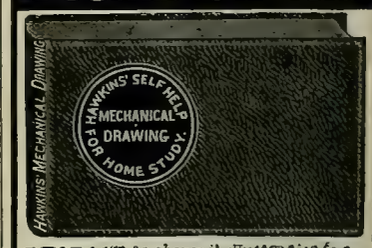

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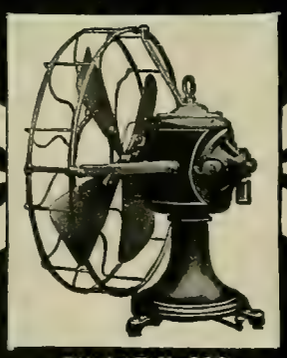

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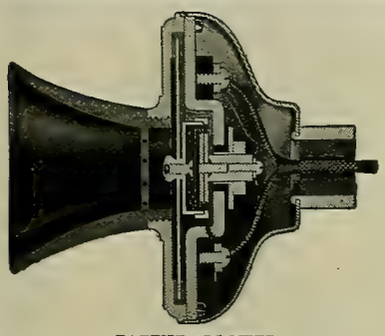

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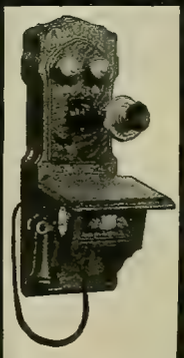

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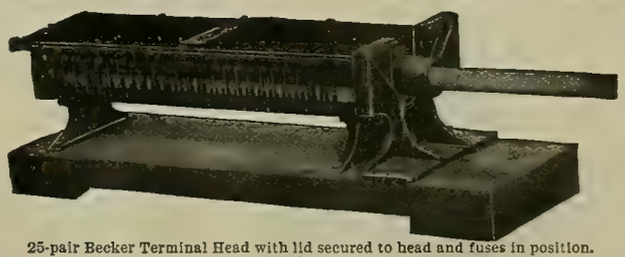

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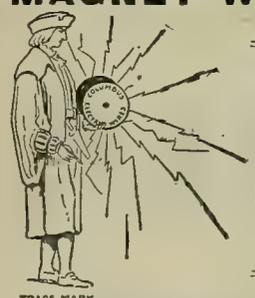

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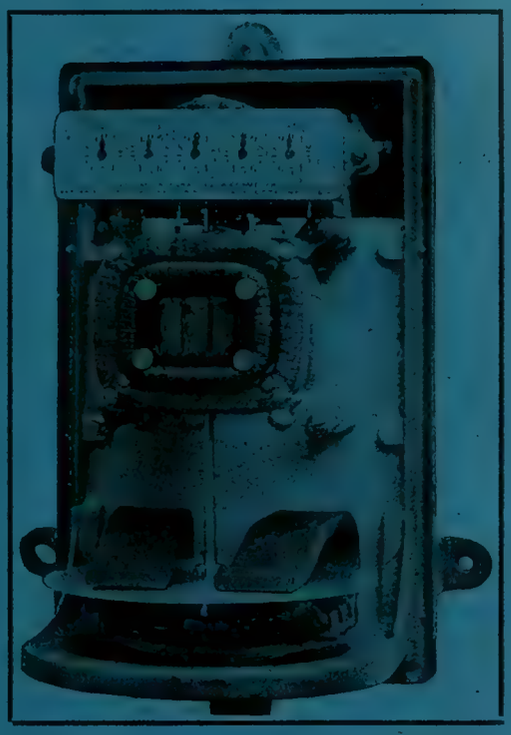

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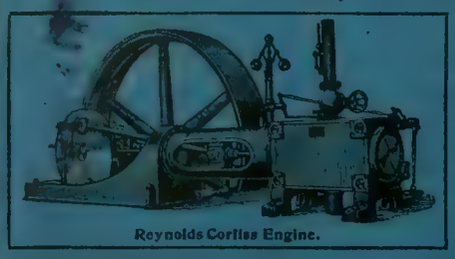

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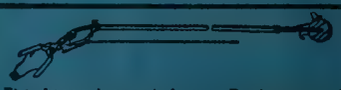

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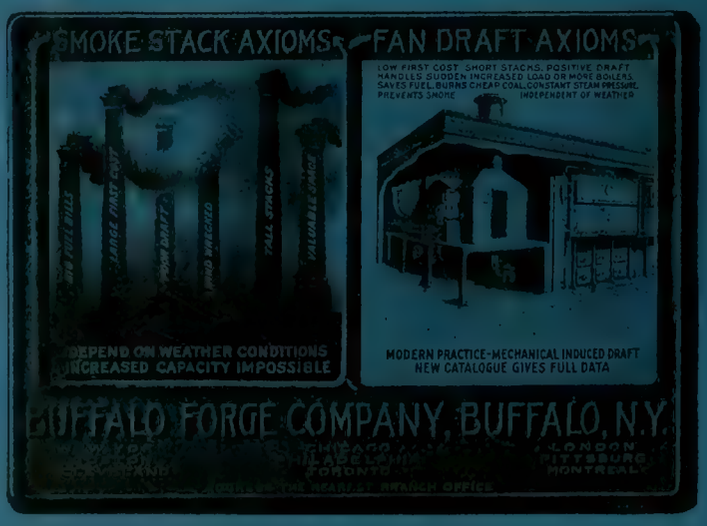

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New York, January 8, 1903.

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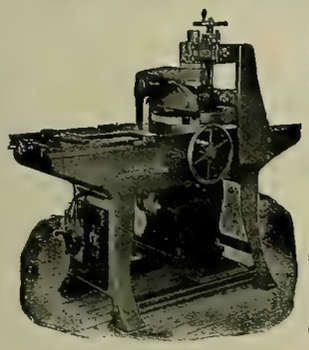

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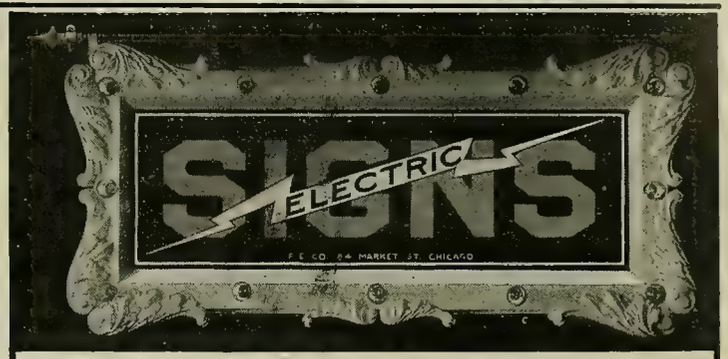

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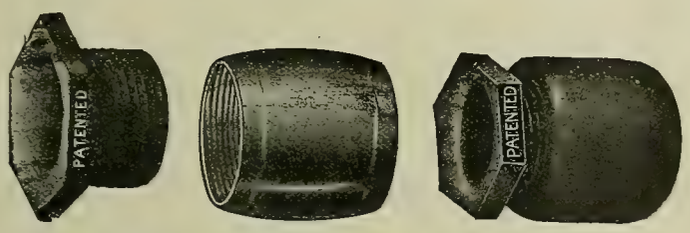

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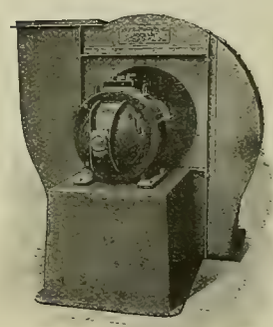

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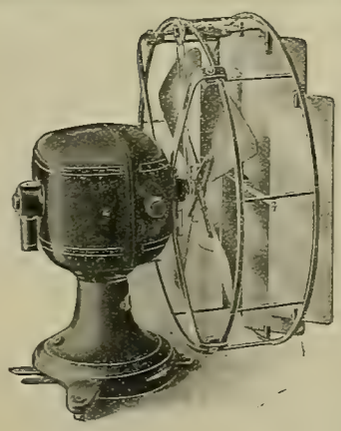

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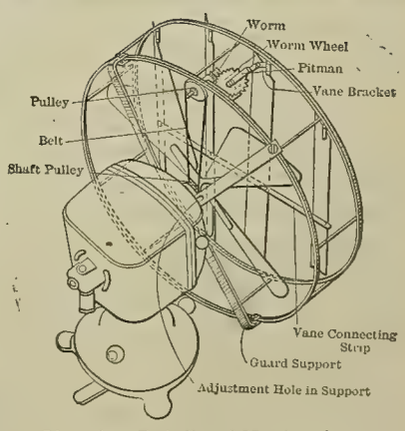

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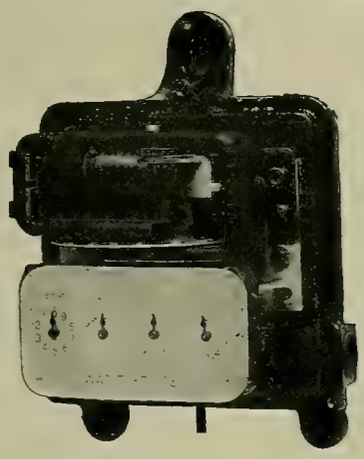

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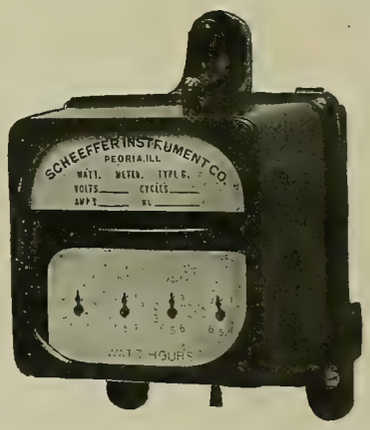

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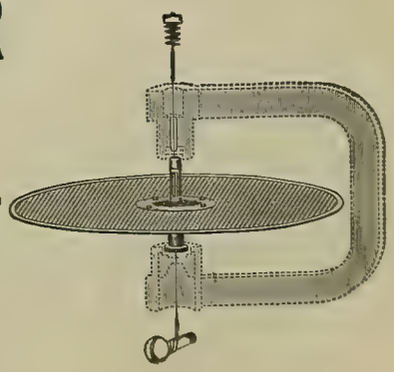

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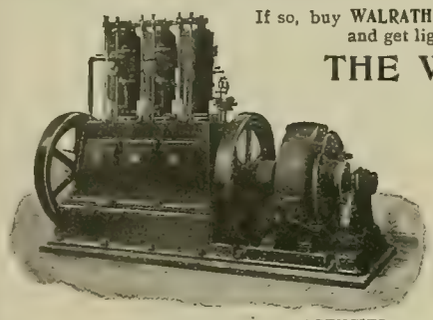

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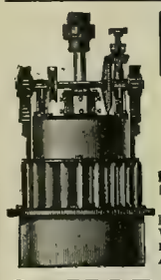

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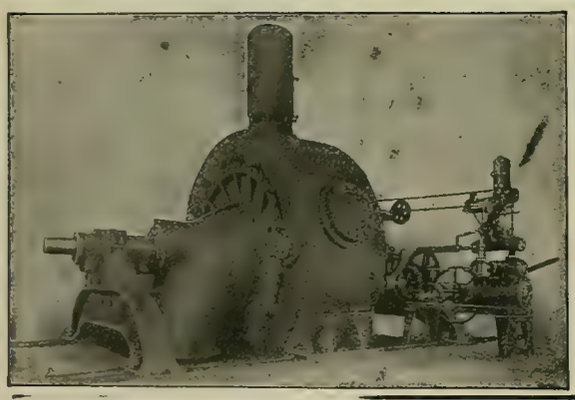

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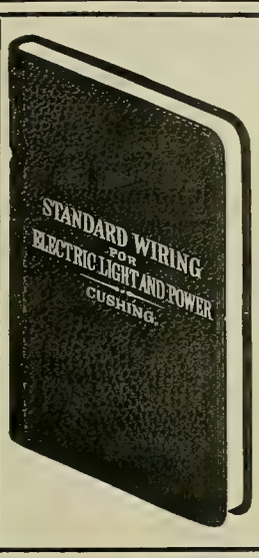

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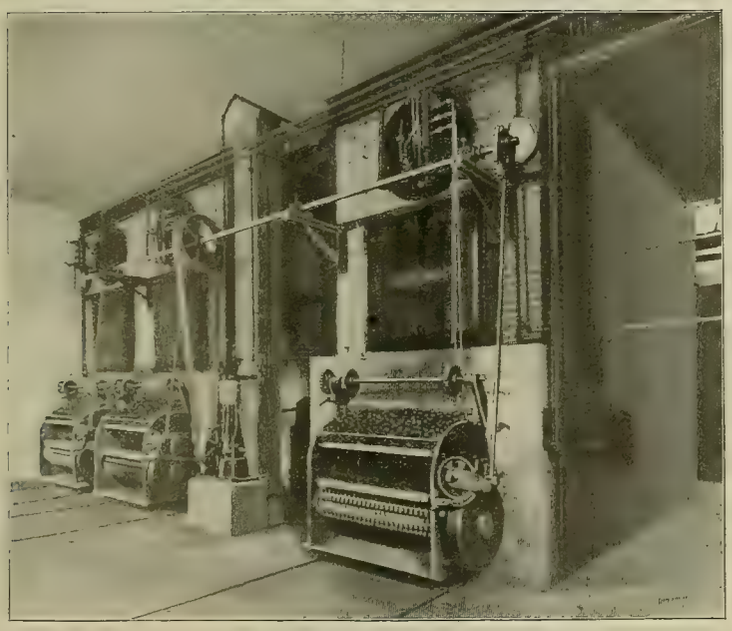

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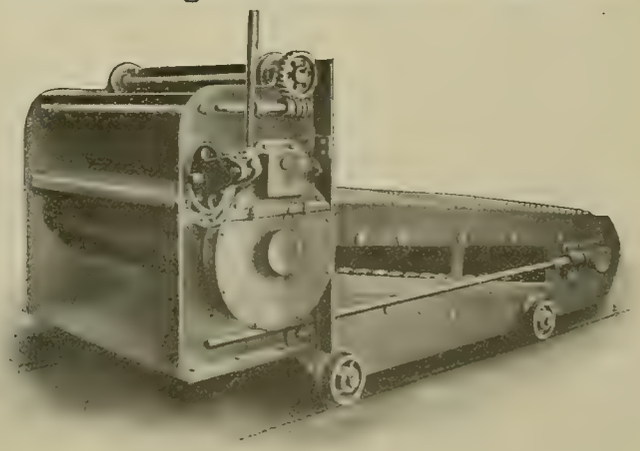

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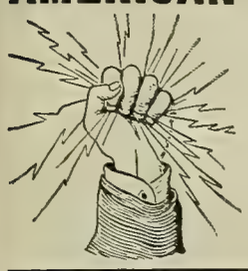

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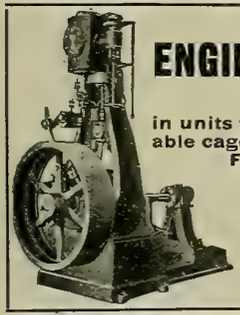

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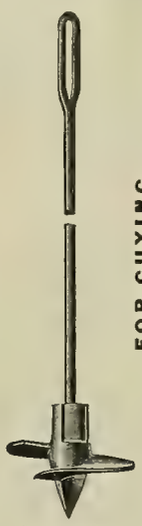

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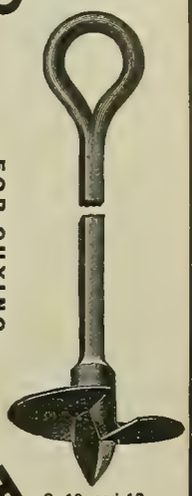

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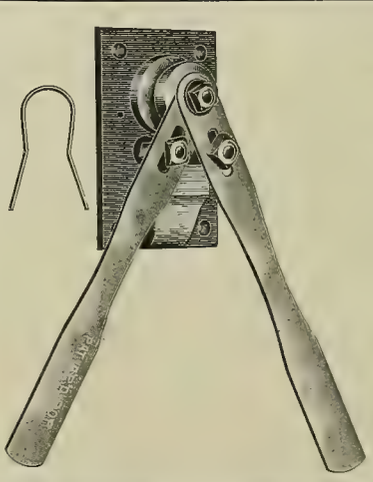

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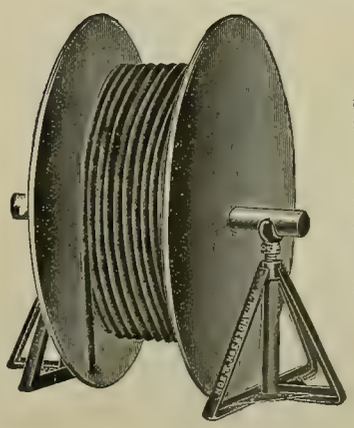

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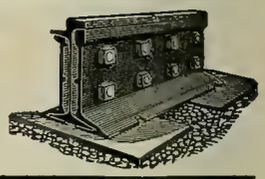

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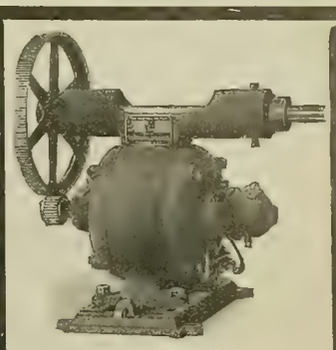

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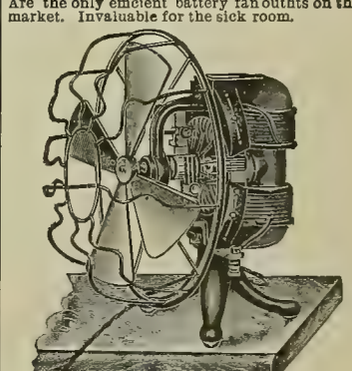

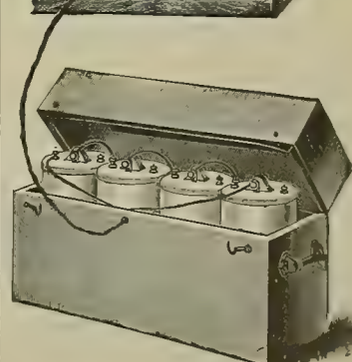

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ILLUSTRATIONS.

Patent of A. G. Bell, No. 174,465. Patent of Emile Berliner, No. 233,969. Patent of Emile Berliner, No. 463,569. Patents of Emile Berliner in Parallel Columns. Patent of C. A. Cheever, No. 208,463. Patent of H. H. Eldred, No. 303,714. Patent of Thos. A. Watson, No. 256,258. Patent of L. B. Firman, No. 283,334 Patent of M. G. Kellogg, No. 247,199. Patent of C. E. Scribner, No. 330,058. Patent of C. E. Scribner, No. 300,144. Trunking Principle. Patent of Shaw & Childs, No. 319,856. Mann System. Patent of L. B. Firman, No. 252 576. Western Union Pin Switch. Express System. Patent of Sabin & Hampton, No. 513,534. Subscriber's Automatic Signal. Raverot-Hess System. Patent of M. J. Carney, No. 258,886. Apostoloff System.

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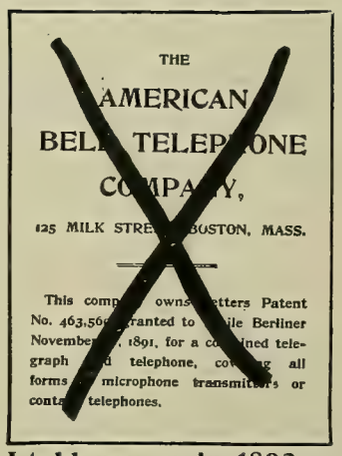
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Other Bell Patents We "Knocked Out."

ELDRED PATENT—Controlling any Clearing Out Signal in Cord Circuit.
ELDRED PATENT—Controlling any Ringing and Listening Keys in Cord Circuits.
ELDRED PATENT—Controlling the use of Alternating Current Generator at central office.
SCRIBNER PATENT—Push-in Crank Shunt on Magneto Bell

WATSON PATENT—Weights on Switchboard Cords.
GRAY PATENT—Automatic Shunt on Crank Shaft of Magneto Bell—(won this after Williams-Abbott lost it.)
CARTY PATENT—Bridging Magneto Bells—(won this after Western Telephone Construction Company lost the case in both courts).
SCRIBNER PATENT—Spring Jack for Switchboard.

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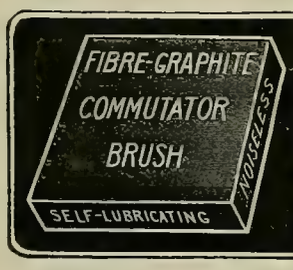

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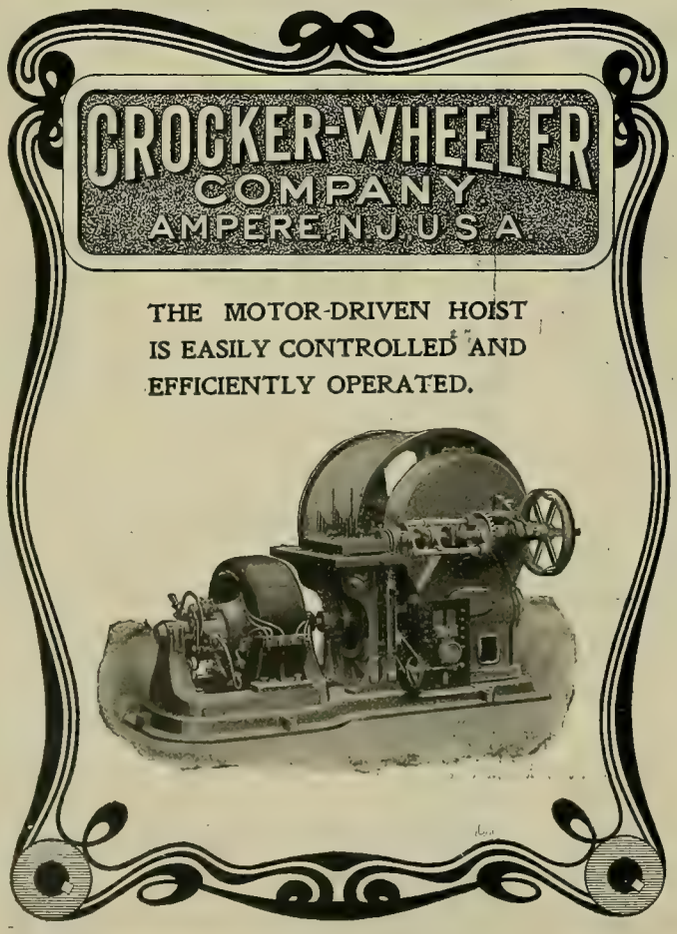

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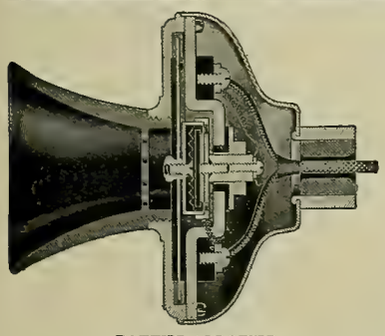

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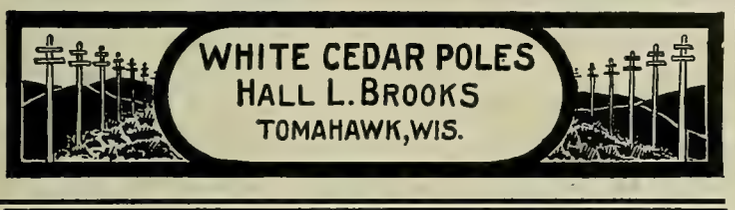

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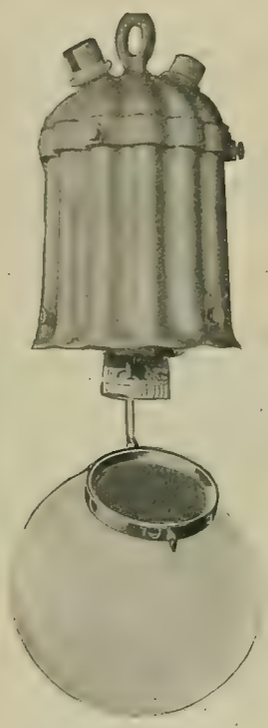

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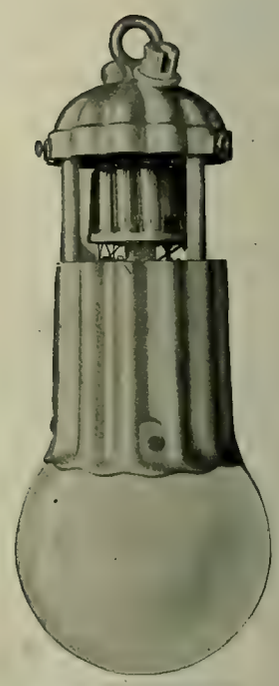

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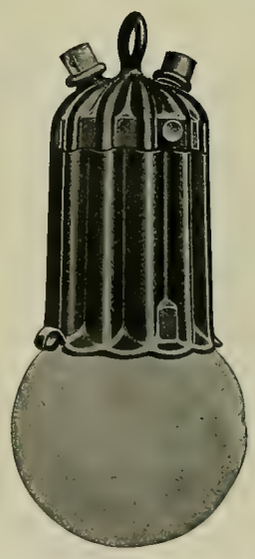

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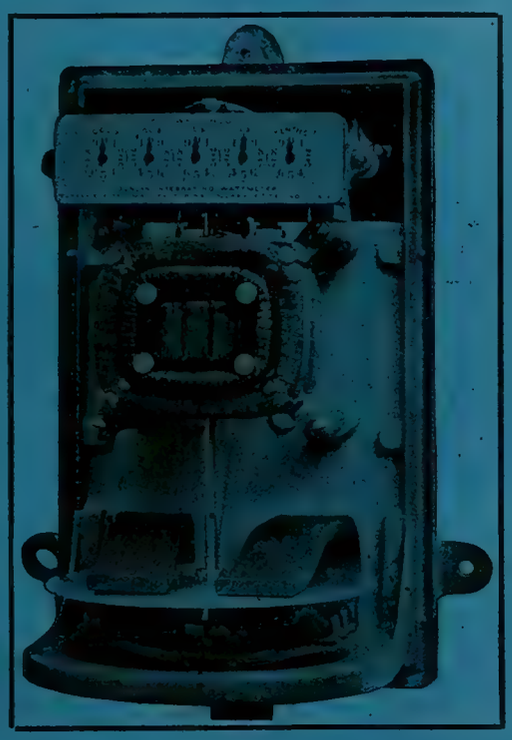

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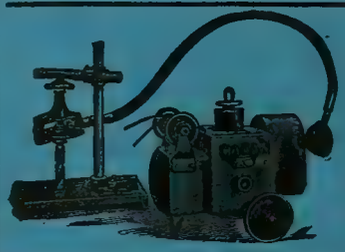
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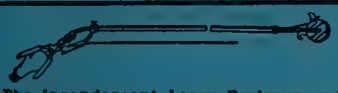
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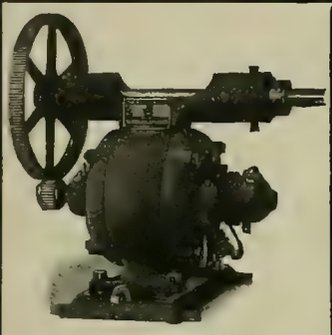

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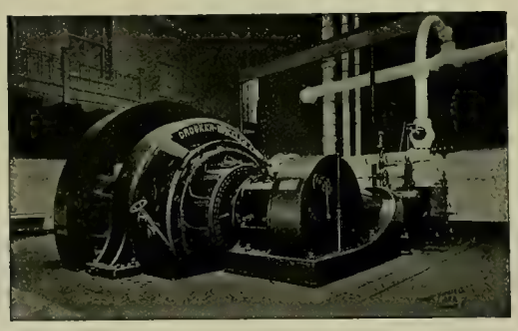

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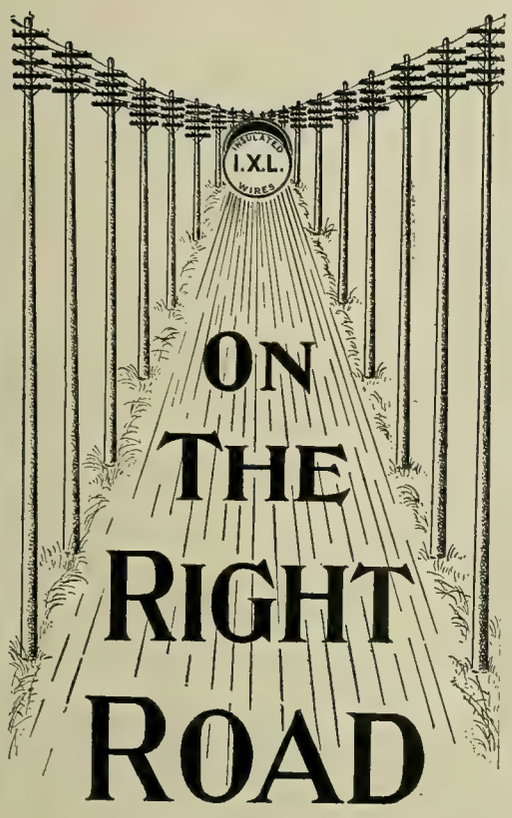

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American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elec. Supply Co.
Western Electric Company.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lamp Guards.
Wagor Mfg. Co., P. R.

Lamps, Arc.
Adams-Bagnall Elec. Co.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Toerring Co., C. J.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
Nernst Lamp Co.
Phelps Company.
Rooney-Westbury El. Lmp. Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Sterling Electrical Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Inc., Adjusters.
Inc. El. Lt. Manipulator Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Lamps, Nernst.
Commercial Elec. Supply Co.
Nernst Lamp Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Anderson & Sons, W. H.
Klein & Sons, Mathias.

Magnet Wires.
(See Insulated Wires.)

Manufacturers' Agent.
Stanley, Arthur F.

Mechanical Draft.
Sturtevant Co., B. F.

Meters.
Diamond Meter Co.
Duncan Electric Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Scheeffer Instrument Co.
Westinghouse El. & Mfg. Co.

Mica.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Name Plates.
Murdock Parlor Grate Co.

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.
Rice, Cyrus W.

Phosphor Bronze.
Phosphor BronzeSm.Co.,Ltd.

Platinum Bought and Sold.
Baker & Company.

Poles and Ties.
Beidler & Co., Francis.
Berthold & Jennings.
Brooks, Hall L.
Carney Bros. Co.
Chicago Lumber & Coal Co.
Coolidge, Marshall H.
Fowler, John H.
Fulmer Lumber Co., D. M.
Huebel Company, C. J.
Lindsley Bros. Co.
Maltby Lumber Co.
Morse Cedar Co.
O. C. Lumber Company.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Standard Pole & Tie Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Vreeland, B. F.
Whitmore, A. E.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain.
Akron Smoking Pipe Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Pulleys.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Refiners.
Gt. West. Sm. and Refining Co.

Reflectors and Shades.
American Refl. & Lighting Co.
Faries Manufacturing Co
Western Electric Co.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Schureman & Hayden.

Rheostats.
Culler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Second-Hand Mach'y.
Dustin Co, Chas. E.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
Matthews & Bro., W. N.
Rose Electric Company.
Schureman & Hayden.
Stewart Electric Co, John A.
Thompson, Son & Co.
Walsh's Sons & Co.
Whitehead Machinery Co.

Slate.
Bonville, Edward.
Maley, Martin.
McNamara Brothers.

Sockets & Receptacles.
Paiste Co., H. T.

Soldering Sticks, Salts and Paste.
Allen Co., L. B.
Western Electric Co.

Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.

Switchboards (Slate and Marble).
Bonville, Edward.
Maley, Martin.
McNamara Brothers.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Automatic Electric Co.
Central Electric Co.
Central Tele. & Elec. Co.
Chicago Pay Station Co.
Farr Tel. & Const. Supply Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co.
Western Electric Co.
Western Elec. Supply Co.

Tools.
Anderson & Sons, W. H.
Klein & Sons, Mathias.
Western Electric Co.

Transformers.
Central Electric Company.
Christensen Engineering Co
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbines, Water Wheels
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile

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Standard Varnish Works.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Water Wheel Governors
Replogle Governor Works.

Wires, Copper.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Western Electric Company.

Wire, Bare.
American Steel & Wire Co
Central Electric Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

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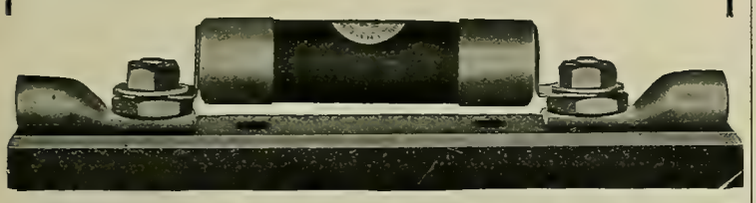

RE-STANDARDIZED TO DATE TO MEET THE LATEST REQUIREMENTS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS.

ABSOLUTE RELIABILITY.

THE NEW SHAWMUT INDICATING FUSE.

Indicating Type P Fuse, intact.

Fuse blown, showing auxiliary indicating patch white.

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Western Representative: THOMAS G. GRIER CO., 128 W. Jackson Blvd., Chicago, Illinois.

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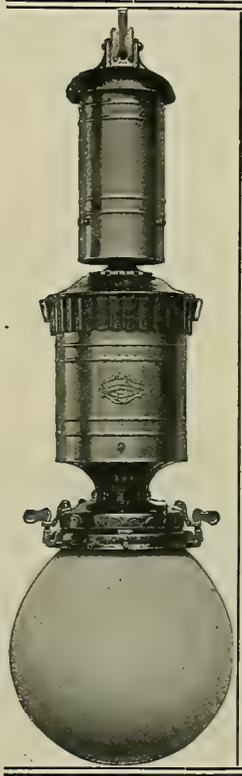


For

Street Railway Lighting

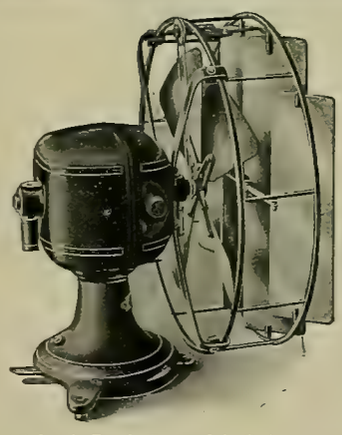
Bulletin No. 7008 Sent on Request

This Lamp will Operate Uniformly on a Circuit with a

Fluctuating Voltage

Western Electric Company,

Chicago. Saint Louis. Philadelphia. Denver. New York.



12-inch Desk Fan with Coleman Guard and Deflector Attached.

THE DIEHL FAN CATALOGUE

FOR 1903

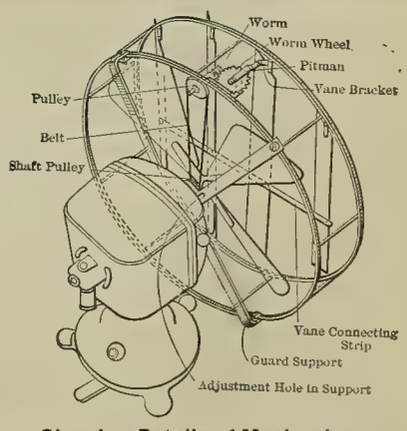
will describe the Coleman device for diffusing the air over nearly ½ of the circle. Can be attached to any make of Desk Bracket or Trunion Fan. Operates on any speed or angle. Positive in operation, attractive in appearance, simple in construction. Send for prices and catalogue. . . . . .

We will also describe a new CEILING FAN, with and without electrolier attachment. 4 blades, 2 or 3 speeds. . . . .

WRITE US AT ONCE.

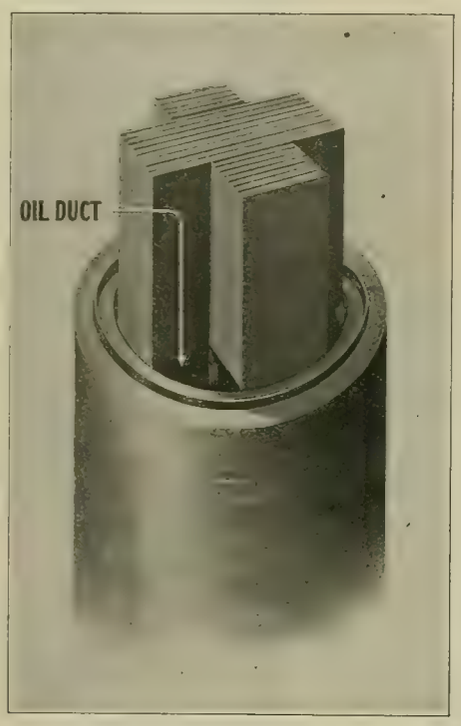
Diehl Manufacturing Co.

ELIZABETHPORT, N. J.



Showing Details of Mechanism. Cannot Get Out of Order.

GENERAL ELECTRIC COMPANY'S



Type "H" Transformers

CORE TYPE—OIL COOLED.

Expert designers, selected materials, and the most approved methods of manufacture — and consequent durability and high efficiency — have made Type H Transformers famous in all respects.

Write nearest sales office for Pamphlet 9114.

GENERAL OFFICES: SCHENECTADY, N. Y.

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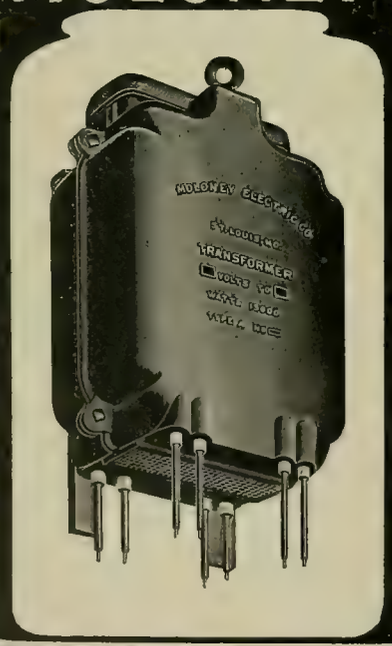
MOLONEY TRANSFORMERS



Highest All-day Efficiency
Electrically and Commercially
Lowest Possible Core Losses
Regulation and Ventilation Perfect

We will ship them on thirty days' trial, should they not be what we claim for them, return and we will pay freight both ways.

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ST. LOUIS, MO., U. S. A.
General Sales Agents

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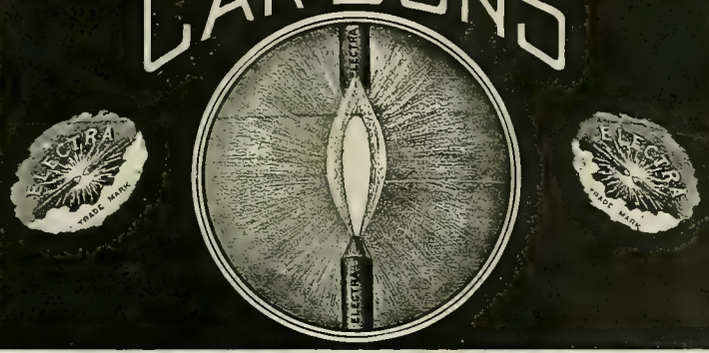
MARVELOUS EFFECT

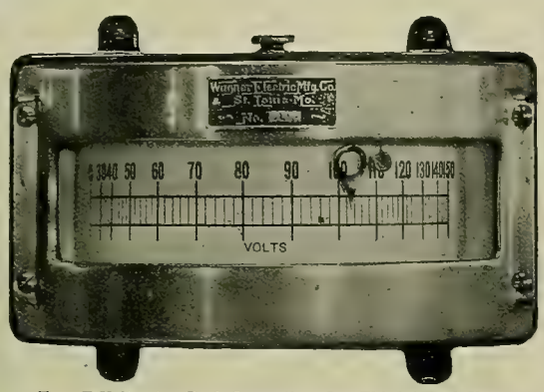
"ELECTRA" Flame Light Carbons are suitable for all types of Open Arc Lamps, either direct or alternating current, with slight charge in regulation of lamp.



HIGHEST INTENSITY

The intensity and brilliancy of light is three times that of regular "ELECTRA," and five times that of other carbons, making them eminently suitable for all special lighting purposes.

HUGO REISINGER, SOLE IMPORTER, 11 BROADWAY, NEW YORK.



Type F Voltmeter, Back Connection, One-Third Actual Size.

STATIC GROUND DETECTORS, SYNCHRONIZERS, POWER FACTOR INDICATORS, GALVANOMETERS, switchboard and portable types of **VOLTMETERS, AMMETERS** and **INDICATING WATTMETERS** are as **ACCURATE, DEADBEAT** and **PERMANENT** as it is possible to build them and withstand ordinary commercial usage.

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"WESCO" ELECTRICAL SUPPLIES

WE CARRY IN ST. LOUIS STOCK

one of the most complete lines of supplies and construction material in the U. S., and are prepared to ship promptly anything pertaining to the operation, maintenance or equipment of Isolated Plants and Central Stations, Electric Railways and Telephone Lines and Exchanges.

We handle nothing but the very best material and our guarantee is back of all our goods. Our prices are as low as they can be on first-class material.

We issue catalogues covering our various lines.

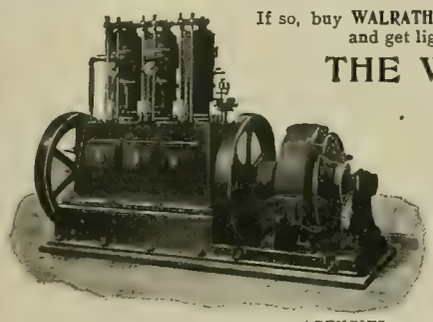
You ought to have them.

WESTERN ELECTRICAL SUPPLY CO.

ST. LOUIS, MO., U. S. A.

THE BRIGHTEST THING THE CHIEF ENGINEER OF THE LIGHTING STATION CAN DO IS TO USE
DEARBORN BOILER COMPOUNDS,
WHICH ARE AN ASSURANCE OF CLEAN, SAFE BOILERS. THE MAN WHO KEEPS HIS BOILERS CLEAN WILL BE FOUND TO HAVE ALL PARTS OF THE PLANT IN EXCELLENT CONDITION.
OUR SPECIALTY IS BOILER WATER TREATMENT. SEND SAMPLE FOR ANALYSIS.
DEARBORN DRUG & CHEMICAL WORKS,
27-34 RIALTO BUILDING, CHICAGO, ILL. WM. H EDGAR, President Telephone: Harrison 3930 and 3931.

ARE YOU LOOKING FOR MONEY?



If so, buy WALRATH GAS OR GASOLINE ENGINES and get light on the subject.
THE WALRATH
Received the Highest Award at the Pan-American Exposition.
It will produce as good a commercial light as that of an automatic steam engine, either belted or direct connected generator. Simple, Economical and Reliable. Send for Catalogue W.
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The Evans-Almirall Hot Water System of Central Station Heating.
NO BACK PRESSURE. ONLY ONE LINE OF PIPE NEEDED.
SEND FOR CATALOGUE.
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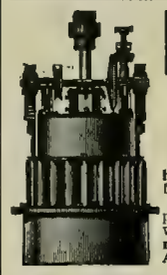

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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.
Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.
Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.
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THE ONLY KNOWN METHOD OF KEEPING BOILERS CLEAN AND FREE OF SCALE.
INSTALLED OUR EXPENSE ON 60 DAYS TRIAL
MECHANICAL BOILER CLEANER CO.
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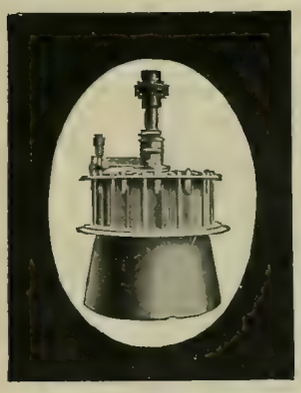

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If you are contemplating the improvement of a water-power where a TURBINE will be required, we can interest you. This is especially true if you wish to use the TURBINE for driving GENERATOR or DYNAMO.
HIGH EFFICIENCY at REDUCED GATEAGE, QUICK SPEED, BALANCED GATES, are just a few of the many points of excellence embodied in the SAMSON. Write Dept. D. for catalog.
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Four graceful poses from life; figures ten inches high, reproduced in colors. Highest example of lithographic art.
"THE ONLY WAY"
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The best railway line between CHICAGO, ST. LOUIS, KANSAS CITY and PEORIA.

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Sterling Extra Black Finishing Varnish,
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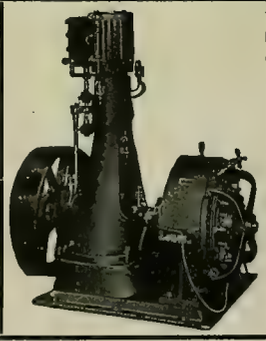

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SMALL GENERATING SETS FOR MARINE WORK OR SMALL ISOLATED PLANTS.
WE MANUFACTURE
GENERATORS AND MOTORS
OF ALL KINDS AND FOR ALL PURPOSES.
TRIUMPH ELECTRIC CO.,
SEND FOR BULLETIN "WE" CINCINNATI, O.

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INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
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ORIGINAL AND SOLE MAKERS IN THE U.S.
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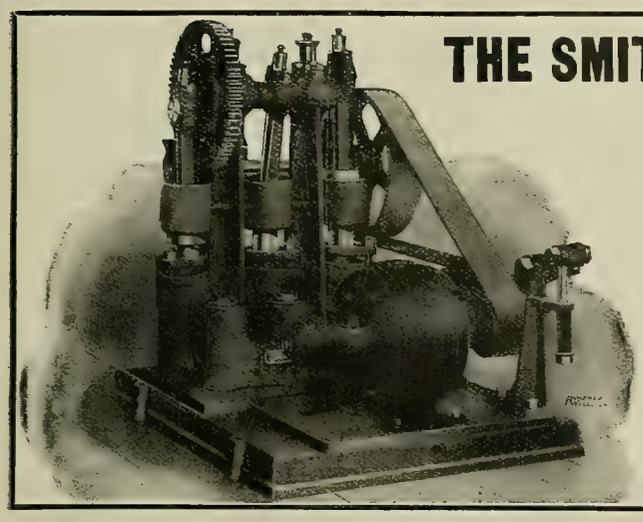
CARBONS
CONSUMERS CARBON CO.
LANCASTER, OHIO, U. S. A.
Carbons of all kinds and for all purposes.



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afford an excellent means for pumping water for House service, Hydraulic Elevator service Factories and Mills desiring an independent water supply, also for Mine Work and : : :

WATER WORKS SUPPLY.

Can be located wherever electric current is available, and require little or no attention after once installed. We make steam and power : : : : : : : : : : : : : : :

PUMPING MACHINERY FOR ALL PURPOSES.

Jet and Surface CONDENSERS, Feed Water Heaters and Victor Turbine Water Wheels

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Sales Agents: FREDERIC NELL, 97 Queen Victoria St., London, Eng. E. F. AUSTIN, Smith Blk., Pittsburg.

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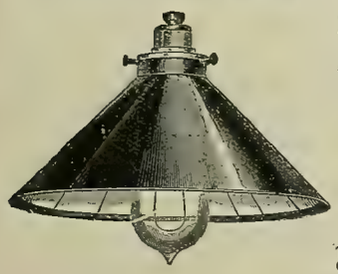

Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows. Get our Catalogue and Prices.

American Reflector & Lighting Co.,

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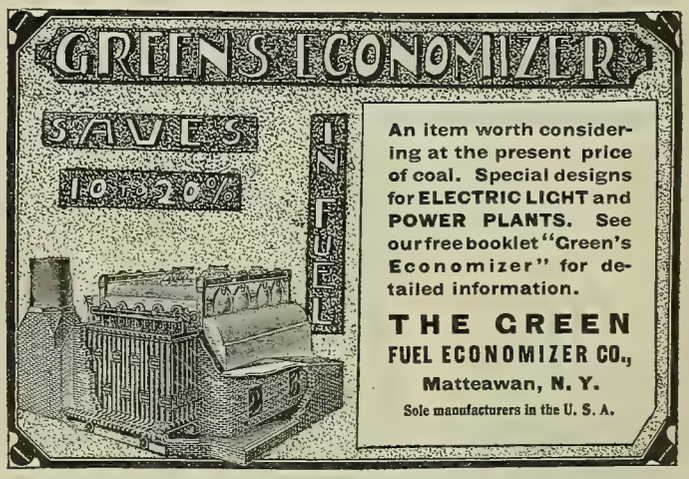

An item worth considering at the present price of coal. Special designs for ELECTRIC LIGHT and POWER PLANTS. See our free booklet "Green's Economizer" for detailed information.

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Sole manufacturers in the U. S. A.

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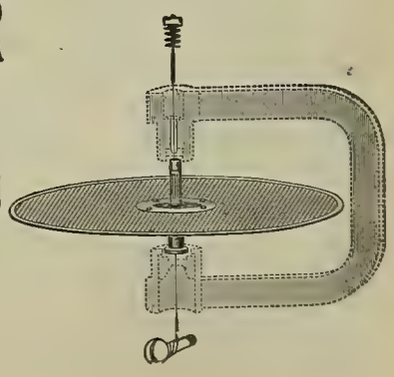
OF THE MOVING PARTS OF
STANLEY RECORDING WATTMETERS
FOR ALTERNATING CURRENT
IS ACCOMPLISHED BY

MAGNETIC SUSPENSION.

NO WEAR. NO LOST REVENUE.
NO FRICTION. ALL CURRENT USED RECORDED.

SEND FOR DESCRIPTION AND BOOK FULL OF GOOD INFORMATION "ABOUT METERS."



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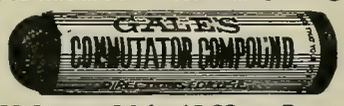

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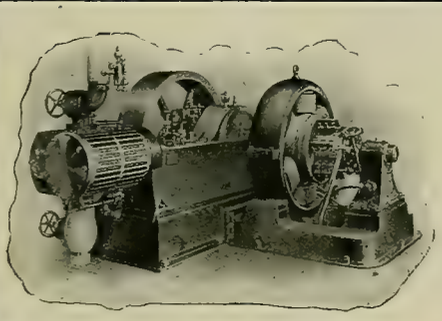

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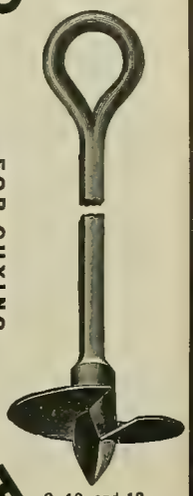

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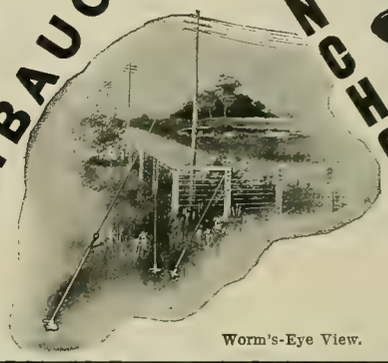

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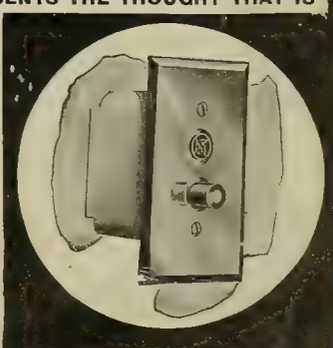

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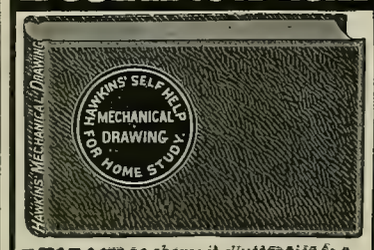

THIS BOOK *as shown in illustration is a self-instructor for home study and practice in the art of MECHANICAL DRAWING for ENGINEERS, MACHINISTS, ELECTRICIANS, METAL WORKERS and all interested in drafting for shop practice, and has been prepared in plain practical language and illustrated by the author of "HAWKINS' EDUCATIONAL WORKS." The book is divided into 28 different subjects which comprise the fundamental principals of drawing, each heading being thoroughly treated.*

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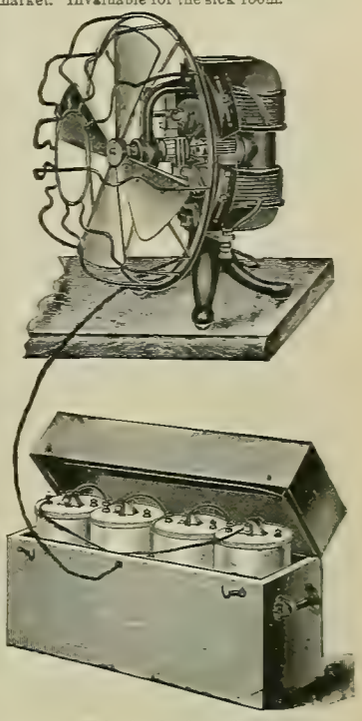

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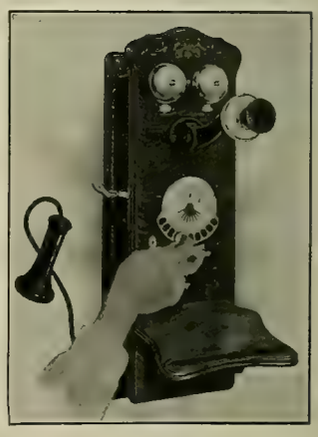

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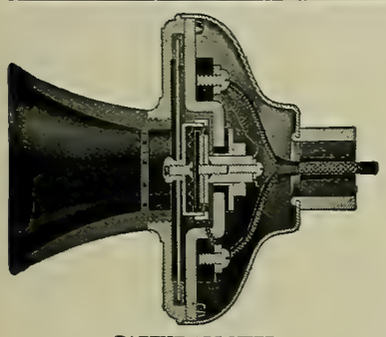

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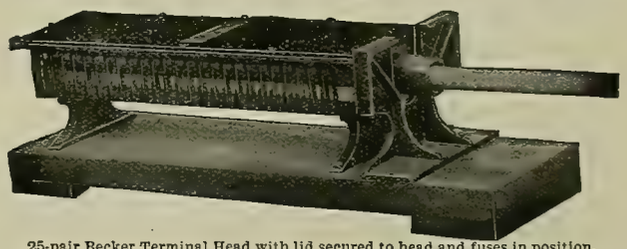

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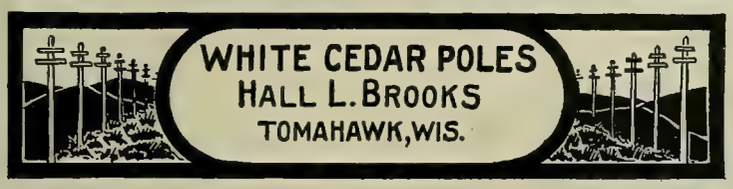

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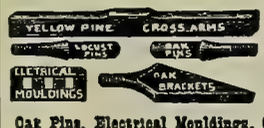

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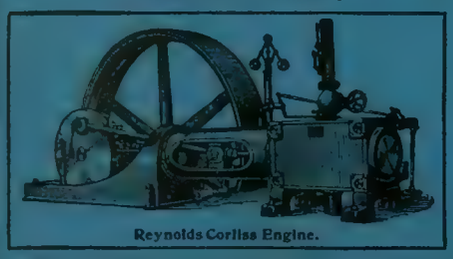

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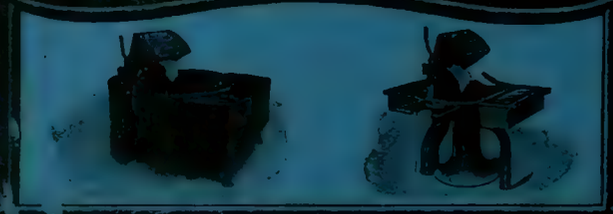

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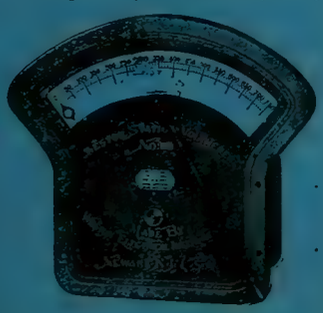
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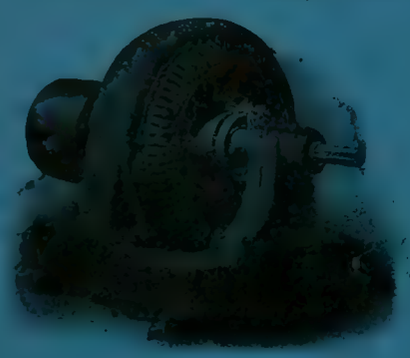

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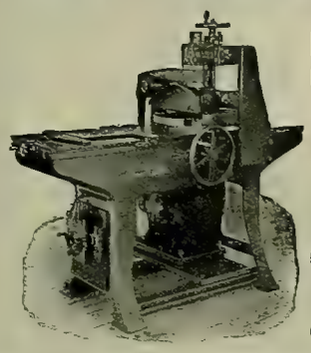

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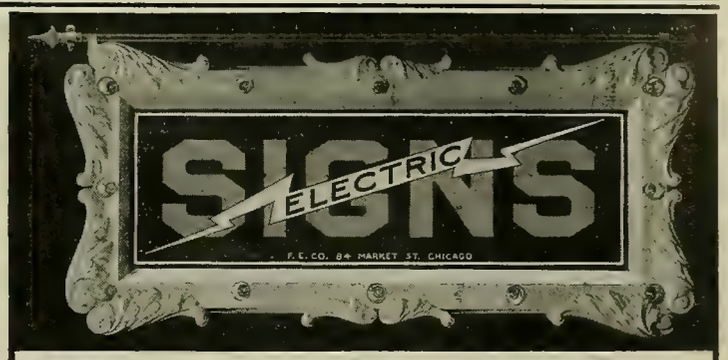

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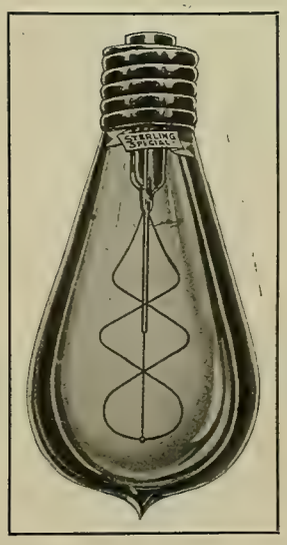

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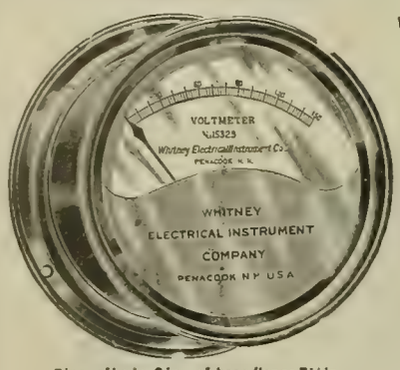

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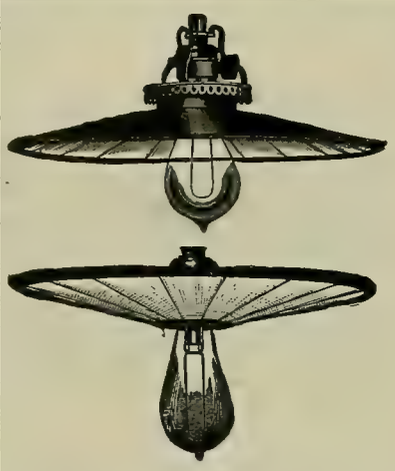

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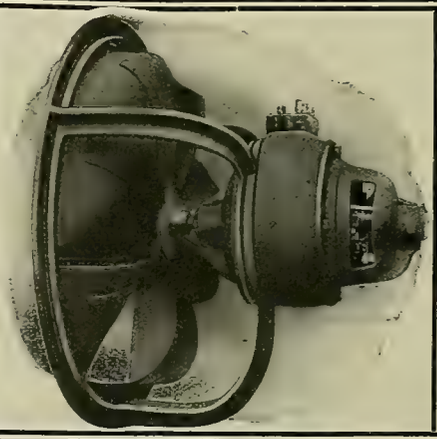

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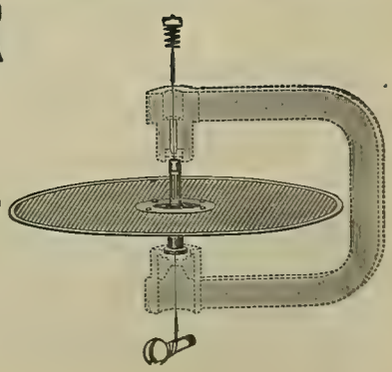

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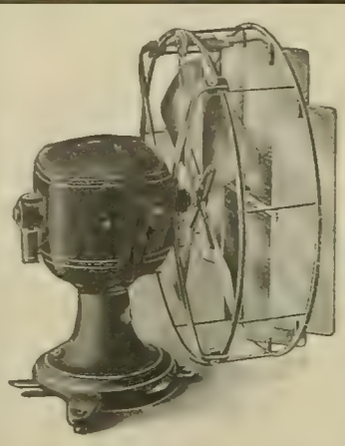

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FOR 1903

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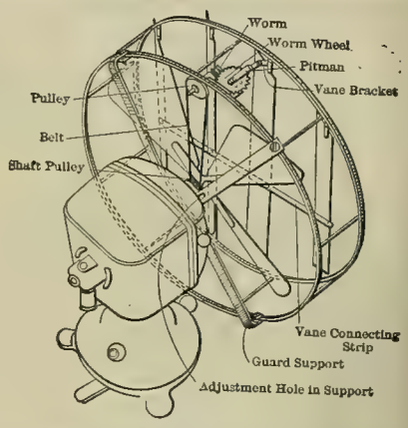

Showing Details of Mechanism. Cannot Get Out of Order.

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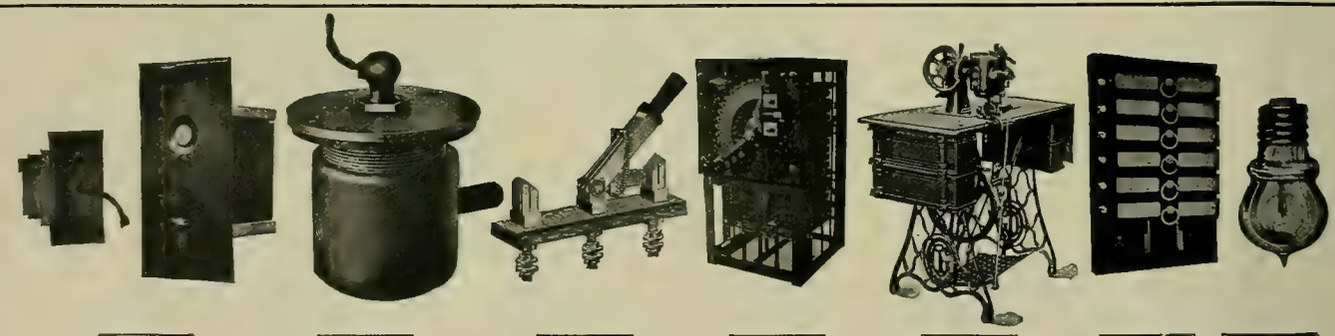

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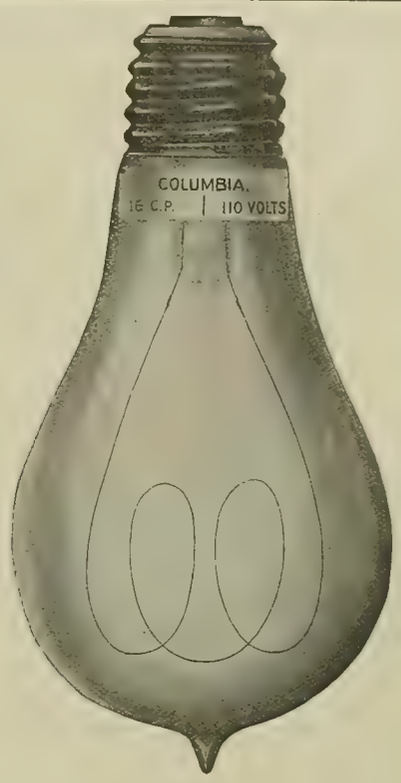

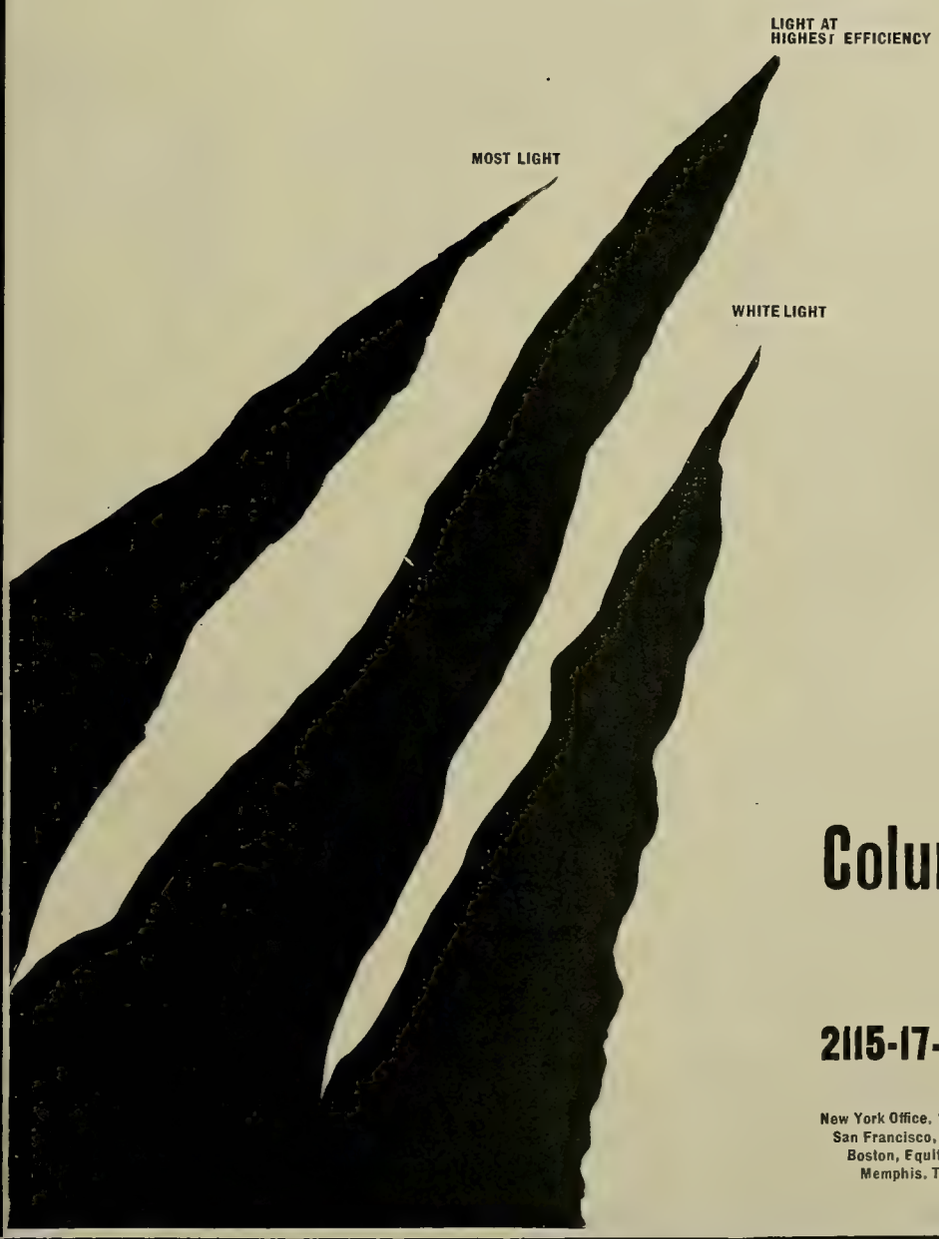

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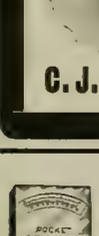

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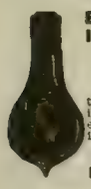

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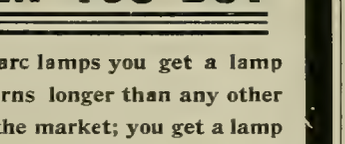

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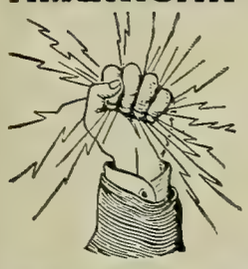

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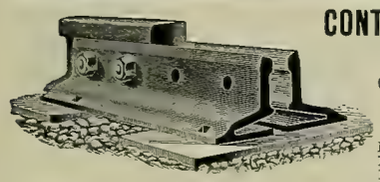

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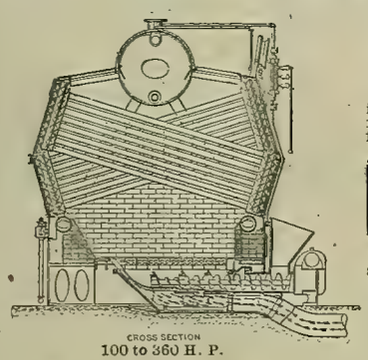

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(1) Automatic Signaling Device for Railroads:
Number 334,194, January 12, 1886.
(2) Electric Welding and Tempering:
Number 370,282, September 20, 1887;
" 386,088, July 10, 1888;
" 402,107, April 23, 1889;
" 402,108, April 23, 1889;
" 444,855, January 20, 1891;
" 453,162, May 26, 1891;
" 453,163, May 26, 1891;
" 453,164, May 26, 1891;
" 564,453, July 21, 1896;
" 499,040, June 6, 1893.
Applications:
Serial Number 280,521, filed July 20, 1888;
" " 285,555, " Sept. 15, 1888;
" " 301,915. " March 5, 1889;
" " 457,479, " Jan. 6, 1893;
" " 473,878, " May 11, 1893.
(3) Electric Riveting:
Number 403,374, May 14, 1889;
" 404,306, May 28, 1889;
" 452,042, May 12, 1891;
" 465,089, December 15, 1891.
(4) Electric Soldering:
Number 485,017, October 25, 1892.
(5) Electric Heating:
Number 381,815, April 24, 1888;
" 381,816, April 24, 1888;
" 381,817, April 24, 1888;
" 381,818, April 24, 1888;
" 381,819, April 24, 1888.
Applications:
Serial Number 266,710, filed March 9, 1888;
" " 270,245, " April 11, 1888;
" " 270,246, " April 11, 1888.
(6) Induction Coils. Dynamo Electric Machines and Motors:
Number 380,138, March 27, 1888 (Coil).
" 381,421, April 17, 1888 (Generator).
" 390,904, October 9, 1888 (Motor).
" 390,905, October 9, 1888 (Generator).
" 390,906, October 9, 1888 (Generator).
(7) Overhead Conductors for Electric Railways:
Number 392,757, filed November 13, 1888.
Application:
Serial Number 250,090, filed September 21, 1887.
(8) Brake and Traction Systems:
Number 356,963, Feb. 1, 1887; } Subject to Licence to Otis Elevator Co. for Elevators.
" 356,964, Feb. 1, 1887; }
" 452,041, May 12, 1891.
Application:
Serial Number 242,122, filed January 22, 1887.
(9) Conduits for Electric and Cable Railways;
Number 338,556, March 23, 1886;
" 352,265, November 9, 1886;
" 370,283, September 20, 1887;
" 383,770, May 29, 1888;
" 386,085, July 10, 1888;
" 386,087, July 10, 1888;
" 409,757, August 27, 1889;
" 409,756 August 27, 1889.
(10) Electric Railway System:
Number 386,086, July 10, 1888;
" 409,237, August 20, 1889;
" 411,301, September 17, 1889;
" 417,338, December 17, 1889.
Applications:
Serial Number 188,083, filed January 9, 1886;
" " 368,194, filed Oct. 15, 1890;
" " 368,195, filed Oct. 15, 1890;
" " 395,231 filed June 5, 1891.
(11) Railway Systems, Transformer:
Number 402,971, May 7, 1889;
" 431,482, July 1, 1890;
" 622,865, April 11, 1899. (See note below).
Applications:
Serial Number 248,405, filed Aug. 31, 1887.
" " 298,726, filed Feb. 5, 1889.
(12) Induction Railway:
Number 458,859, September 1, 1891.
Applications:
Serial Number 429,182, filed April 14, 1892.
" " 442,058, filed Aug. 3, 1892.
(13) Apparatus for Removing Ice and Snow from Railway Tracks:
Number 390,619, October 2, 1888.

Note: Sale of patent No. 622,865 subject to the terms and conditions of agreement between Ries & Henderson and George Westinghouse, dated November 22, 1893. Recorded Liber V sixty-three, page four hundred and six of transfer of patents.

The foregoing patents and the inventions described in above applications will be offered for sale by public auction by the undersigned, at the Real Estate Exchange, southwest corner of Lexington and Saint Paul Streets, Baltimore, Maryland, on Tuesday, the 3rd day of March, 1903, at 1 o'clock P. M.

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1—200 kw., Stanley, 2,400 volts, 60 cycles, 2-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
3—150 kw., G. E., 2,300 volts, 60 cycles, 3-phase.
2—120 kw., G. E., 2,000 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
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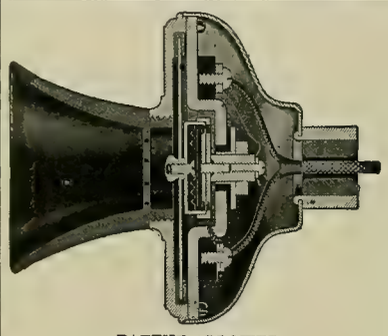

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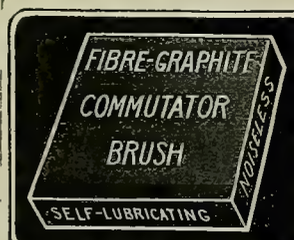

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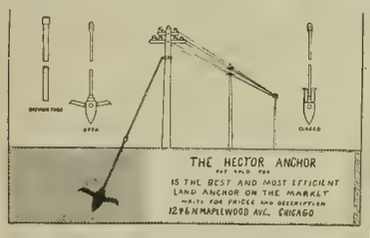

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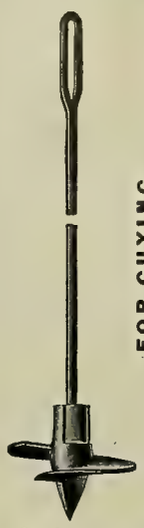

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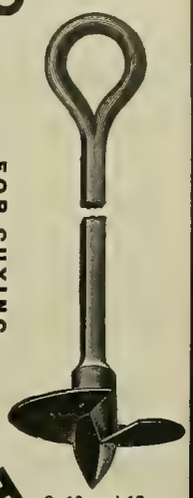

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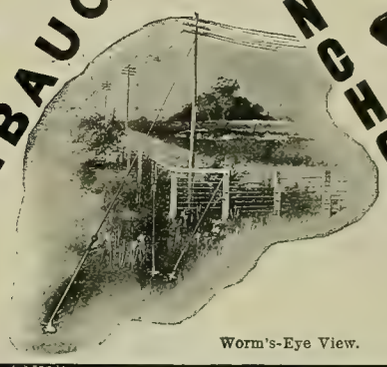

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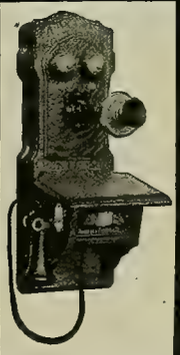

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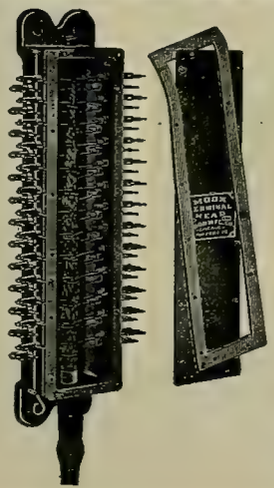

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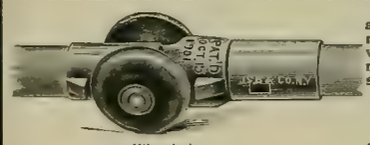

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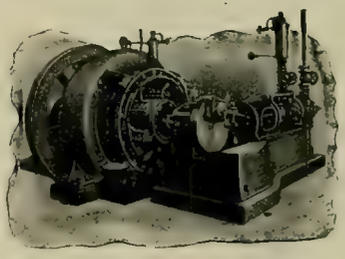

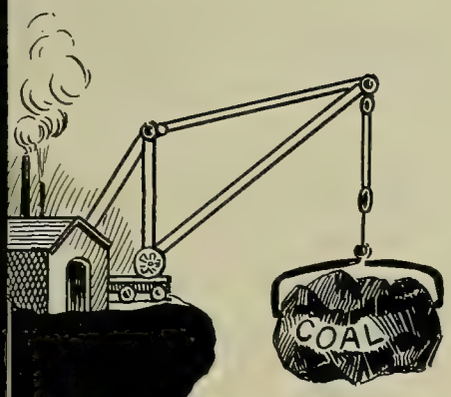

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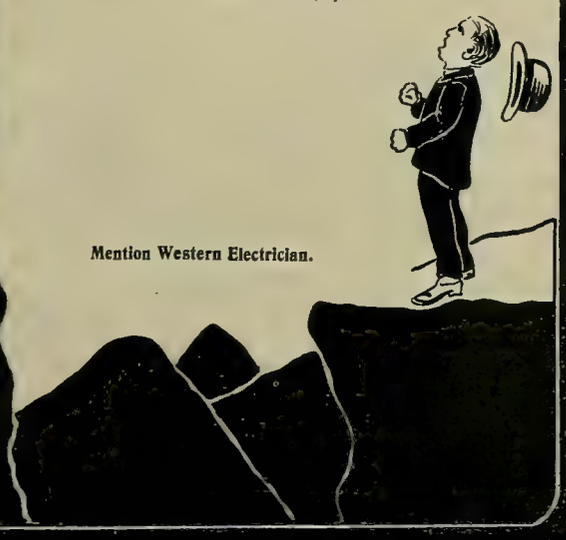

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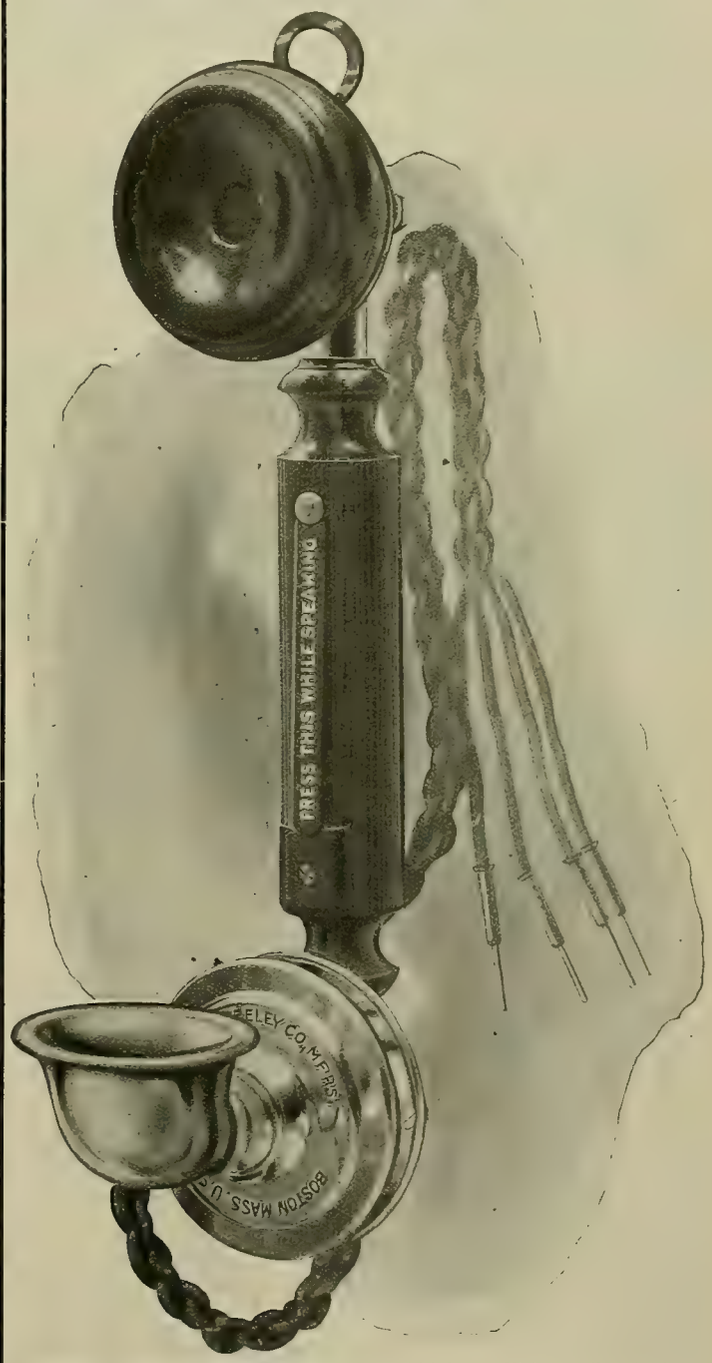

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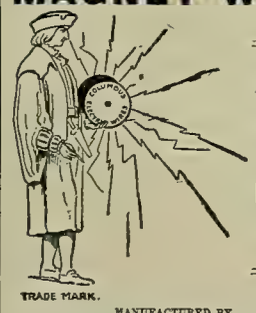

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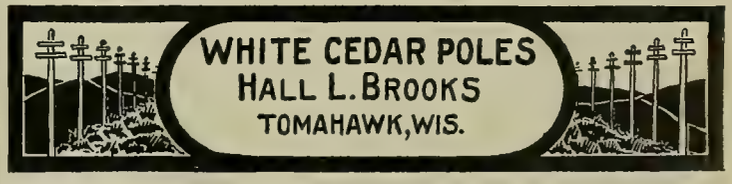

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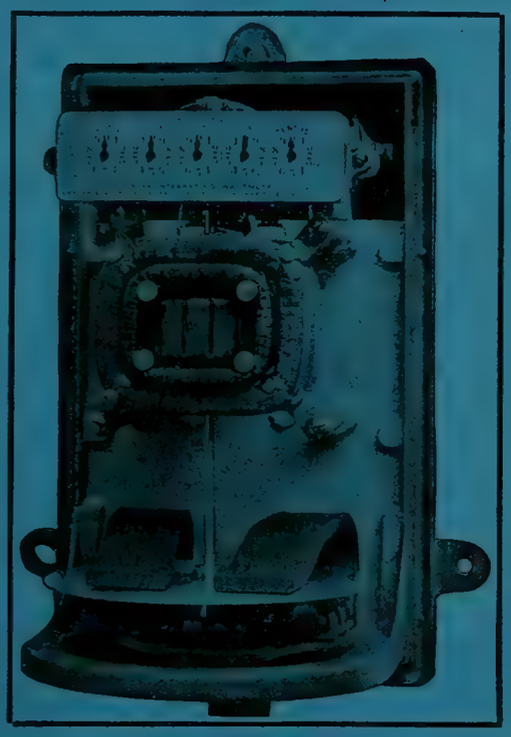

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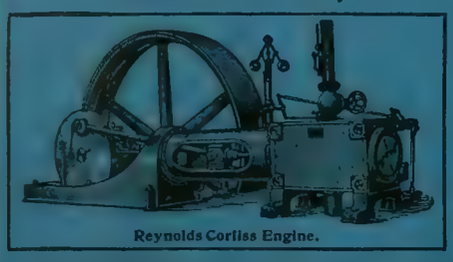

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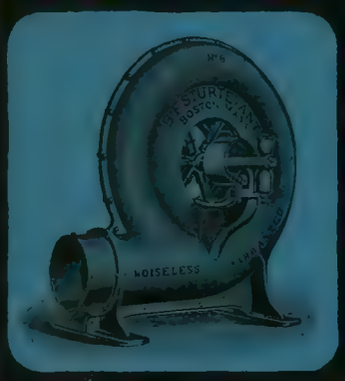

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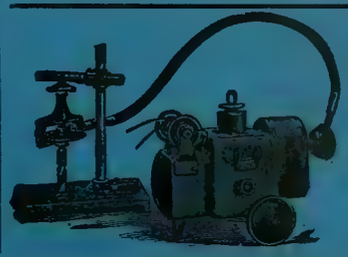
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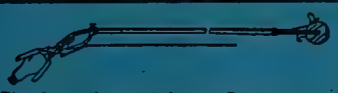
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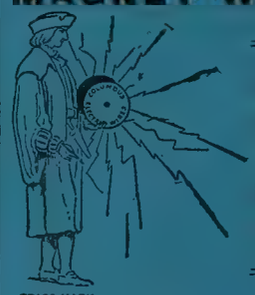
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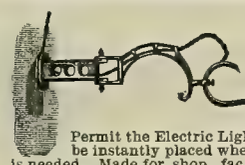

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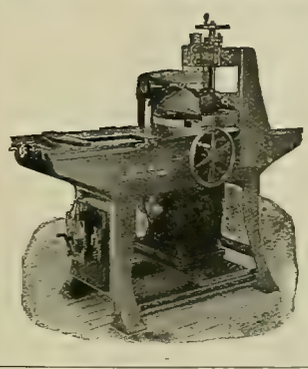

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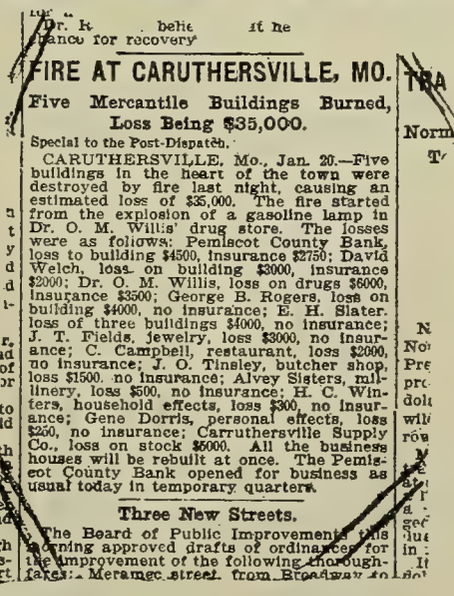

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Five Mercantile Buildings Burned, Loss Being $35,000.

Special to the Post-Dispatch.

CARUTHERSVILLE, Mo., Jan. 20.—Five buildings in the heart of the town were destroyed by fire last night, causing an estimated loss of $35,000. The fire started from the explosion of a gasoline lamp in Dr. O. M. Willis' drug store. The losses were as follows: Pemiscot County Bank, loss to building $4500, insurance $2750; David Welch, loss on building $3000, insurance $2000; Dr. O. M. Willis, loss on drugs $6000, insurance $3500; George B. Rogers, loss on building $4000, no insurance; E. H. Slater, loss of three buildings $4000, no insurance; J. T. Fields, jewelry, loss $3000, no insurance; C. Campbell, restaurant, loss $2000, no insurance; J. O. Tinsley, butcher shop, loss $1500, no insurance; Alvey Sisters, millinery, loss $500, no insurance; H. C. Winters, household effects, loss $300, no insurance; Gene Dorris, personal effects, loss $250, no insurance; Carruthersville Supply Co., loss on stock $5000. All the business houses will be rebuilt at once. The Pemiscot County Bank opened for business as usual today in temporary quarters.

Three New Streets.

The Board of Public Improvements this morning approved drafts of ordinances for the improvement of the following thoroughfares: Meramec street, from Broadway to

LOSS $35,000

The above loss is nothing compared to the business that may get away from one by not keeping up to date.

"We give you MORE LIGHT for LESS MONEY."

The Nernst Lamp is the proper weapon with which to fight gasoline competition. It is the Welsbach mantle of the electric lighting business. Write for circular and prices.

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MISSOURI, IOWA, SOUTHERN ILLINOIS, NEBRASKA, KANSAS, ARKANSAS, TEXAS, LOUISIANA, MISSISSIPPI, TENNESSEE, ALABAMA, KENTUCKY, and the TERRITORIES

1000 Market Street, ST. LOUIS, MO.

TRADE MARK.

GOULD STORAGE BATTERY CO.,

NEW YORK.

STORAGE BATTERY INSTALLATIONS

FOR

RAILROAD REGULATING, LIGHTING, POWER AND ISOLATED PLANTS.

GOULD C, E-M-F BOOSTER SYSTEMS.

SALES OFFICES:

Boston, 53 State Street — Chicago, Rookery Building — New York, 25 West 33d Street

Century Electric Company, San Francisco, Cal. — Pittsburg Engineering Company, Pittsburg, Pa.

WORKS: DEPEW, N. Y.

Bulletin No. 2, describing "GOULD BOOSTER SYSTEMS," on application.

CLASSIFIED INDEX OF ADVERTISEMENTS.

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Inc. El. Lt. Manipulator Co.

Anchors (Tel. & Tel.)
Hector, Wm.
Matthews & Bro., W. N.

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Spies Electric Company.
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Leather Preserver Mfg. Corp.

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Installers of Complete Underground Conduit Systems.

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UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

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MANUFACTURERS OF

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AND

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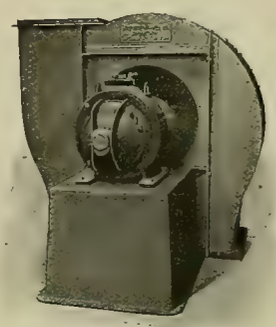

DESCRIPTIVE BULLETIN No. 3020 SENT ON REQUEST.

Western Electric Company

Chicago
Saint Louis

New York
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424 PAGES. ILLUSTRATED. PRICE $2.50.

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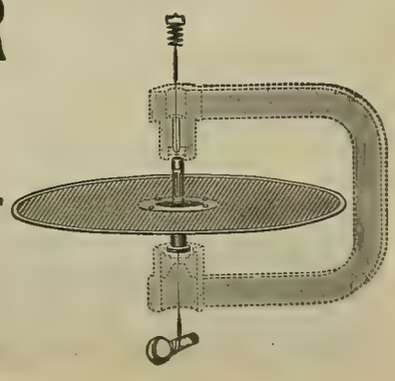
FLOTATION IN AIR

OF THE MOVING PARTS OF
STANLEY RECORDING WATTMETERS
FOR ALTERNATING CURRENT
IS ACCOMPLISHED BY

MAGNETIC SUSPENSION.

NO WEAR. NO LOST REVENUE.
NO FRICTION. ALL CURRENT USED RECORDED.

SEND FOR DESCRIPTION AND BOOK FULL OF GOOD INFORMATION
"ABOUT METERS."



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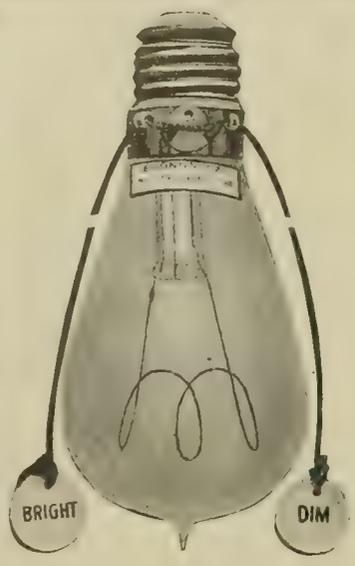

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DON'T WORRY

About any stories concerning infringement of turn down lamps.

We hear once in a while that somebody is infringing alleged patents.

WE ARE NOT THE PEOPLE.

We own patents on the Economical Turn-Down Lamp, ARE ADVISED THAT THEY ARE VALID, propose to make and market the Economical Lamp and

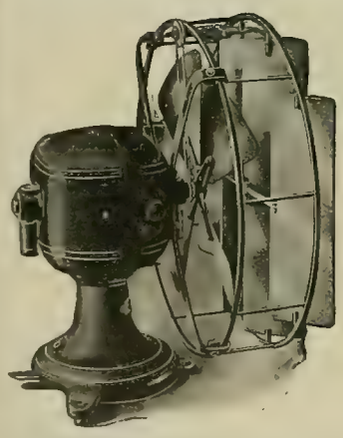
WILL PROTECT OUR CUSTOMERS

Against Damages and Suits for Alleged Infringement.

The Economical Lamp is superior to any other of similar intent and we have sold more in the past three months, as a consequence, than have ever been put on the market before in a like period.

THE ECONOMICAL ELECTRIC LAMP CO., 123 Liberty St., New York

NO ONE KNOWS BETTER THAN OUR COMPETITORS THAT OUR PATENTS ARE VALID.



12-inch Desk Fan with Coleman Guard and Deflector Attached.

THE DIEHL FAN CATALOGUE

FOR 1903

will describe the Coleman device for diffusing the air over nearly ½ of the circle. Can be attached to any make of Desk Bracket or Trunion Fan. Operates on any speed or angle. Positive in operation, attractive in appearance, simple in construction. Send for prices and catalogue. . . . . .

We will also describe a new CEILING FAN, with and without electrolier attachment. 4 blades, 2 or 3 speeds. . . . .

WRITE US AT ONCE.

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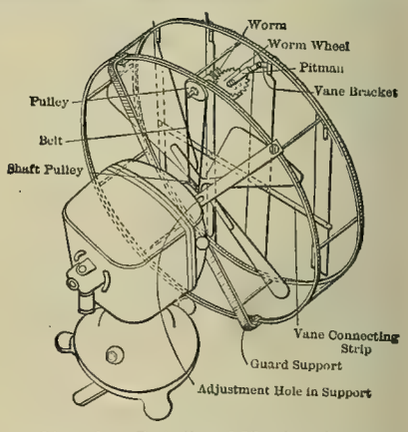

Showing Details of Mechanism. Cannot Get Out of Order.

Crimshaw. Raven White Core. Raven Black Core.

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NEW YORK.

WE SELL

The Highest Price Incandescent Lamp

ON THE MARKET.

Our sales during the year 1902 were
MORE THAN DOUBLE those of 1901

ABRAHAM LINCOLN SAID:

You can fool some of the people all of the time, and all of the people some of the time, but you cannot fool all of the people all of the time.

NOW, IF

THE IMPERIAL

DOUBLE FILAMENT LAMP

were not a great money saver, we could not continue to sell to more of the people all of the time.

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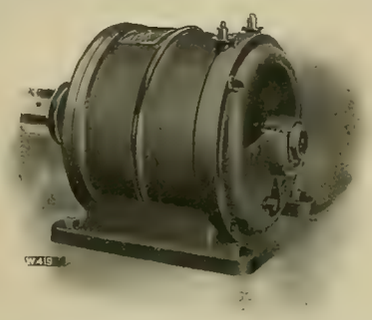

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Single Phase Self Starting A.C. Motors

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Highest All-day Efficiency
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We will ship them on thirty days' trial, should they not be what we claim for them, return and we will pay freight both ways.

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"ELECTRA" Flame Light Carbons are suitable for all types of Open Arc Lamps, either direct or alternating current, with slight charge in regulation of lamp.

HIGHEST INTENSITY

The intensity and brilliancy of light is three times that of regular "ELECTRA," and five times that of other carbons, making them eminently suitable for all special lighting purposes.

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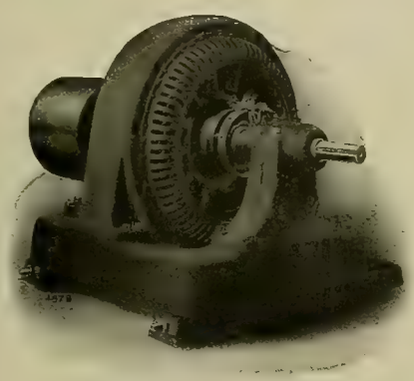

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It is the flexible conduit that saves time.
It is used in any length desired; cuts off easy with a sharp knife.
Wire slips thru easy 'count of its smooth interior.
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A VERY SOFT MICA FOR COMMUTATOR INSULATION.

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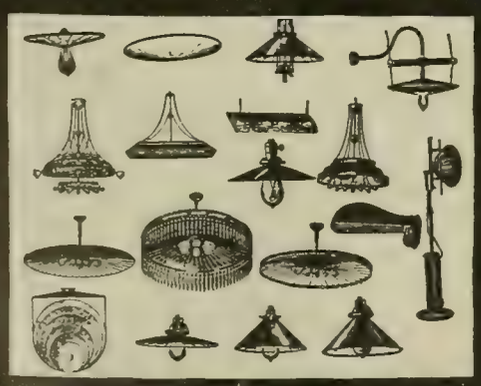

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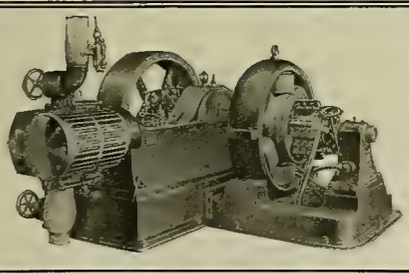

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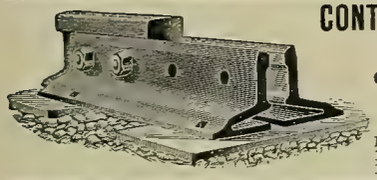

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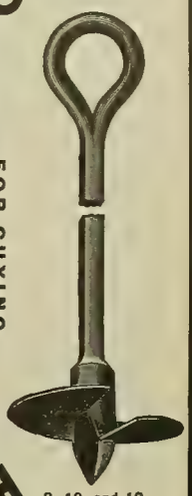

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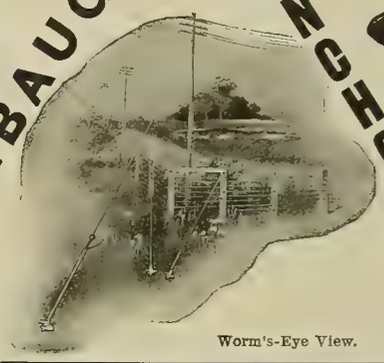

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This cut represents the Maxstadt patent improved American Joint, ready for use. Made in copper and tinned steel, for copper and galvanized iron wire. This joint is absolutely perfect and costs less money than any other joint on the market. Our Tinned Steel Joints are especially adapted for iron wire, and give entire satisfaction wherever used. Prices and samples on application.

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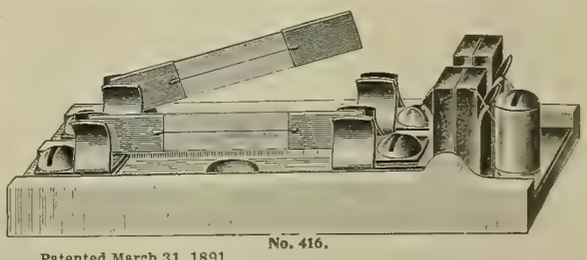

No. 416.

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Manufacturers of the Maxstadt Patent Improved American Joint.
CHICAGO DIE & ELECTRIC CO.,
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First-class salesmen for electrical machinery. Only those possessing an engineering knowledge that will qualify them to completely negotiate the sale of both alternating and direct-current machinery need apply. State experience. All applications treated confidential. Address BOX 168, care Western Electrician, 510 Marquette Bldg., Chicago.

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All dynamos, motors, meters and transformers listed by this Company are at their warehouse ready for immediate delivery.

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Alternators 125-133 cycles, 1,100 volts.
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Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

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Electric-light plant located in Western Indiana. Price $8,000, part time. Gross receipts $5,000 last year. Will show net income $3,000. First-class condition—20-year franchise. For full particulars address J. G. POMEROY, 309 Dearborn St., Chicago.

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1 New 75 K. W. Wood alternator 125 cycle, latest type, $890. 2-1300 light Slattery alternators, $400. 2-1500 light Ft. Wayne alternators, 1 Slattery type with new toothed armatures, $550 each. 1 2000 light Ft. Wayne alternator, $600.

1-60 K. W. Westinghouse new toothed armature, $475. 1-60 General Electric alternator new toothed armature, $450. 1-750 light Slattery alternator, $275.

1-20 light Wood arc dynamo, $90. 1-30 light Sperry arc dynamo, $100. 1-40 light Wood arc dynamo, $175.

3-50 light 1200 C. P. T. H. (Ring armatures), $250 each. 1-75 light 1200 C. P. Wood $325. T. H. M 2, M 12, K 2 and K 12 arc lamps in good condition, $3.75 each. Wood arc lamps, $5.00 each. Shallenberger and Schaefer meters, $3.25 each. Duncan meters, $4.50 each. Thomson meters, $8.75 each. General Electric type F transformers, $5.00 each up. Send for complete list.

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Light Plant for Sale.

Notice is hereby given that sealed proposals will be received up to 6 o'clock P. M. Monday, February 16, 1903, by the City Clerk or Mayor of the City of Dexter, Missouri, for the sale of the electric-light plant now operated by said city.

Bids will also be taken for furnishing the city with from 6 to 12 arc lights and 15 clusters (3 to cluster) of 32 c.-p. to each lamp. Liberal 20-year franchise will be given to purchaser, which can be had on application February 1st. Certified checks of $500 must accompany bids.

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500-VOLT MOTORS, FROM TWO TO FIFTEEN HORSEPOWER.

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FOR SALE.

A lot of new rheostat frames, without resistance wires, cheap. Old material and machinery of all kinds purchased.

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For Sale, four 60-K. W. Edison Generators, 500 Volts, F. O. B. Cars, Hamilton, Ohio. Each $450

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Above six boilers in Waterbury, Conn.
Two B. & W., 275 H. P. each, 140 lbs.
Now operating at Slater Cotton Company, Pawtucket, Rhode Island.
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One Heine, 310 H. P. 140 lbs
Two Heine 325 H. P. each, 140 lbs.
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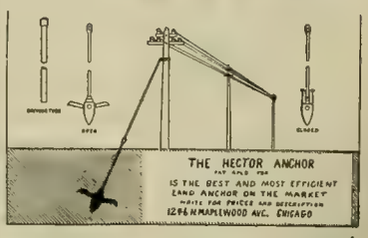

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13 and 18x24 200 H. P. Atlas Tandem Compound Automatic.
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One 325 H. P. Heine Watertube Boiler.
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Single and Duplex Pumps, all sizes.
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RETURN TUBULARS all sizes

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2-150 K. W. G. E., 60 cycle, 3 phase, 2080-2300 volts.
1-216 K. W. Stanley, 2 phase 133 cycles, 1200 volts.
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4- 60 K. W. G. E., S. P., 125 c.
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(1) Automatic Signaling Device for Railroads:
Number 334,194, January 12, 1886.
(2) Electric Welding and Tempering:
Number 370,282, September 20, 1887;
" 386,088, July 10, 1888;
" 402,107, April 23, 1889;
" 402,108, April 23, 1889;
" 444,855, January 20, 1891;
" 453,162, May 26, 1891;
" 453,163, May 26, 1891;
" 453,164, May 26, 1891;
" 564 453, July 21, 1896;
" 499,040, June 6, 1893.
Applications:
Serial Number 280,521, filed July 20, 1888;
" " 285,555, " Sept 15, 1888;
" " 301,915, " March 5, 1889;
" " 457,479, " Jan. 6, 1893;
" " 473,878, " May 11, 1893.
(3) Electric Riveting:
Number 403,374, May 14, 1889;
" 404,306, May 28, 1889;
" 452,042, May 12, 1891;
" 465,089, December 15, 1891.
(4) Electric Soldering:
Number 485,017, October 25, 1892.
(5) Electric Heating:
Number 381,815, April 24, 1888;
" 381,816, April 24, 1888;
" 381,817, April 24, 1888;
" 381,818, April 24, 1888;
" 381,819, April 24, 1888.
Applications:
Serial Number 266,710, filed March 9, 1888;
" " 270,245, " April 11, 1888;
" " 270,246, " April 11, 1888.
(6) Induction Coils. Dynamo Electric Machines and Motors:
Number 380,138, March 27, 1888 (Coil).
" 381,421, April 17, 1888 (Generator).
" 390,904, October 9, 1888 (Motor).
" 390,905, October 9, 1888 (Generator).
" 390,906, October 9, 1888 (Generator).
(7) Overhead Conductors for Electric Railways:
Number 392,757, filed November 13, 1888.
Application:
Serial Number 250,090, filed September 21, 1887.
(8) Brake and Traction Systems:
Number 356,963, Feb. 1, 1887; } Subject to Licence to Otis Elevator Co. for Elevators.
" 356,964, Feb. 1, 1887; }
" 452,041, May 12, 1891.
Application:
Serial Number 242,122, filed January 22,1887.
(9) Conduits for Electric and Cable Railways;
Number 338,556, March 23, 1886;
" 352 265, November 9, 1886;
" 370,283, September 20, 1887;
" 383,770, May 29, 1888;
" 386,085, July 10, 1888;
" 386,087, July 10, 1888;
" 409,757, August 27, 1889;
" 409,756 August 27, 1889.
(10) Electric Railway System:
Number 386,086, July 10, 1888;
" 409,237, August 20, 1889;
" 411,301, September 17, 1889;
" 417,338, December 17, 1889.
Applications:
Serial Number 188,083, filed January 9, 1886;
" " 368,194, filed Oct. 15, 1890;
" " 368,195, filed Oct. 15, 1890;
" " 395,231 filed June 5, 1891.
(11) Railway Systems, Transformer:
Number 402,971, May 7, 1889;
" 431,482, July 1, 1890;
" 622,865, April 11, 1899. (See note below).
Applications:
Serial Number 248,405, filed Aug. 31, 1887.
" " 298,726, filed Feb. 5, 1889.
(12) Induction Railway:
Number 458,859, September 1, 1891.
Applications:
Serial Number 429,182, filed April 14, 1892.
" " 442,058, filed Aug. 3, 1892.
(13) Apparatus for Removing Ice and Snow from Railway Tracks:
Number 390,619, October 2, 1888.

Note: Sale of patent No. 622,865 subject to the terms and conditions of agreement between Ries & Henderson and George Westinghouse, dated November 22, 1893. Recorded Liber V sixty-three, page four hundred and six of transfer of patents.

The foregoing patents and the inventions described in above applications will be offered for sale by public auction by the undersigned, at the Real Estate Exchange, southwest corner of Lexington and Saint Paul Streets, Baltimore, Maryland, on Tuesday, the 3rd day of March, 1903, at 1 o'clock P. M.

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1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
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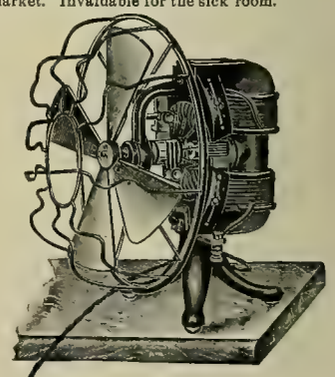

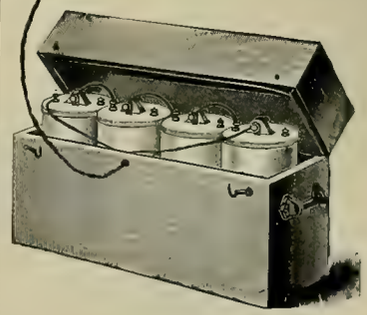

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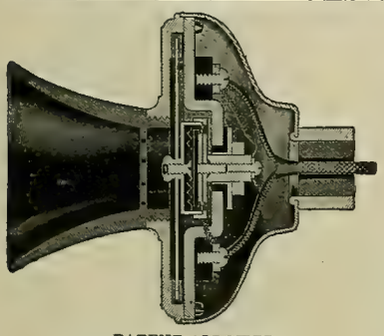

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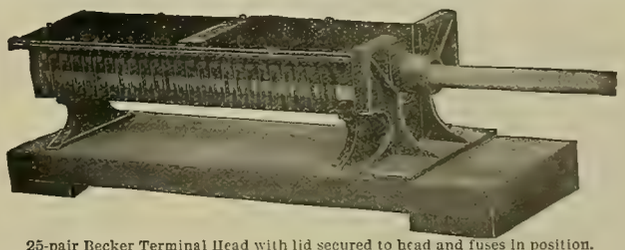

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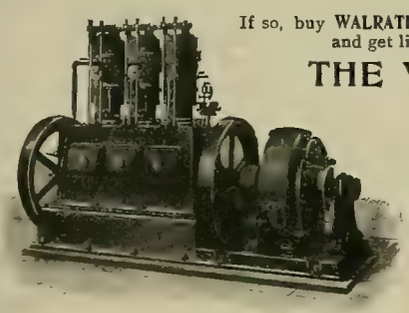

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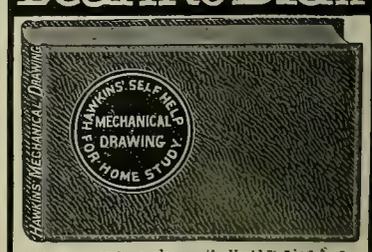

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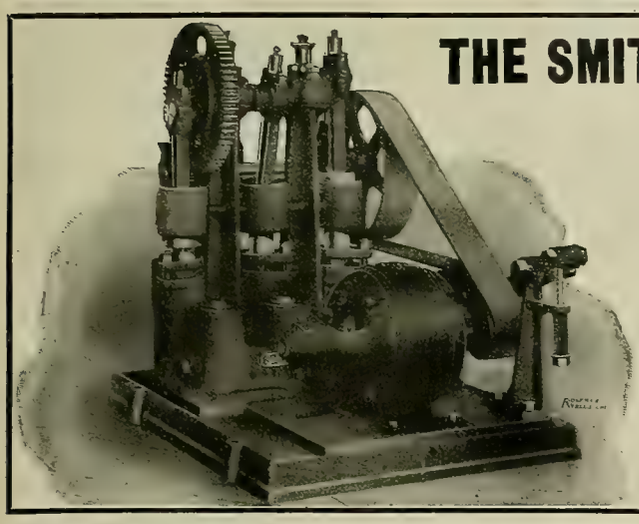

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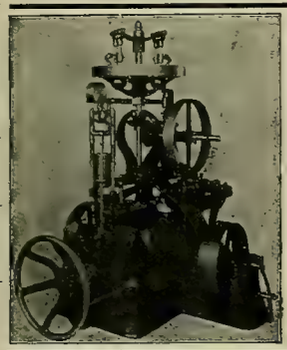

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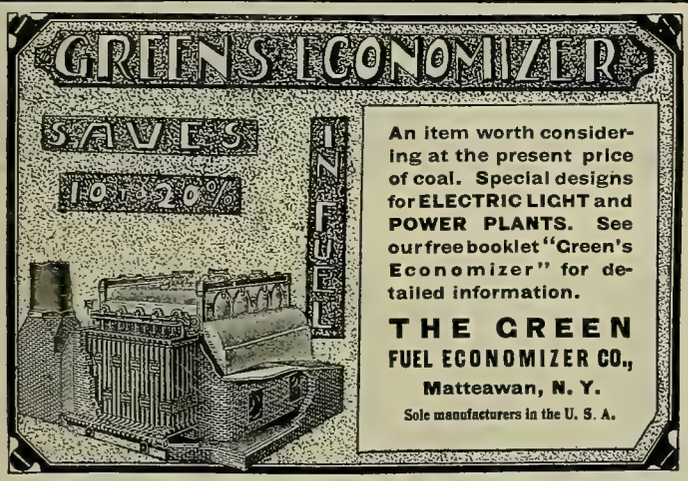

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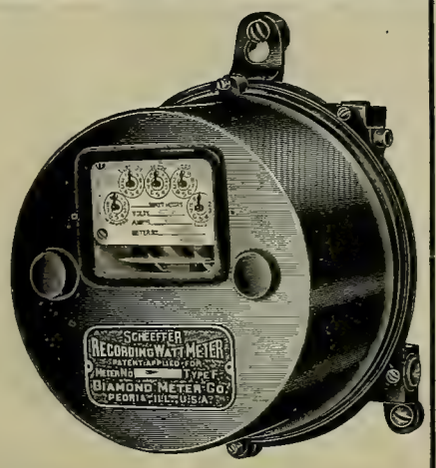

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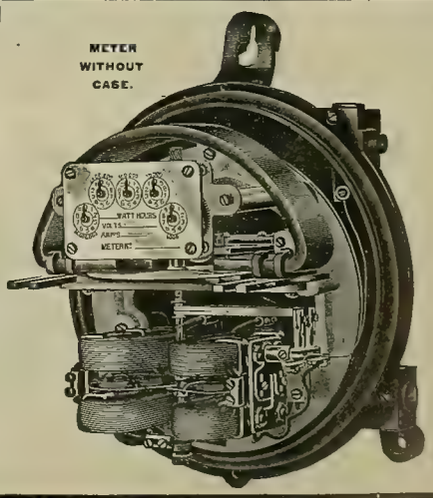

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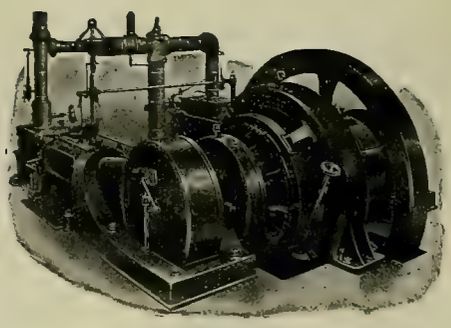

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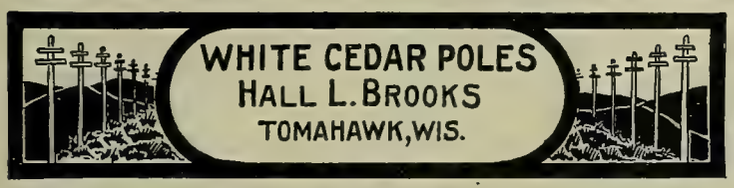

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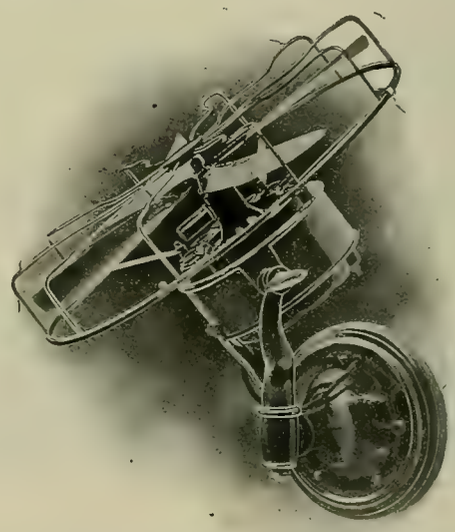

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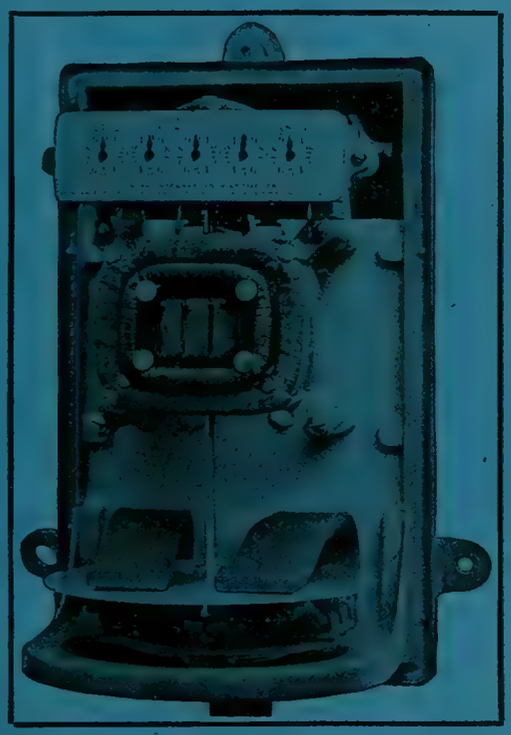

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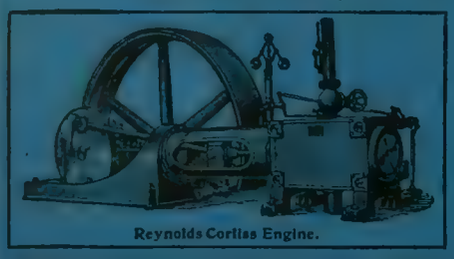
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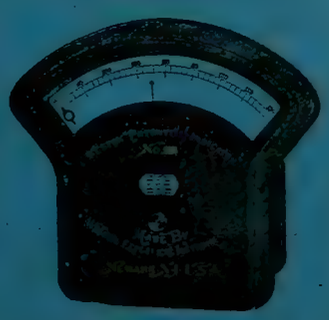
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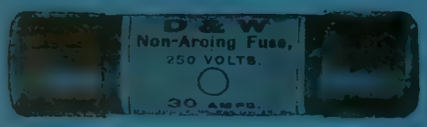

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Arc Lamps,
Circuit Breakers, Etc., Etc.

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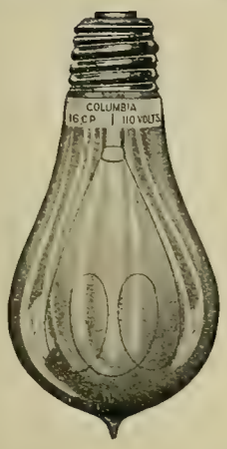

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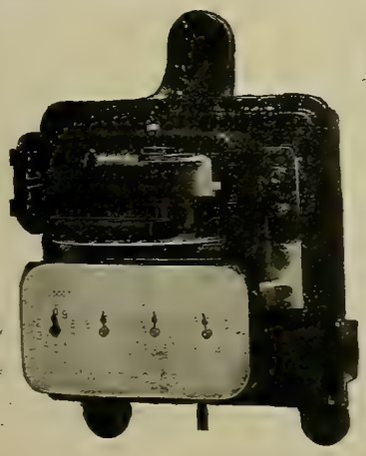

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TYPE "G."

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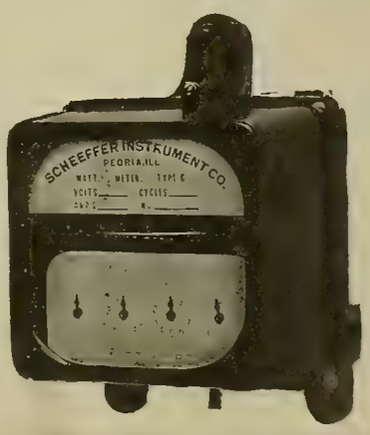

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Catalogue 27.

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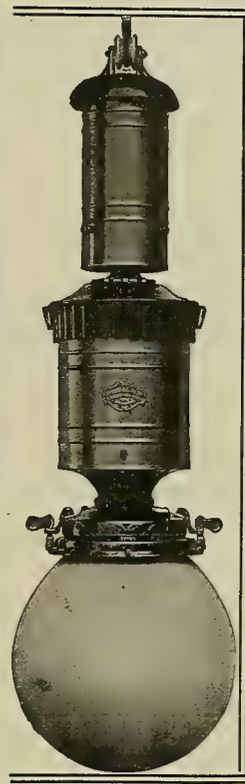

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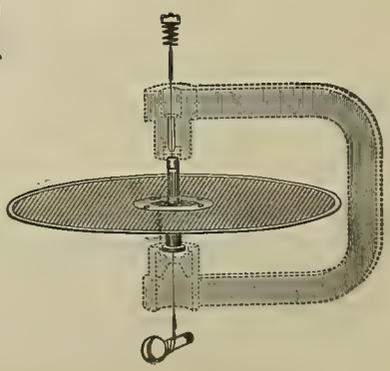

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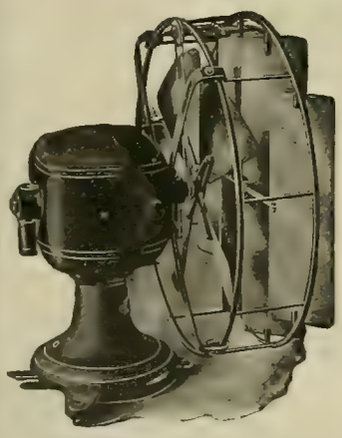

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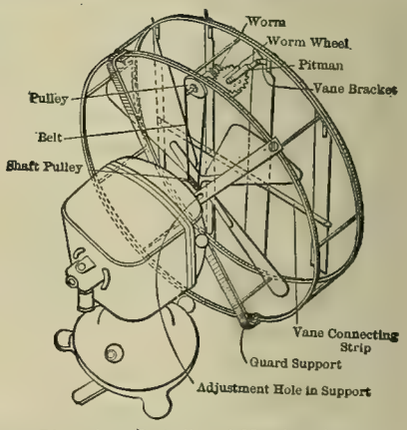

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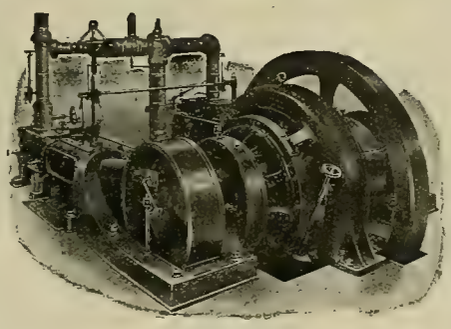

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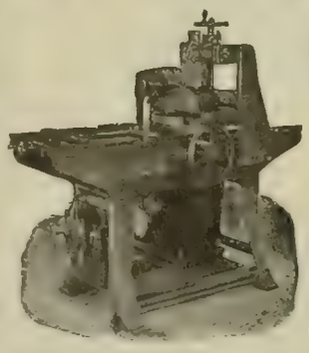

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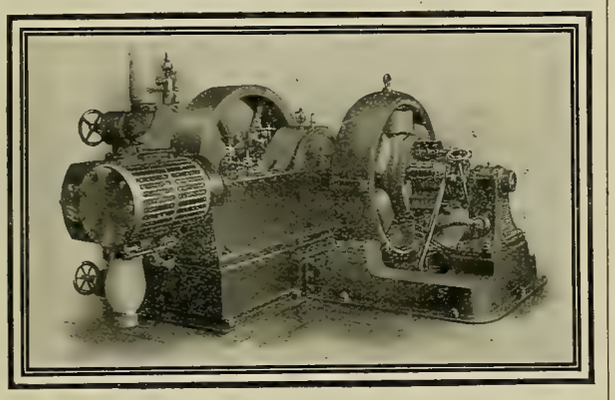

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EVER SPILL YOUR ACID BOTTLE?
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The Simplest, Most Practical and Economical Turn-down Electric Lamp ever Invented.
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Style 1—Pull string for bright or dim. Style 2—For variation in light turn bulb one way or the other. Write for booklet and prices. All voltages and bases.
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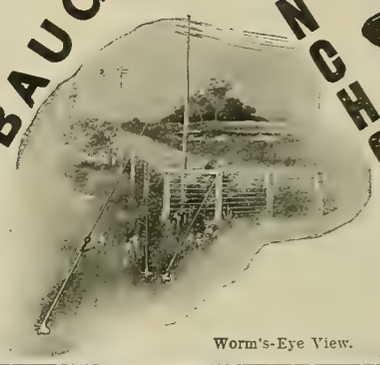
FOR GUYING FENCES, POLES, SIGNS and All Light Strains.

3½, 5 and 6 inch.



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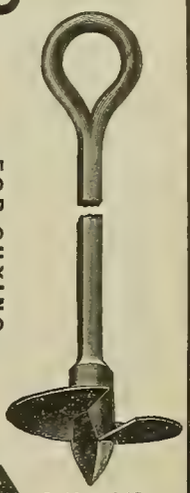

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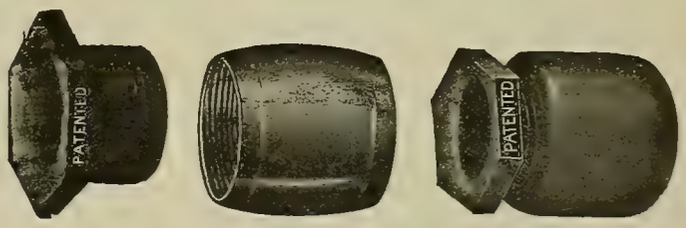
IN YOUR JUNCTION AND OUTLET BOXES.



IT SAVES IN { COST, LABOR OF INSTALLING, ECONOMY OF SPACE IN BOX.

It Makes Rigid Connection Between Box and Conduit. No Other Combination Leaves so Much Working Space in the Box.—This is of Great Importance in Switch Boxes.

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(SOLE MANUFACTURERS.)
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WESTERN REPRESENTATIVE.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

AFTER MARCH 15th. Ten years' experience with steam, electrical and water power plants. Understand polyphase work and modern transformer practice. Can handle your meter system to the satisfaction of yourself and your customers. Just finished installing 500 H. P. steam and water power plant. Western location preferred. Address BOX 175, care Western Electrician.

POSITION WANTED.

As chief engineer and electrician, thoroughly practical and technical in automatic, high speed and Corliss engines and all kinds of electrical machines. Good on figuring for the economy of fuel, etc. Own indicator and testing instruments. Married. **Strictly sober.** References A1. Address BOX 171, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED.

Swiss (9 months in the country) with good technical education, 3 years' shop and 7 years' draughting room experience, wishes steady position with prosperous firm. Can furnish best of references as construction engineer. Salary wanted $80 per month. Address BOX 174, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Salesman with experience in selling direct-current machinery by Chicago office of one of the oldest manufacturers of direct-current machinery. Applicants must have knowledge of engineering and be well recommended. State experience and full particulars. Address BOX 172, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Experienced electrical engineer to take charge of electric-light plant and also of large motor installations in several large manufacturing concerns in a town of 15,000. He must be thoroughly conversant with the repairing of generators, motors, etc., and with station work in general; must also be able to take charge of overhead lines, meters and office work. Plant to be remodeled. Good opportunity to advance in position and pay. State age, references, salary expected, etc. and enclose photo. Address immediately BOX 173, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

First-class salesmen for electrical machinery. Only those possessing an engineering knowledge that will qualify them to completely negotiate the sale of both alternating and direct-current machinery need apply. State experience. All applications treated confidential. Address BOX 168, care Western Electrician, 510 Marquette Bldg., Chicago.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings). Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
6— 60 K. W. General Electric A. 60.
2— 60 K. W. Westinghouse.

Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

IT'S UP TO YOU.

We pay highest market prices for

SCRAP COPPER, BRASS AND PLATINUM, ALSO Incandescent Lamp Bases, Etc.

WRITE US.

We Manufacture Copper Hard Babbitt

the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.

GREAT WESTERN SMELTING AND REFINING CO., CHICAGO.

WANTED.

There is an opening for a beginner, at moderate salary, on the editorial staff of a technical journal. Applicants should state in their own handwriting, qualifications and salary expected, Address BOX 167, care Western Electrician. 510 Marquette Bldg., Chicago.

WANTED.

An established manufacturing company in the electric railway supply line requires several additional salesmen. State age, previous experience, salary required etc. Must be thoroughly competent to handle first-class trade. Address BOX 164, care Western Electrician.

WANTED.

A well known manufacturers' agent, located in Chicago, desires to represent manufacturers of electrical specialties. Have large acquaintance among the trade. Address BOX 170, care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.

200 H. P. boiler; 120 H. P. engine; one 24 inch, one 14 inch, 62 feet double leather belts; one smoke stack 40 feet by 33 inches; one 60 K.W., one 120 K. W. alternator; all now in operation, at bargain prices to make room for larger plant to be installed. CITY GAS & ELECTRIC CO., Murfreesboro, Tenn.

SALES AGENTS WANTED.

Several men wanted, of first-class ability, persistent industry, experience and intimate acquaintance with managers and chief officials of Electric Light and Power Companies throughout the United States, to sell electrical articles widely known and acknowledged as of the highest class and needed in quantities.

Technical electrical knowledge helpful and preferable but not strictly necessary. Applications will be held entirely confidential, but to enable advertisers to consider them understandingly they must be complete and explicit, with all requisite information including previous experience and expectations. None other will receive any attention. Excellent opportunity for right men. Address

Box 169, Care of WESTERN ELECTRICIAN, Chicago, Ill.

McNAMARA BROS.

ELECTRIC SWITCHBOARDS, SLATE AND MARBLE.

Write for Catalogue B. **Fair Haven, Vt.**

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500-VOLT MOTORS, FROM TWO TO FIFTEEN HORSEPOWER.

ROSE ELECTRIC CO., ST. LOUIS.

FOR SALE.

2-100 K. W. General Electric 500-volt generators, $975 each. 1-100 K. W. 250-volt General Electric generator, $975. 1-80 K.W. 500-volt Sprague, $500. 1-75 K. W. Rae 500-volt, $400.

1 New 75 K. W. Wood alternator 125 cycle, latest type, $890. 2-1300 light Slattery alternators, $400. 2-1500 light Ft. Wayne alternators, 1 Slattery type with new toothed armatures, $550 each. 1 2000 light Ft. Wayne alternator, $600.

1-60 K. W. Westinghouse new toothed armature, $475. 1-60 General Electric alternator new toothed armature, $450. 1-750 light Slattery alternator, $275.

1-20 light Wood arc dynamo, $90. 1-30 light Sperry arc dynamo, $100. 1-40 light Wood arc dynamo, $175.

3-50 light 1200 C. P. T. H. (Ring armatures), $250 each. 1-75 light 1200 C. P. Wood $325. T. H. M 2, M 12, K 2 and K 12 arc lamps in good condition, $3.75 each. Wood arc lamps, $5.00 each. Shallenberger and Schaefer meters, $3.25 each. Duncan meters, $4.50 each. Thomson meters, $8.75 each. General Electric type F transformers, $5.00 each up. Send for complete list.

NATIONAL STAMPING WORKS,
Cor. Michigan St. and La Salle Ave., Chicago, Ill.

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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
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RY. GENERATORS.
4-500 K. W. Gen'l Electric.
1-250 K.W. Westinghouse.
1-150 K. W. Westinghouse.
1-120 K. W. C. & C., 6 pole.
2-100 K. W. C. & C., 6 pole.

ENGINES.
3-18x30x16 Westinghouse.
2-15x23x17 McI. & Seymour.
2-15x24x18 Armington & Sims
18x14 ½x10½ McI. & Seymour
2-22x33 Buckeye (new).
1-22x48 Harris Corliss.
1-20x48 Wheelock Corliss.
1-18x42 Allis Corliss.
1-14x36 Allis Corliss.
1-18½x18 McI. & Seymour
2-13x12 Armington & Sims.

BOILERS.
1-375 H. P. National watertube
1-250 H. P. Sterling watertube.
3-267 H. P. Abendroth & Root.
1-100 H. P. Babcock & Wilcox.
RETURN TUBULARS all sizes

ALTERNATORS.
2-150 K. W. G. E., 60 cycle, 3 phase, 2080-2300 volts.
1-216 K. W. Stanley, 2 phase 133 cycles, 1200 volts.
1-150 K.W. Stanley 2 p., 125 c.
2-120 K. W. G. E., 125 cycle, single phase, 1100-2200 volts.
2-75 K. W. Stanley, 2 phase, 133 cycle, 1100-2200 volts.
1-60 K. W. Stanley, 2 p., 60 c.
2-60 K. W. Stanley, 2 p., 125 c.
4- 60 K. W. G. E., S. P., 125 c.
2-30 K. W. Westinghouse 125 cycle, single phase.

DIRECT CONNECTED.
1-80 K. W. Jenny, 110 volt, d. c. Russell, 4 valve engine.
4-73 K. W. G. E., 110 volt, d.c. Ames tandem engines.
1-50 K. W. West. Elec., 110 volts, d. c. Ball & Wood.
1-50 K. W. Walker, 110 v., d. c. Russell engine (new).
1-43 K. W. Westinghouse, 110 v., d.c. Russell engine.
1-30 K. W. C. & C., 110 v., d. c. Atlas engine.
1-5 K.W. Perritt, 110 v., d.c. double Sturtevant engine.
1-4 K. W. N. Elec., 110 v., d. c. automatic engine (new).
1-3 K.W.N. Electric, 110 v., d. c. auto. en., (new)

Motors & Dynamos.
110 and 220 and 500 volts.

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114, 116, 118 Liberty Street, NEW YORK.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

U.S. METAL POLISH 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE. GEO. W. HOFFMAN

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180 K. W. 60 cycle G. E., 2,000 volt.
150 K. W. 60 cycle Ft. Wayne, 1,100 volt.
120 K. W. 60 cycle G. E., 2,000 volt.
90 K. W. 60 cycle G. E., 2,000 volt.
200 K. W. 60 cycle Stanley, 2 phase.
150 K. W. 60 cycle Stanley, 3 phase.
175 K. W. Edison bipolar railway generator.
100 K. W. Edison 140 volt.
65 K. W. Jenny 140 volt.
500 H. P. Cooper Corliss Engine.
28x48 Allis Corliss Engine.
10x13 Frost Automatic Engine.

Also Motors, Boilers, Pumps, etc.

Write for our Stock List number 51

ILLINOIS MAINTENANCE COMPANY. 1625 MARQUETTE BLDG. CHICAGO.

NOTICE TO ELECTRIC LIGHT CONTRACTORS.

Public notice is hereby given that the City Council of the City of Muscatine, Iowa, will receive sealed proposals until 7:30 o'clock p. m., on the 10th day of March 1903, for lighting the streets, public grounds and public buildings of said city with electricity, for a period of ten years from the 1st day of October, 1903, and for furnishing electric light and power to consumers thereof in said city.

The estimated quantities of light are as follows:

Fifty (50), or more, arc street lamps burning on a schedule from one-half hour after sunset until one-half hour before sunrise, each and every night in the year.

One hundred (100), or more, arc street lamps burning on a schedule from one-half hour after sunset until 1 o'clock a. m., each and every night in the year.

Bids will be received on lamps operated in series, and on both the alternating and direct currents.

The successful contractor for arc street lighting will be granted a ten-year franchise, for commercial lighting in the City of Muscatine.

A certified check on some bank in the City of Muscatine, for the sum of five thousand dollars, enclosed in a separate sealed envelope, properly endorsed, must accompany each bid. Said check shall be payable to the order of the Treasurer of the City of Muscatine.

Bids will be enclosed in a sealed envelope, addressed to A. K. Raff, City Recorder, and endorsed, "Proposals for Electric Lights."

For a printed copy of specifications, proposals, and the location sheets, etc., address A. K. Raff, City Recorder, Muscatine, Iowa.

The City Council reserves the right to reject any or all bids.

Given by order of the City Council of said city, this 31st day of January, 1903.

A. K. RAFF,
City Recorder.

60-K. W. EDISON, 500-VOLT.

For Sale, four 60-K. W. Edison Generators, 500 Volts, F. O. B. Cars, Hamilton, Ohio. Each $450

ROSE ELECTRIC CO., ST. LOUIS.

FOR SALE. ELECTRICAL CURIOSITIES. JABLOCKOFF CANDLES—used on the early arc lamps—for colleges, laboratories, museums, etc. Old material of all kinds purchased. **WALSH'S SONS & CO.,** 261 Washington St, Newark, N. J.

FOR SALE—Immediate Delivery

3500 Horse Power BABCOCK & WILCOX AND HEINE SAFETY WATER TUBE BOILERS

Two B. & W., 285 H. P. each, 150 lbs.
Three B. & W., 275 H. P. each, 140 lbs.
One B. & W. 175 H. P. 125 lbs.
Above six boilers in Waterbury, Conn.
Two B. & W., 275 H. P. each, 140 lbs.
Now operating at Slater Cotton Company, Pawtucket, Rhode Island.
Two B. & W., 150 H. P. each, 140 lbs.
In Davenport, Iowa.
One Heine, 310 H. P. 140 lbs.
Two Heine 325 H. P. each, 140 lbs.
Now operating at L. Hoster Brewing Company, Columbus, Ohio.

Whitehead Machinery Company
DAVENPORT, IOWA.

CHICAGO EDISON COMPANY REPAIR SHOPS

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Machine and Carpenter Work of All Kinds. Correspondence Solicited.

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Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

PEREMPTORY SALE OF VALUABLE PATENTS.

By virtue of decrees of the Circuit Court of the United States, for the District of Maryland, entered in the case of ALBERT H. HENDERSON vs. ELIAS E. RIES pending in that Court, the undersigned Special Masters were appointed and directed to sell at public sale all of the right, title and interest of the parties to said case in and to the following Letters Patent of the United States, as well as the inventions described in applications for Letters Patent which are now on file in the United States Patent Office, enumerated below, although some or all of the said applications have become forfeited under the Statute for want of prosecution within the statutory period since the last official action upon them; yet it is possible that some or all of the applications might be renewed under the circumstances:

(1) **Automatic Signaling Device for Railroads:**
Number 334,194, January 12, 1886.

(2) **Electric Welding and Tempering:**
Number 370,282, September 20, 1887;
" 386,088, July 10, 1888;
" 402,107, April 23, 1889;
" 402,108, April 23, 1889;
" 444,855, January 20, 1891;
" 453,162, May 26, 1891;
" 453,163, May 26, 1891;
" 453,164, May 26, 1891;
" 564,453, July 21, 1896;
" 499,040, June 6, 1893.
Applications:
Serial Number 280,521, filed July 20, 1888;
" " 285,555, " Sept. 15, 1888;
" " 301,915, " March 5, 1889;
" " 457,479, " Jan. 6, 1893;
" " 473,878, " May 11, 1893.

(3) **Electric Riveting:**
Number 403,374, May 14, 1889;
" 404,306, May 28, 1889;
" 452,042, May 12, 1891;
" 465,089, December 15, 1891.

(4) **Electric Soldering:**
Number 485,017, October 25, 1892.

(5) **Electric Heating:**
Number 381,815, April 24, 1888;
" 381,816, April 24, 1888;
" 381,817, April 24, 1888;
" 381,818, April 24, 1888;
" 381,819, April 24, 1888.
Applications:
Serial Number 266,710, filed March 9, 1888;
" " 270,245, " April 11, 1888;
" " 270,246, " April 11, 1888.

(6) **Induction Coils. Dynamo Electric Machines and Motors:**
Number 380,138, March 27, 1888 (Coil).
" 381,421, April 17, 1888 (Generator).
" 390,904, October 9, 1888 (Motor).
" 390,905, October 9, 1888 (Generator).
" 390,906, October 9, 1888 (Generator).

(7) **Overhead Conductors for Electric Railways:**
Number 392,757, filed November 13, 1888.
Application:
Serial Number 250,090, filed September 21, 1887.

(8) **Brake and Traction Systems:**
Number 356,963, Feb. 1, 1887; } Subject to Licence to Otis Elevator Co. for Elevators.
" 356,964, Feb. 1, 1887; }
" 452,041, May 12, 1891.
Application:
Serial Number 242,122, filed January 22, 1887.

(9) **Conduits for Electric and Cable Railways;**
Number 338,556, March 23, 1886;
" 352,265, November 9, 1886;
" 370,283, September 20, 1887;
" 383,770, May 29, 1888;
" 386,085, July 10, 1888;
" 386,087, July 10, 1888;
" 409,757, August 27, 1889;
" 409,756, August 27, 1889.

(10) **Electric Railway System:**
Number 386,086, July 10, 1888;
" 409,237, August 20, 1889;
" 411,301, September 17, 1889;
" 417,338, December 17, 1889.
Applications:
Serial Number 188,083, filed January 9, 1886;
" " 368,194, filed Oct. 15, 1890;
" " 368,195, filed Oct. 15, 1890;
" " 395,231, filed June 5, 1891.

(11) **Railway Systems, Transformer:**
Number 402,971, May 7, 1889;
" 431,482, July 1, 1890;
" 622,865, April 11, 1899. (See note below).
Applications:
Serial Number 248,405, filed Aug. 31, 1887.
" " 298,726, filed Feb. 5, 1889.

(12) **Induction Railway:**
Number 458,859, September 1, 1891.
Applications:
Serial Number 429,182, filed April 14, 1892.
" " 442,058, filed Aug. 3, 1892.

(13) **Apparatus for Removing Ice and Snow from Railway Tracks:**
Number 390,619, October 2, 1888.

Note: Sale of patent No. 622,865 subject to the terms and conditions of agreement between Ries & Henderson and George Westinghouse, dated November 22, 1893. Recorded Liber V sixty-three, page four hundred and six of transfer of patents.

The foregoing patents and the inventions described in above applications will be offered for sale by public auction by the undersigned, at the Real Estate Exchange, southwest corner of Lexington and Saint Paul Streets, Baltimore, Maryland, on Tuesday, the 3rd day of March, 1903, at 1 o'clock P. M.

The property will first be offered in separate groups as above numbered and will thereafter be offered as an entirety. If the highest bid for the property as an entirety exceeds the aggregate of the highest bids for the separate groups, the highest bid for the property as an entirety will be accepted; otherwise the highest independent bids for the separate groups will be respectively accepted.

Terms: CASH ON RATIFICATION OF SALE. A deposit of $500 will be required at the time and place of sale from the purchaser of each group, or a deposit of $5,000 from the purchaser of the entire property.

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701 Maryland Trust Bldg.
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810 Maryland Trust Bldg.
Baltimore, Md.
SPECIAL MASTERS.

JOHN N. STEELE,
JOHN P. POE,
Counsel.

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Electrical and Steam MACHINERY

DIRECT-CONNECTED UNITS.

300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

187½ kw., Westinghouse, M. P. 8, 120-volt Generator, direct connected to Westinghouse Compound Engine.

50 kw., Westinghouse, 6-pole, 110-volt Compound Generator, with 13x12 Ames Automatic Engine. But little used, as good as new.

50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½-13x12 Armington & Sims Tandem Compound Engine. One year old.

50 kw., Eddy Compound Generator, 125 volts, direct connected to 13x13 Harrisburg Ideal Engine.

25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

25 kw., General Electric, 110 volts, 4-pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—300 kw., G. E., 2,000 volts, 60 cycles, 3-phase.
1—200 kw., Stanley, 2,400 volts, 60 cycles, 2-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
3—150 kw., G. E., 2,300 volts, 60 cycles, 3-phase.
2—120 kw., G. E., 2,000 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1— 60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.
1—30 H. P., Westinghouse, Ind. Motor, 200 volts, 60 cycles, 2-phase.
1—20 H. P., Westinghouse, Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—20 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—10 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.
1—15 H. P., G. E., Ind. Motor, 220 volts, 60 cycles, 2-phase.

RAILWAY GENERATORS.

2—500 kw., 6-pole General Electric.
1—270 kw., 4-pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., Thomson-Houston.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

ENGINES.

12 and 20x36 Slater Engine Tandem Compound.
14x14 Rice Automatic.
16x16 Rice Automatic.
13 and 23x17 Tandem Compound McIntosh & Seymour.
10x18x20 Payne Compound.
13x12 Armington & Sims.
12 and 20x12 Westinghouse Compound.
7x8 Payne.
18x42 Allis-Corliss.
18x48 Geo. H. Corliss.
16x42 Greene.
13x12 Erie Ball.
10½x16½x12 Cross Compound Armington & Sims.

ARC GENERATORS.

No. 12 Brush, 150 light, 9.6 amp.
No. 11 Brush, 125 light, 9.6 amp.
No. 9B Brush, 120 light, 6.6 amp.
M. D. 2 T.-H., 50 light, 9.6 amp.
L. D. 12 T.-H., 75 light, 6.6 amp.
M. 12 T.-H., 45 light, 6.6 amp.

A large assortment of Arc Lamps all in good working order, for direct and alternating currents, series and multiple circuits. Also a fine lot of Transformers, especially General Electric Type H. and Thomson-Houston Type F.

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CHARLES E. DUSTIN CO.

11 Broadway, NEW YORK. Storehouse, ORANGEBURGH, N. Y.

WE BUY OR SELL

Generators and Motors

Engines and Boilers

Recognized a great factor in electrical problems for twenty years.

ARMATURE FIELDS REWOUND.
We make a specialty of Drop Forged Commutator Segments.

FOR SALE.

GENERATORS—500 Volts.

6—Edison, No. 20, 60 K. W., each.....$ 400
6—T. H. D—62, each..... 500
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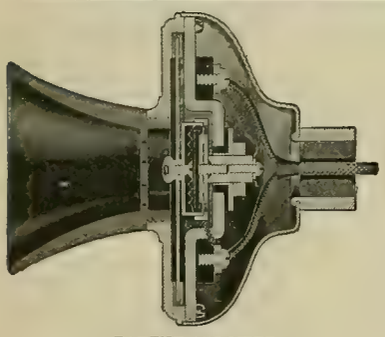

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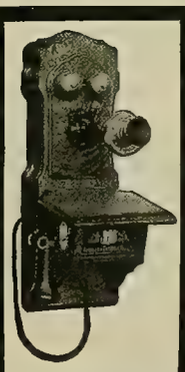

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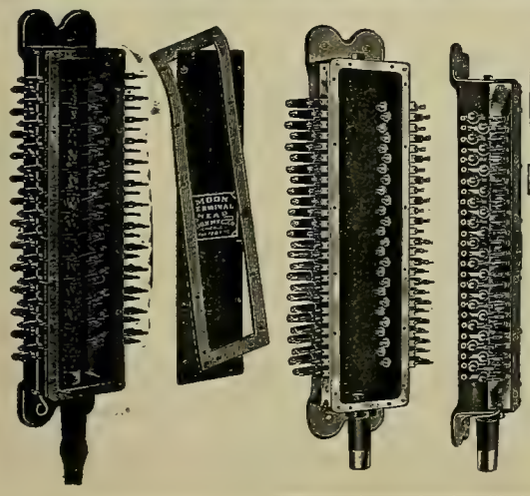

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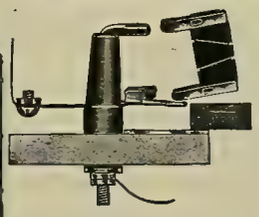

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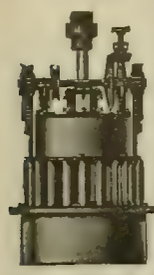

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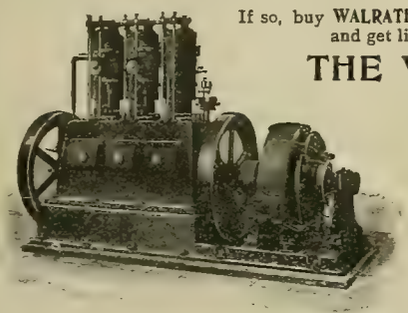

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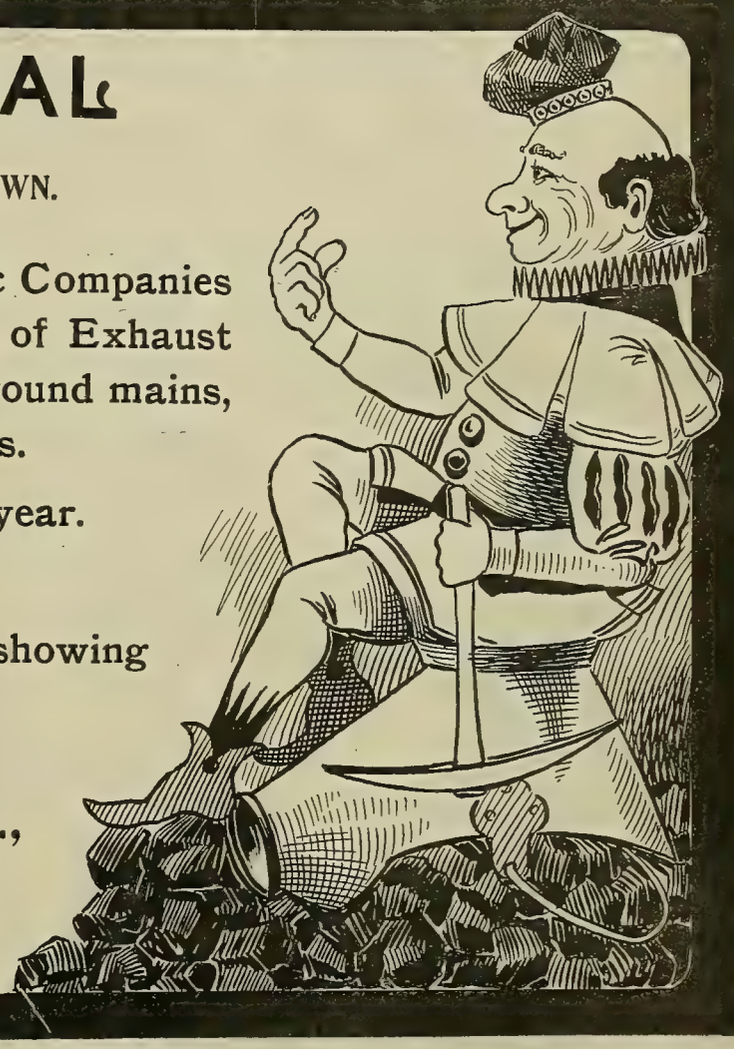

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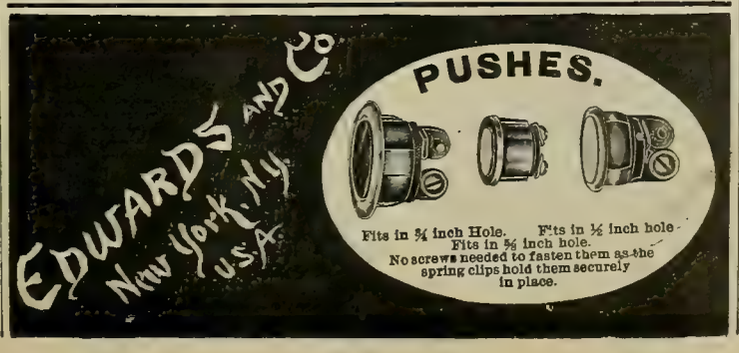

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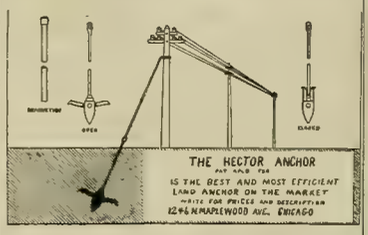

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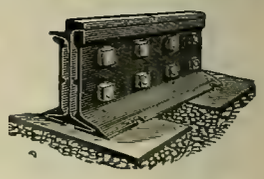

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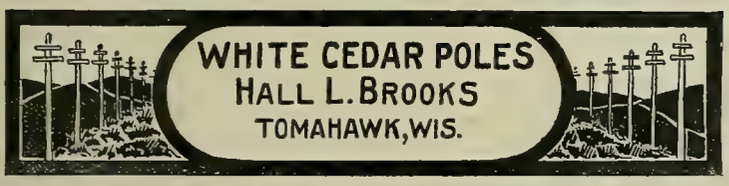

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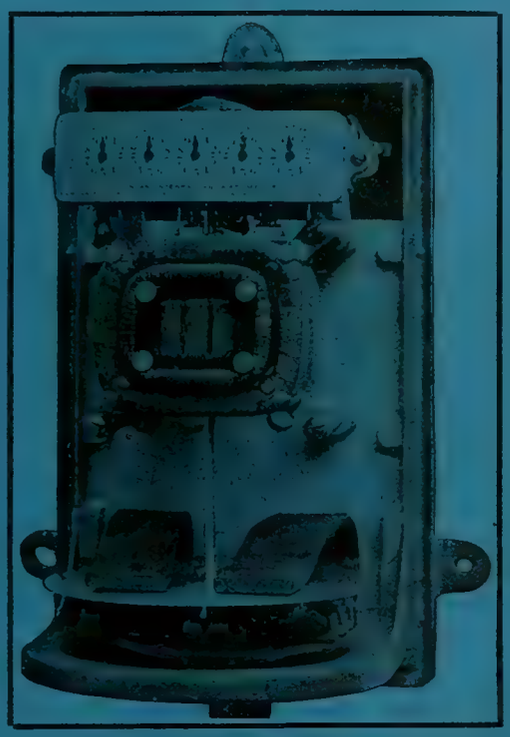

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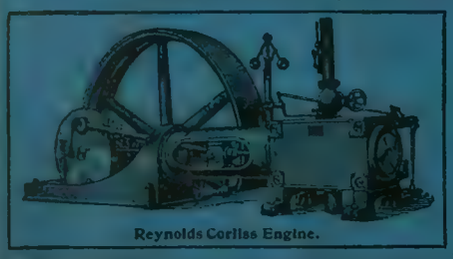

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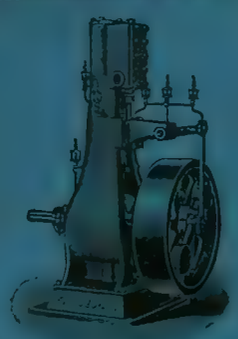

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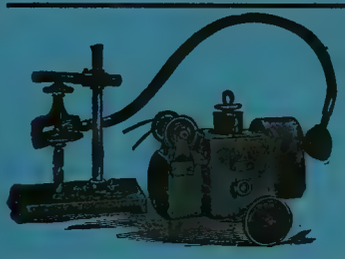
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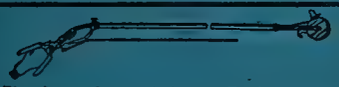
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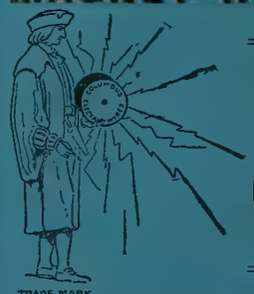
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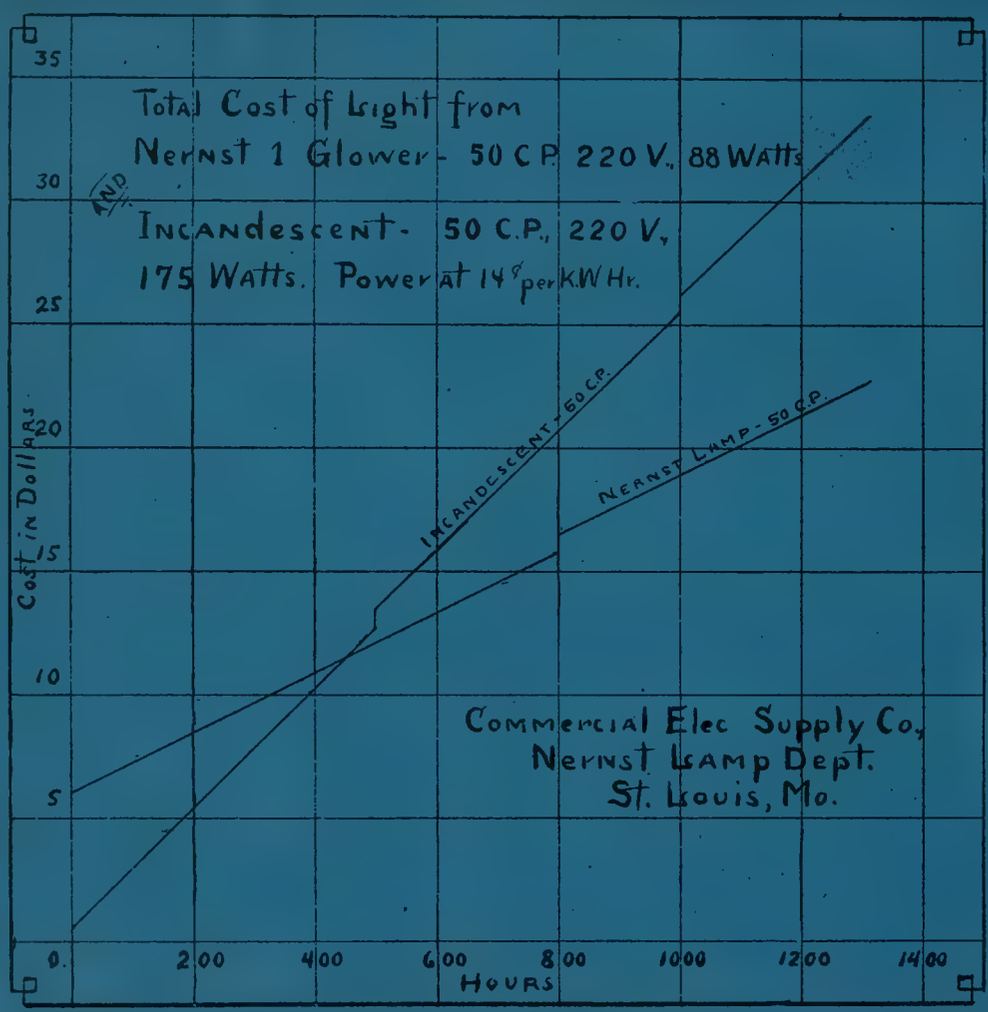

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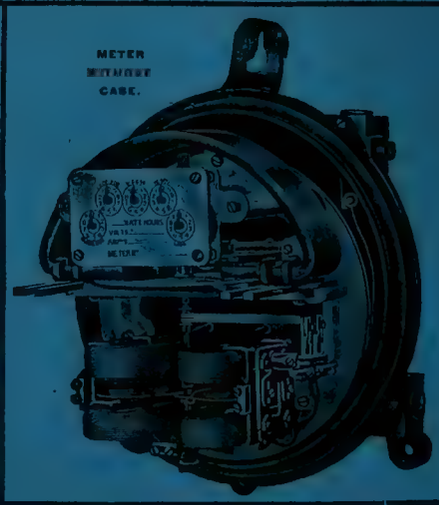

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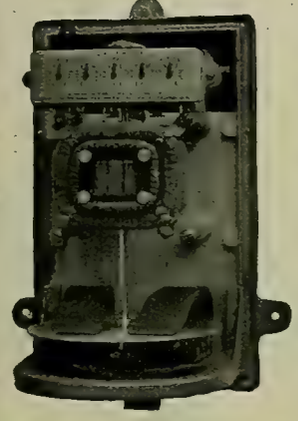

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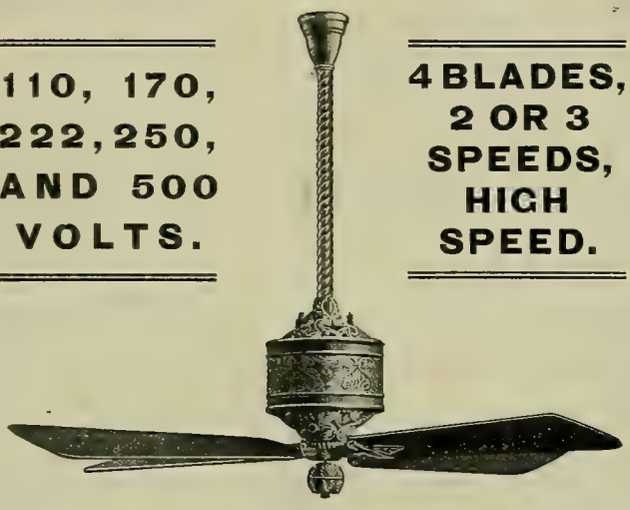

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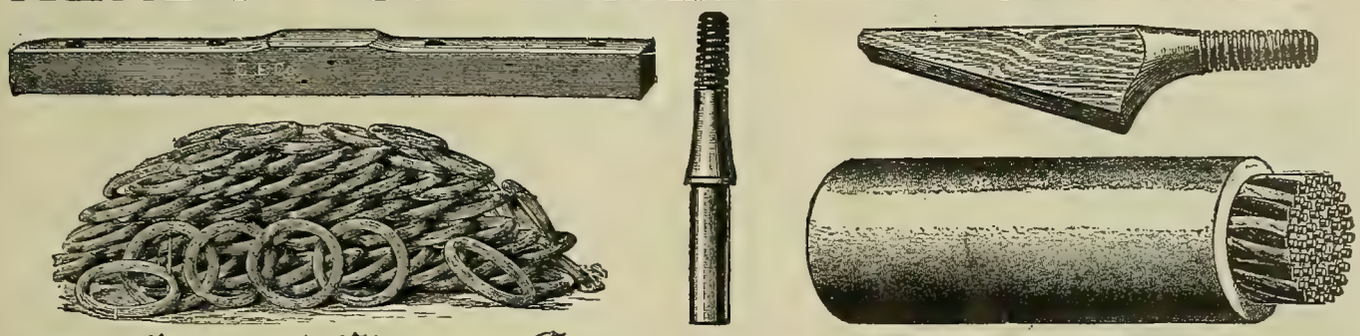

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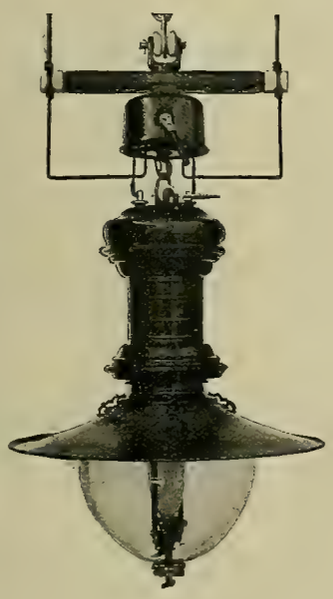

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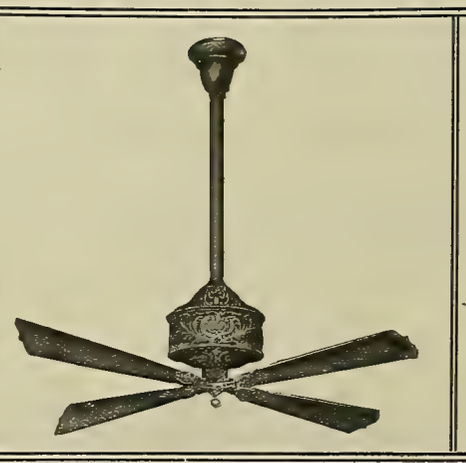

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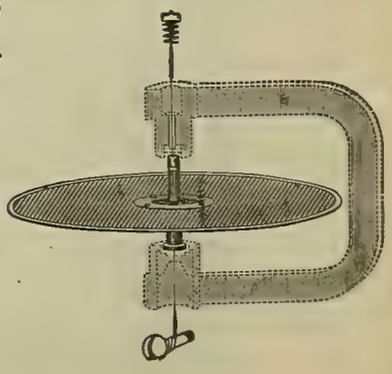

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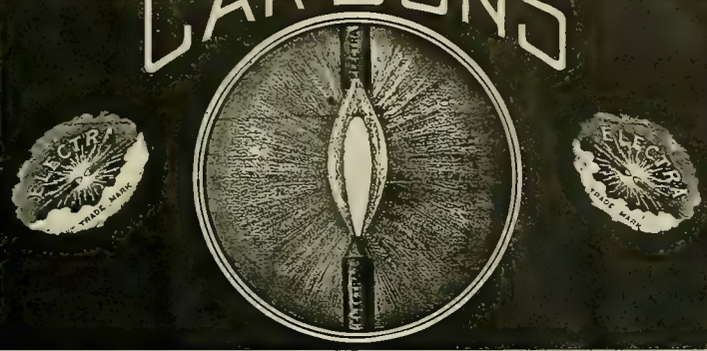

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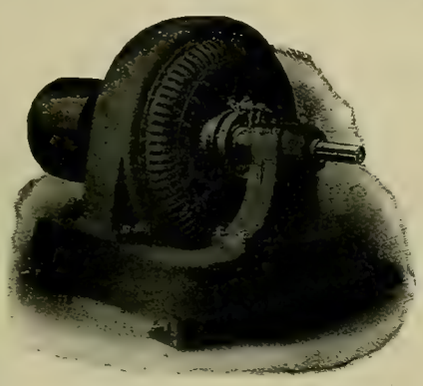

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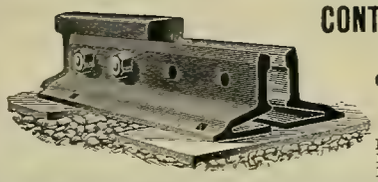

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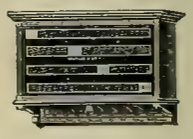

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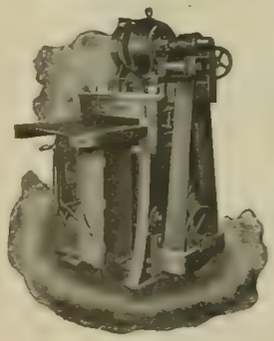

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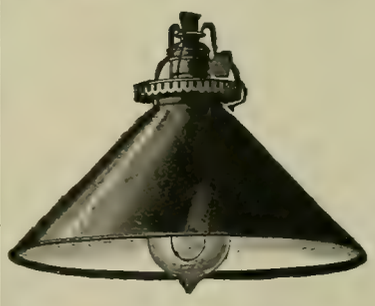

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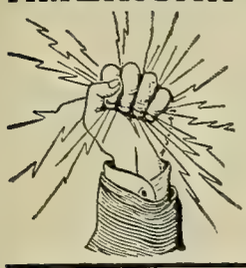

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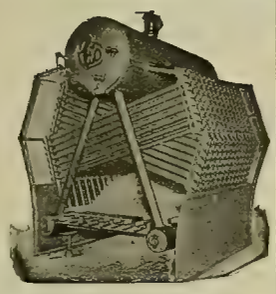

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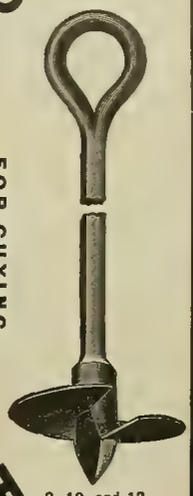

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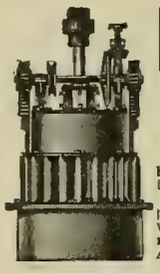

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(1) Automatic Signaling Device for Railroads:
Number 334,194, January 12, 1886.
(2) Electric Welding and Tempering:
Number 370,282, September 20, 1887;
" 386,088, July 10, 1888;
" 402,107, April 23, 1889;
" 402,108, April 23, 1889;
" 444,855, January 20, 1891;
" 453,162, May 26, 1891;
" 453,163, May 26, 1891;
" 453,164, May 26, 1891;
" 564,453, July 21, 1896;
" 499,040, June 6, 1893.
Applications:
Serial Number 280,521, filed July 20, 1888;
" " 285,555, " Sept. 15, 1888;
" " 301,915, " March 5, 1889;
" " 457,479, " Jan. 6, 1893;
" " 473,878, " May 11, 1893.
(3) Electric Riveting:
Number 403,374, May 14, 1889;
" 404,306, May 28, 1889;
" 452,042, May 12, 1891;
" 465,089, December 15, 1891.
(4) Electric Soldering:
Number 485,017, October 25, 1892.
(5) Electric Heating:
Number 381,815, April 24, 1888;
" 381,816, April 24, 1888;
" 381,817, April 24, 1888;
" 381,818, April 24, 1888;
" 381,819, April 24, 1888.
Applications:
Serial Number 266,710, filed March 9, 1888;
" " 270,245, " April 11, 1888;
" " 270,246, " April 11, 1888.
(6) Induction Coils. Dynamo Electric Machines and Motors:
Number 380,138, March 27, 1888 (Coil).
" 381,421, April 17, 1888 (Generator).
" 390,904, October 9, 1888 (Motor).
" 390,905, October 9, 1888 (Generator).
" 390,906, October 9, 1888 (Generator).
(7) Overhead Conductors for Electric Railways:
Number 392,757, filed November 13, 1888.
Application:
Serial Number 250,090, filed September 21, 1887.
(8) Brake and Traction Systems:
Number 356,963, Feb. 1, 1887; } Subject to
" 356,964, Feb. 1, 1887; } Licence to Otis Elevator Co. for Elevators.
" 452,041, May 12, 1891.
Application:
Serial Number 242,122, filed January 22, 1887.
(9) Conduits for Electric and Cable Railways:
Number 338,556, March 23, 1886;
" 352,265, November 9, 1886;
" 370,283, September 20, 1887;
" 383,770, May 29, 1888;
" 386,085, July 10, 1888;
" 386,087, July 10, 1888;
" 409,757, August 27, 1889;
" 409,756, August 27, 1889.
(10) Electric Railway System:
Number 386,086, July 10, 1888;
" 409,237, August 20, 1889;
" 411,301, September 17, 1889;
" 417,338, December 17, 1889.
Applications:
Serial Number 188,083, filed January 9, 1886;
" " 368,194, filed Oct. 15, 1890;
" " 368,195, filed Oct. 15, 1890;
" " 395,231, filed June 5, 1891.
(11) Railway Systems, Transformer:
Number 402,971, May 7, 1889;
" 431,482, July 1, 1890;
" 622,865, April 11, 1899. (See note below).
Applications:
Serial Number 248,405, filed Aug. 31, 1887.
" " 298,726, filed Feb. 5, 1889.
(12) Induction Railway:
Number 458,859, September 1, 1891.
Applications:
Serial Number 429,182, filed April 14, 1892.
" " 442,058, filed Aug. 3, 1892.
(13) Apparatus for Removing Ice and Snow from Railway Tracks:
Number 390,619, October 2, 1888.

Note: Sale of patent No. 622,865 subject to the terms and conditions of agreement between Ries & Henderson and George Westinghouse, dated November 22, 1893. Recorded Liber V sixty-three, page four hundred and six of transfer of patents.

The foregoing patents and the inventions described in above applications will be offered for sale by public auction by the undersigned, at the Real Estate Exchange, southwest corner of Lexington and Saint Paul Streets, Baltimore, Maryland, on Tuesday, the 3rd day of March, 1903, at 1 o'clock P. M.

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25 kw., General Electric, 110 volts, 4 pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
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1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., General Electric.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

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Two General Electric, 100 K. W., 6 pole.
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Six T. H., D62.
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Two 100 K. W., G. E., 1100 volts monocyclic, complete.
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One 35 K. W., Westinghouse, 1100 volts, complete.

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One 20x42 Wheelock.
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
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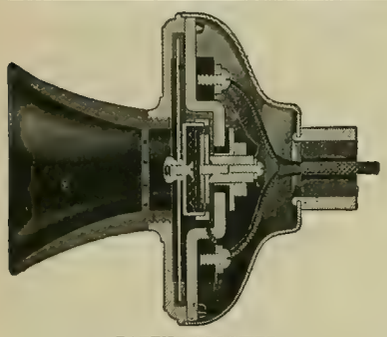

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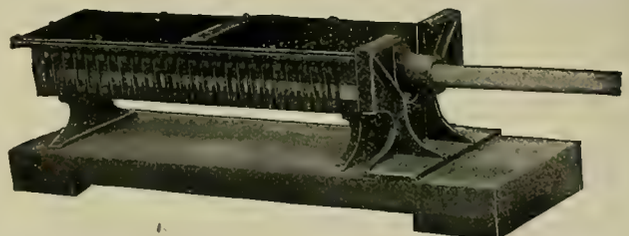

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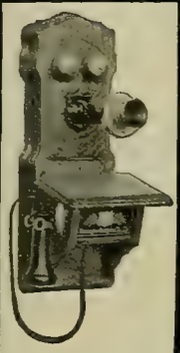

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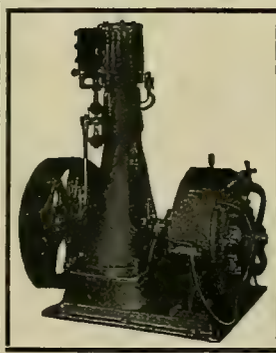

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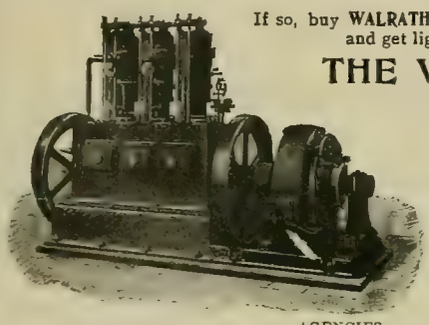

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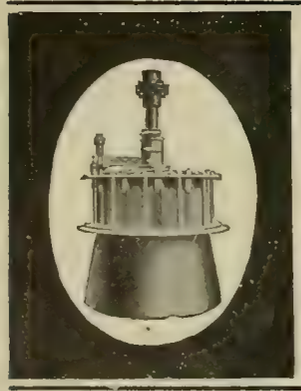

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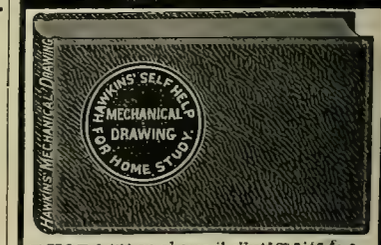

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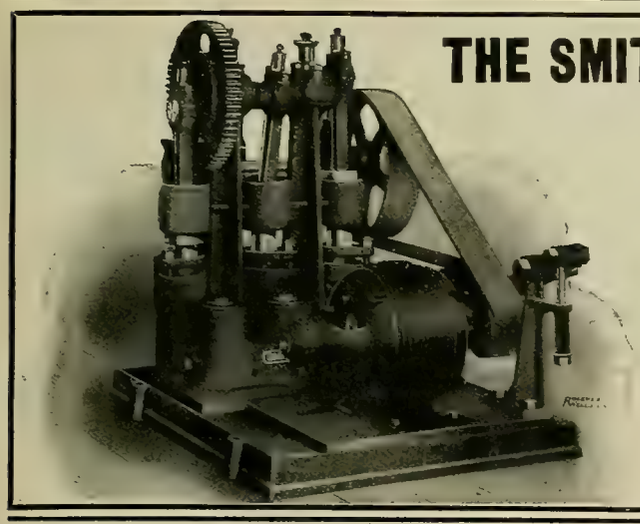

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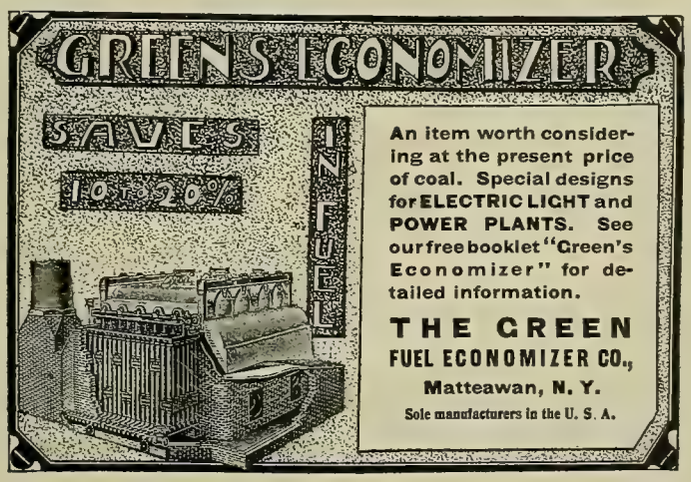

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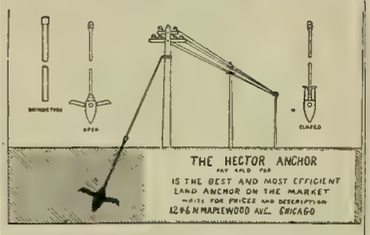

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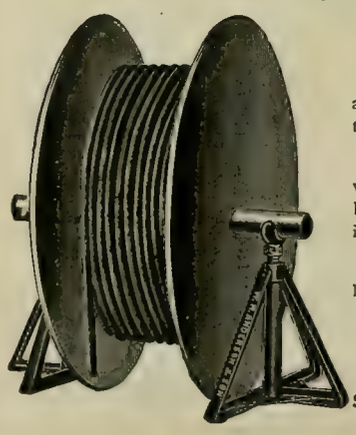

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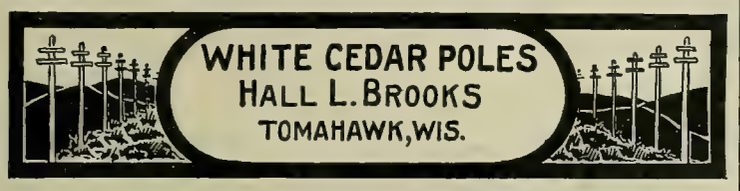

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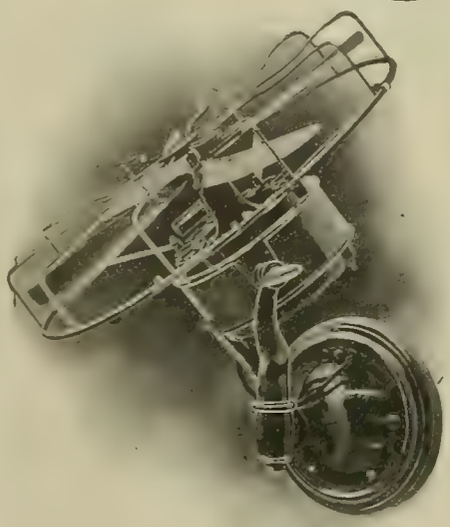

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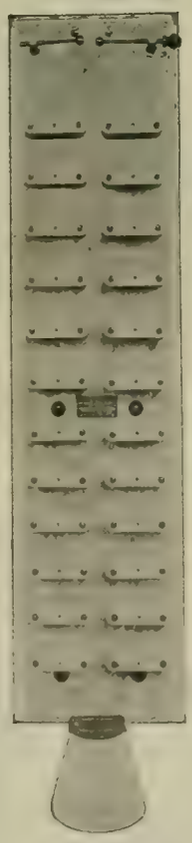

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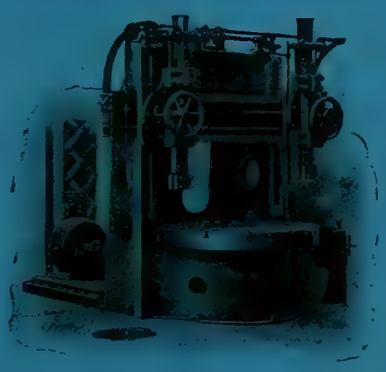

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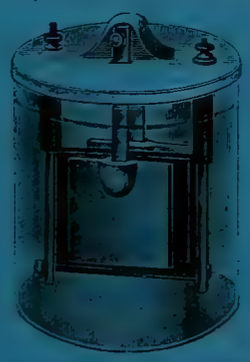

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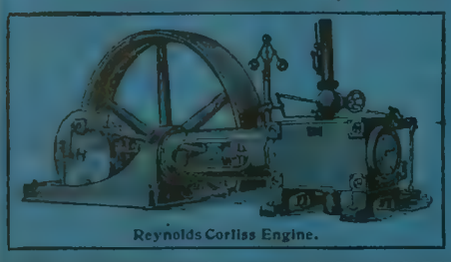
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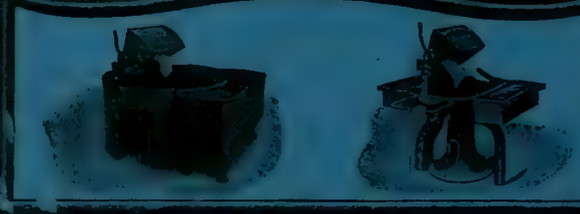

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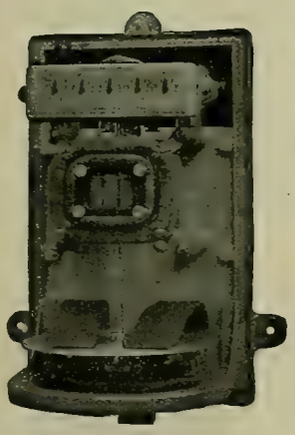

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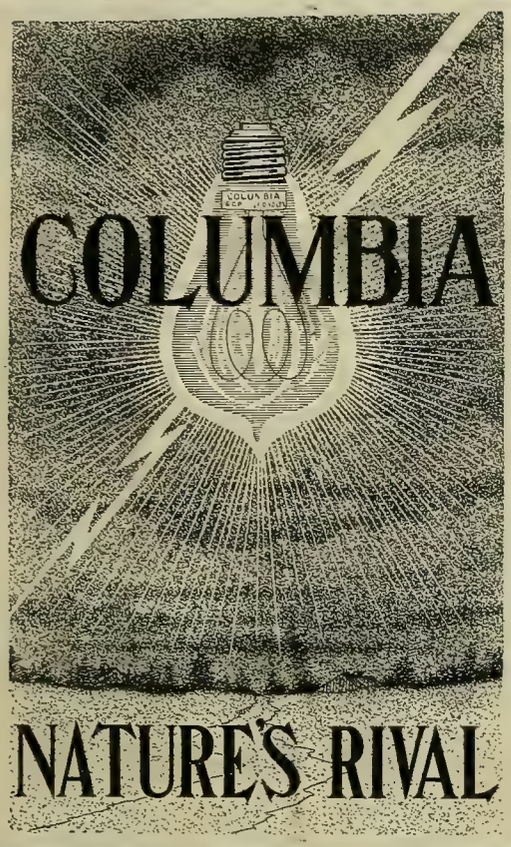

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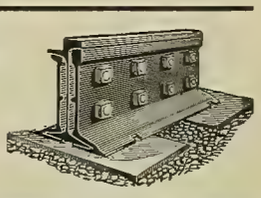

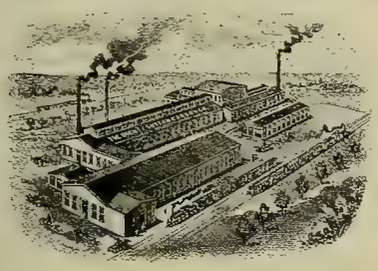

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Are winners. Scales are equally divided, indications are dead beat, high range ammeters have separate shunts and the cases are of heavy polished brass.

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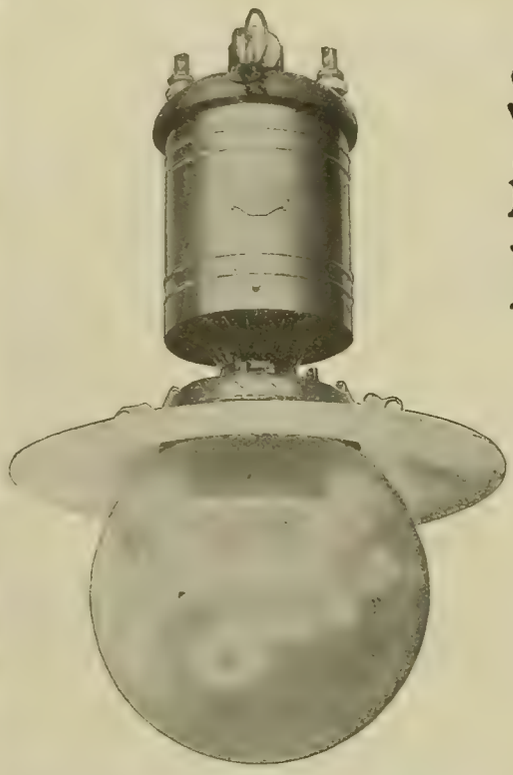

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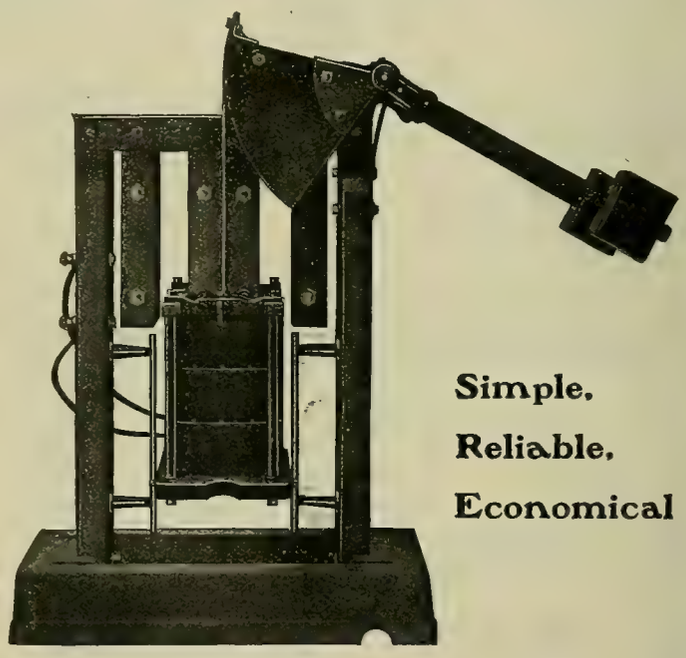

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Yours very truly,

Charles A. Brown

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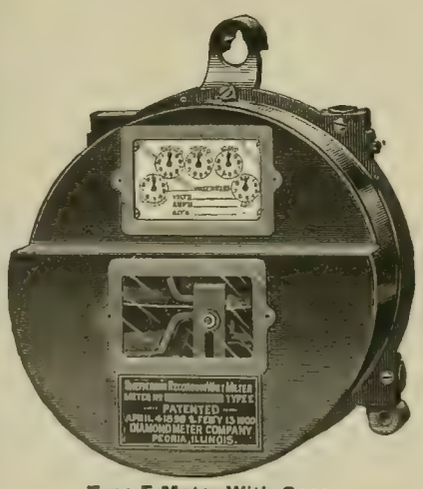

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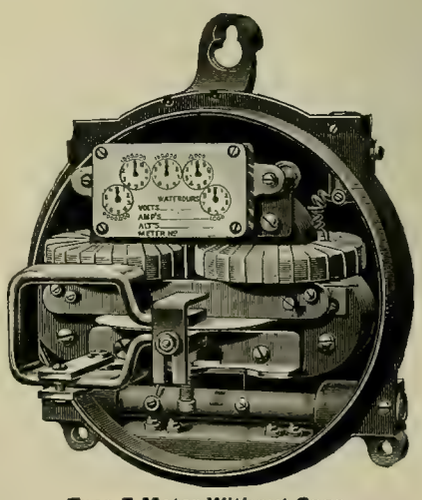

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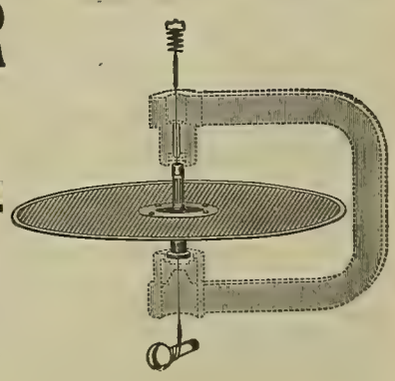

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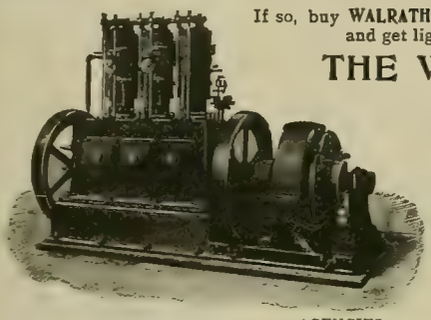

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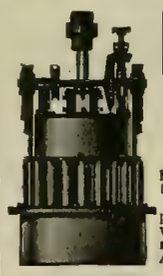

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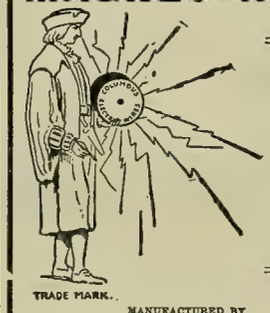

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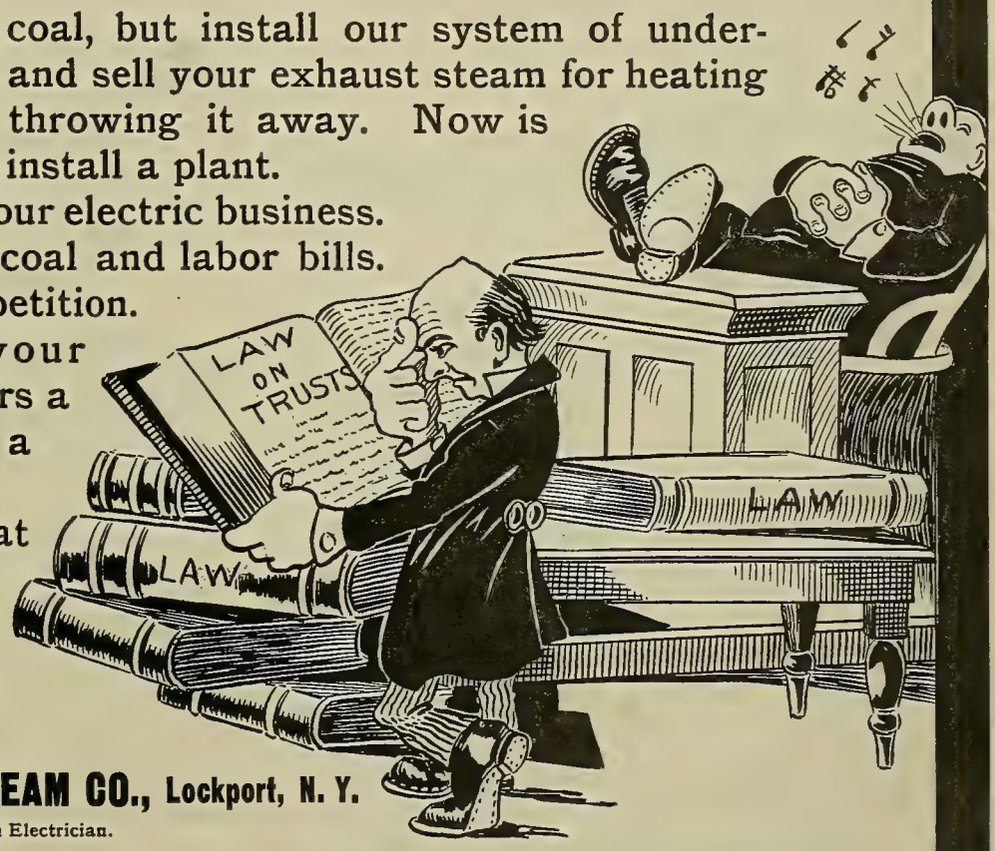

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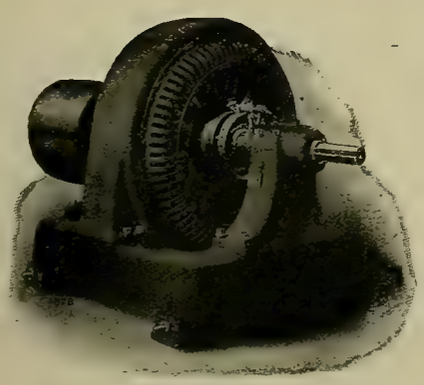

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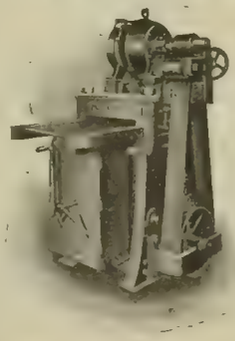

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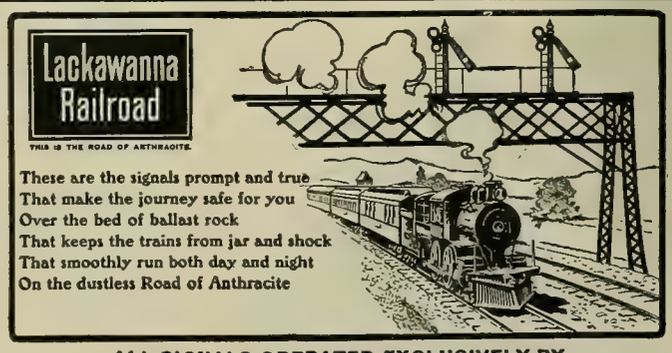

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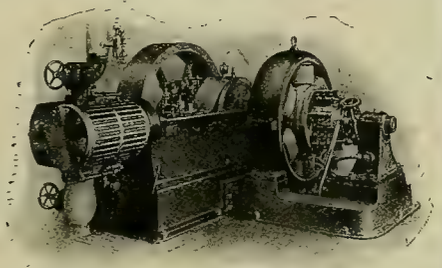

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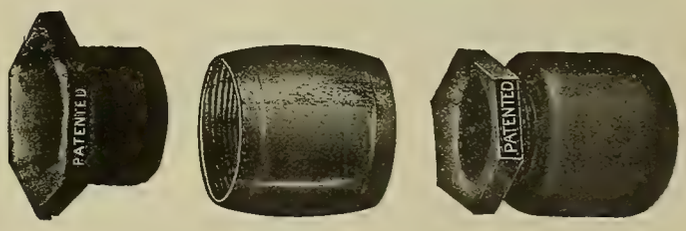

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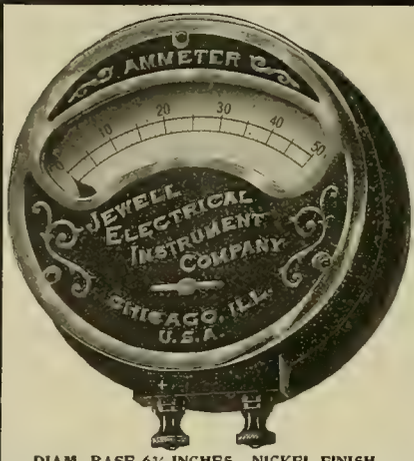

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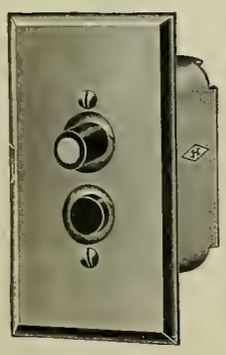

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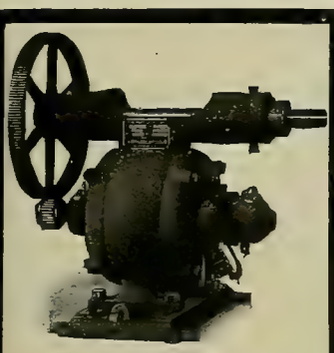

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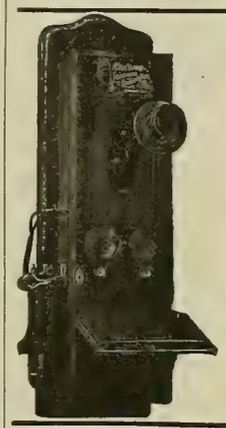

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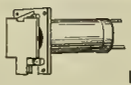

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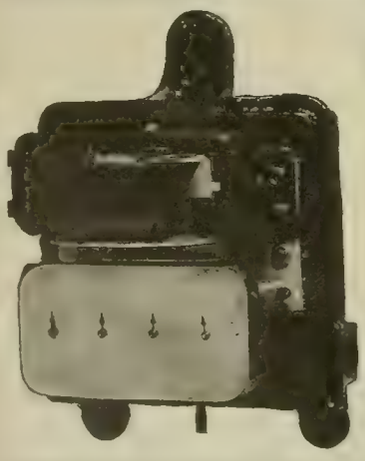

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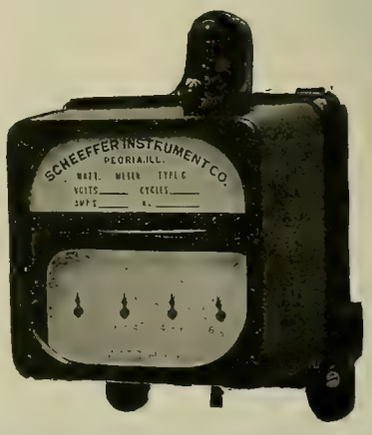

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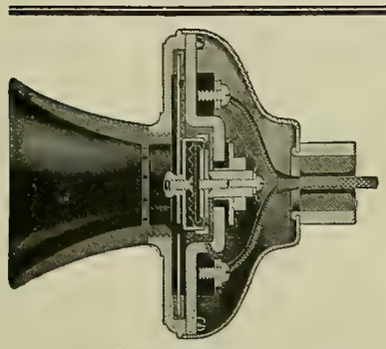

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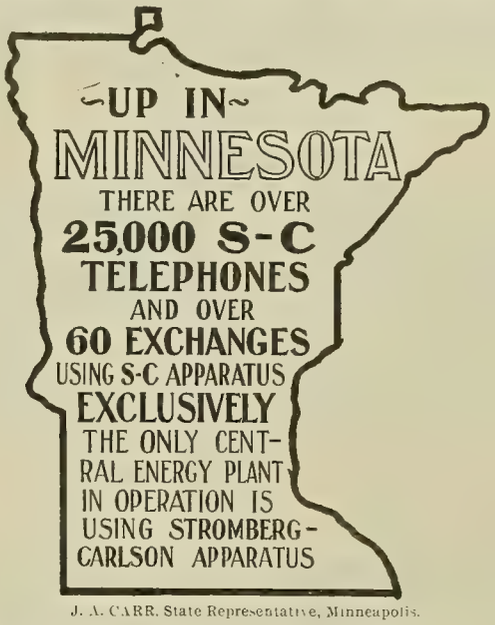

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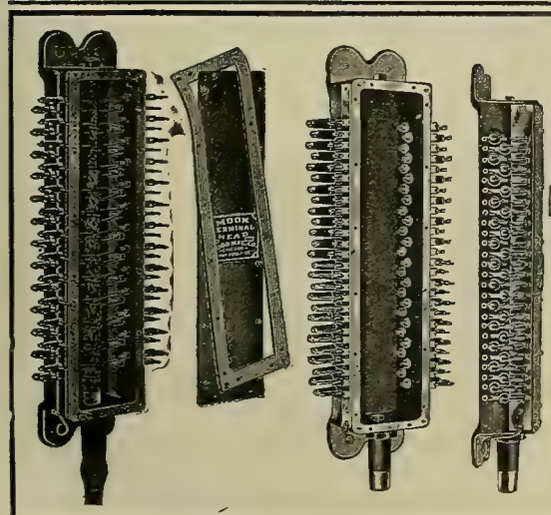

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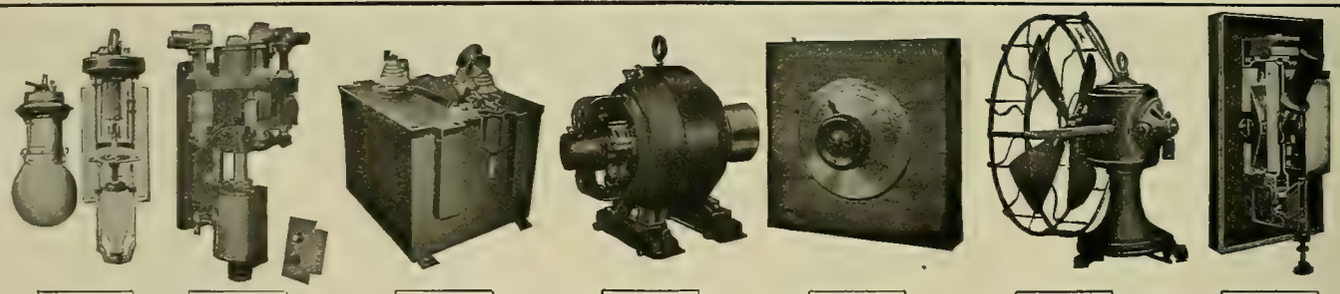
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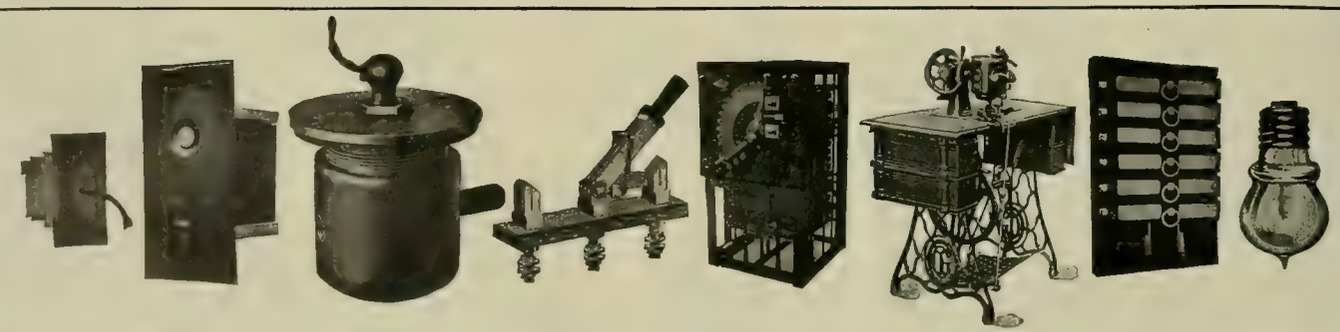
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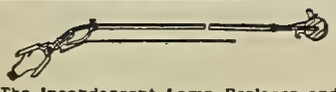

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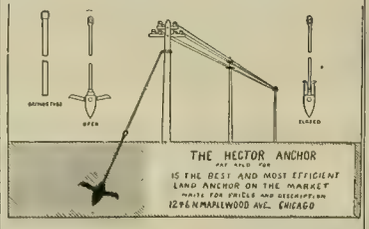

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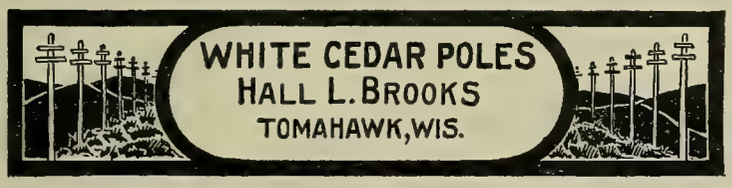

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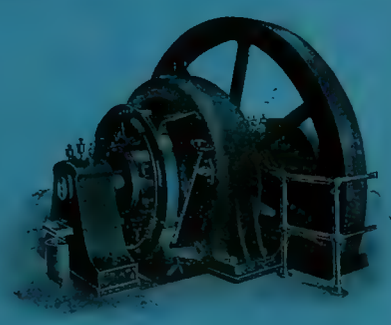

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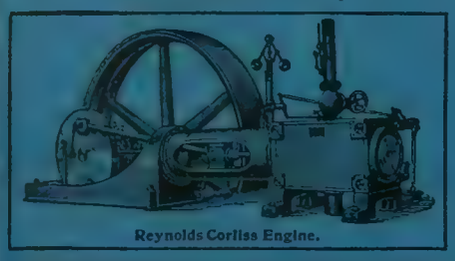
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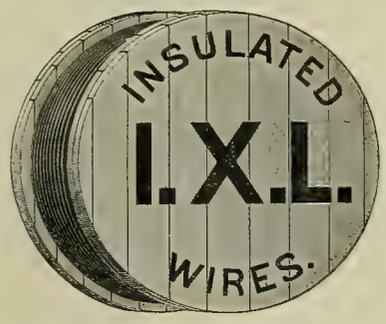

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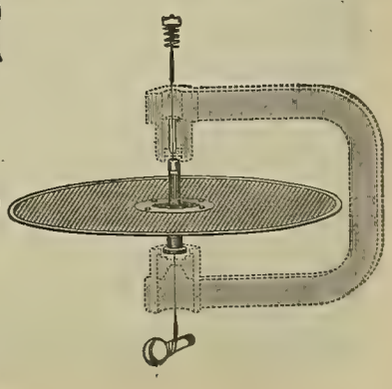

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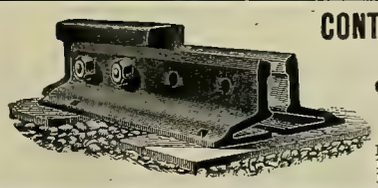

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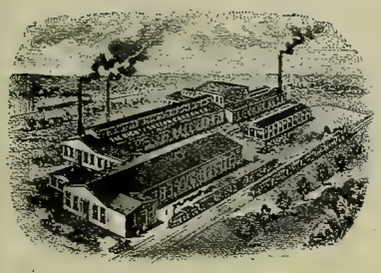

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WE MANUFACTURE ELECTRIC LIGHT CARBONS OF ALL KINDS, DRY BATTERIES AND BATTERY CARBONS, CARBON BRUSHES AND SPECIALTIES, ELECTROTYPE CARBONS.

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Ceiling Fan Motors

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Metal parts finished in either polished brass or bronze

An Ornament to any room.

Can be operated at three speeds by means of a controlling switch.

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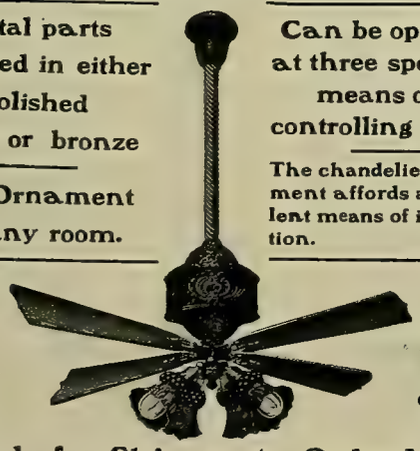

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Ready for Shipment. Order Now.

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UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

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CAUSES THE GREATEST ILLUMINATION OF THE

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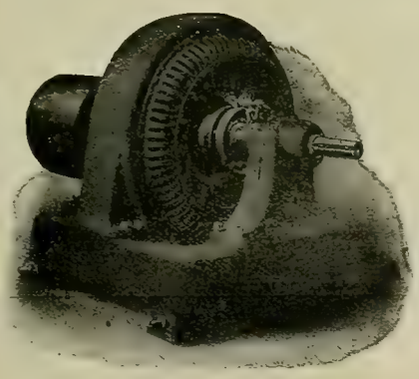

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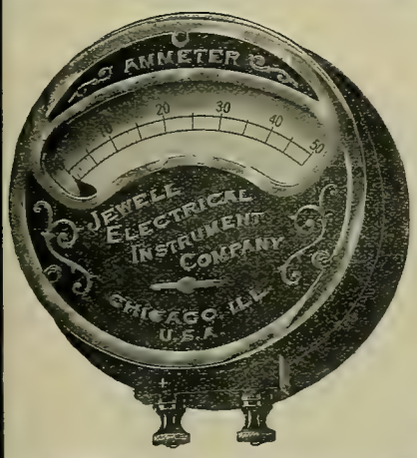

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Is entirely encased in iron and is weather-proof. The mechanism is very powerful and gives 375 blows to each winding. Continuous ringing or single stroke.

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Teaches people to use more current by turning lamps down instead of out.
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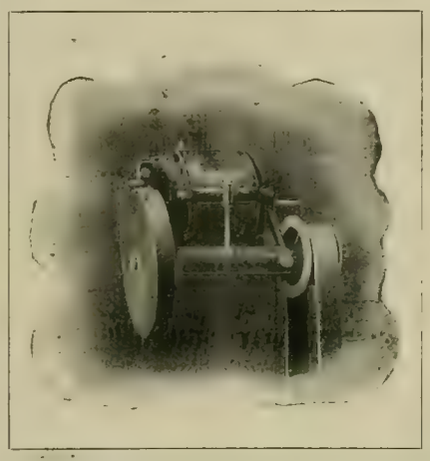

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WITH BACK GEARED ATTACHMENTS ADAPTED FOR MOUNTING ON THE FLOOR, SIDEWALL OR CEILING

CLOSE THE MAIN SWITCH TO START THEM AND THEY WILL TAKE CARE OF THEMSELVES

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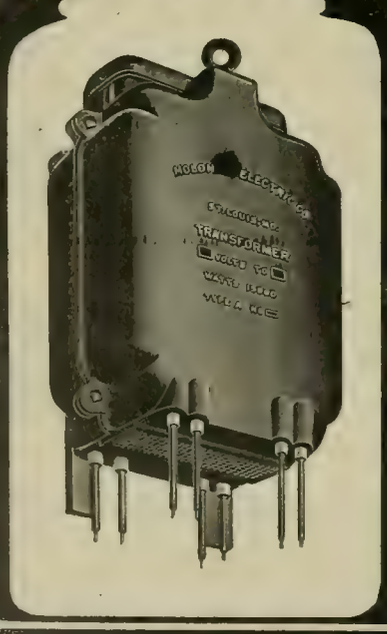

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Lowest Possible Core Losses
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We will ship them on thirty days' trial, should they not be what we claim for them, return and we will pay freight both ways.

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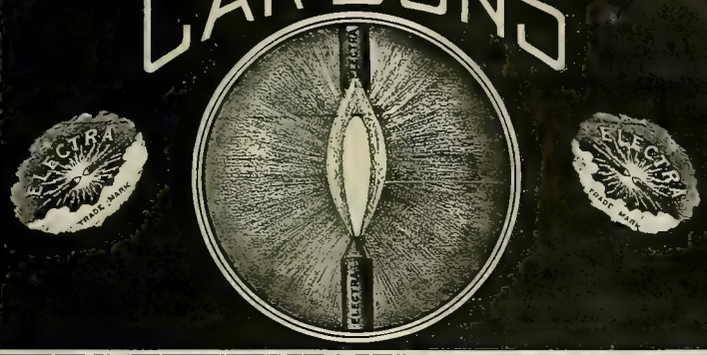
"ELECTRA" Flame Light Carbons are suitable for all types of Open Arc Lamps, either direct or alternating current, with slight charge in regulation of lamp.



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The intensity and brilliancy of light is three times that of regular "ELECTRA," and five times that of other carbons, making them eminently suitable for all special lighting purposes.

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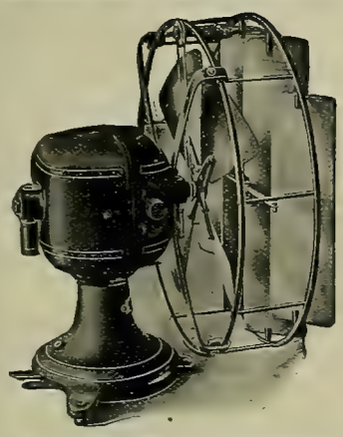

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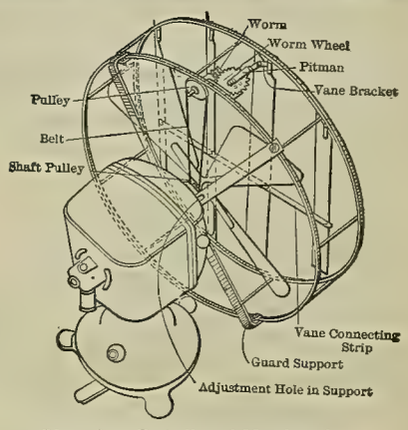

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Weatherproof wires do not soften in the sun nor crack in cold weather. The insulation is polished and well placed; is compact and solid.

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Absolutely will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen.
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Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.

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MOST ACCURATE AND UP-TO-DATE METER UPON THE MARKET.

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EVER SPILL YOUR ACID BOTTLE?
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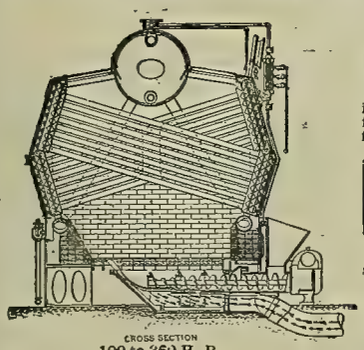

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is side-fired, and set in battery in units from 100 to 360 H. P. We make our end-fired type in powers from 20 to 125 H. P.
NO BRICKWORK.
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CASING Lined with Non-Conductor.
LARGE Power in Small Space.
High Pressure with Safety.
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Prices and Samples on Application.

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RE-STANDARDIZED TO DATE TO MEET THE LATEST REQUIR MENTS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS.
ABSOLUTE RELIABILITY.
THE NEW SHAWMUT INDICATING FUSE.

Indicating Type P fuse, showing red indicating disc.

Fuse, blown.

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WANTED

One 60 or 75 K. W. Alternator, 125 Cycle, 1100 Volt, Single Phase.
One 60 or 75 K. W. Alternator, 60 Cycle, 1100 Volt, Single Phase.

Send description of machine, price, and date shipment can be made.

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MOTORS WANTED.

500-VOLT MOTORS, FROM TWO TO FIFTEEN HORSEPOWER.

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A large number of flexible armed electroliers or brackets very cheap. Old material and machinery of all kinds purchased. WALSH'S SONS & CO., 261 Washington St., Newark, N. J.

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Immediate Returns.

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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,

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GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

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Alternators 125-133 cycles, 1,100 volts.
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Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

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Two B. & W., 285 H. P. each, 150 lbs.
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Above six boilers in Waterbury, Conn.
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Now operating at Slater Cotton Company, Pawtucket, Rhode Island.
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Now operating at L. Hoster Brewing Company, Columbus, Ohio.

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For Sale, four 60-K. W. Edison Generators, 500 Volts, F. O. B. Cars, Hamilton, Ohio. Each $450

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For Electrical Purposes. Everything in turned Slate.

Only Firm in Vermont who makes a Specialty of Manufacturing and Drilling Small Slates for Electrical Purposes.

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THE MONSON BURMAN SLATE CO.
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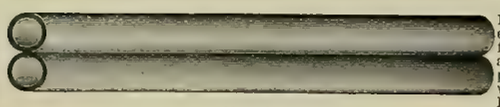
Sole Owners of the Maxstadt Patent No. 655,905

We **manufacture our joints under the *patent* we advertise.**

PATENTED AUGUST 14, 1900, IN THE UNITED STATES AND FOREIGN COUNTRIES.



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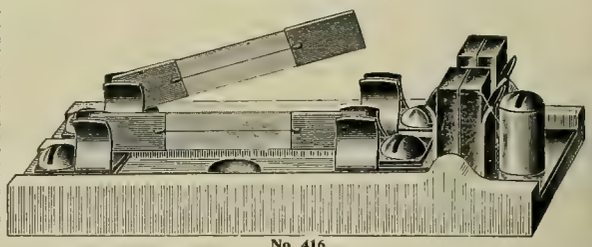
This cut represents the Maxstadt patent improved American Joint, ready for use. Made in copper and tinned steel, for copper and galvanized iron wire. This joint is absolutely perfect and costs less money than any other joint on the market. Our Tinned Steel Joints are especially adapted for iron wire, and give entire satisfaction wherever used. Prices and samples on application.

This illustration represents one of the many different styles of Maxstadt Fuse Blocks and Fuse we manufacture We can also furnish fuses, paper sleeves, fuse wire and links. Write for prices and samples.



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Manufacturers of the Maxstadt Patent Improved American Joint.

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180 K. W. 60 cycle G. E., 2,000 volt.
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200 K. W. 60 cycle Stanley, 2 phase.
150 K. W. 60 cycle Stanley, 3 phase.
175 K. W. Edison bipolar railway generator.
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65 K. W. Jenny 140 volt.
500 H. P. Cooper Corliss Engine.
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Also Motors, Boilers, Pumps, etc.

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REPAIRS AND SECOND-HAND MACHINERY.

STREET RAILWAY, LIGHTING AND POWER.

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1-15x23x17 McI. & Seymour.
2-15x24x18 Armington & Sims
1-22x33 Buckeye (new).
1—25x32 Sturt'v't, Slide Valve
1—18x36 Cummer, 4 Valve.
1—18x30 E. P. Hampson.
1—20x42 Brown Corliss.
1-14x36 Allis Corliss.
1-18½x18 McI. & Seymour
1—16x18 Lake City.
1—14x14 Weston Automatic.
2-13x12 Armington & Sims.
1—11x16 Straightline.
1 9x9 New York Safety.
3—7½x7 Westinghouse.

ALTERNATORS.

1—400 K.W. Wood, 140 cyc.
2—150 K.W. Wood, 140 cyc.
2—120 K W. G. E., 125 cyc.
1—150 K.W St'nley 2 phase
4—60 K.W. G. E. S'gle phase
2—220 K.W. Wes. 133 cyc.
2—30 K.W. Wes. S'gle phase

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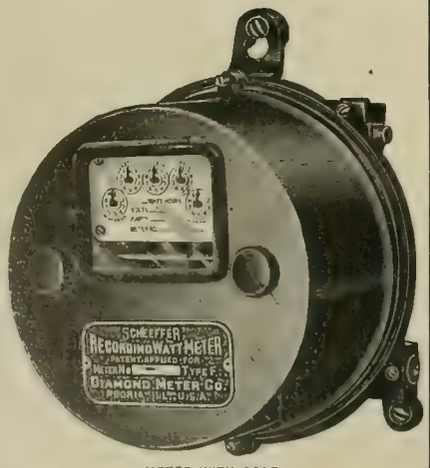

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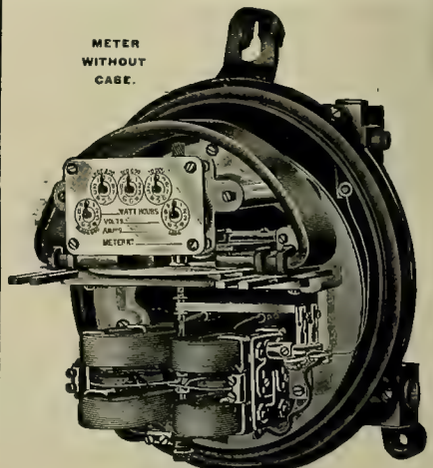

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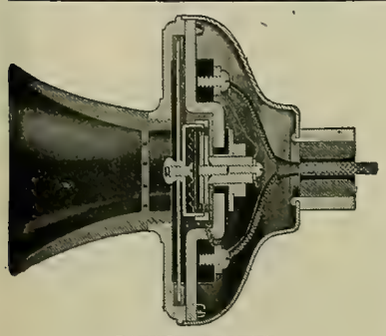

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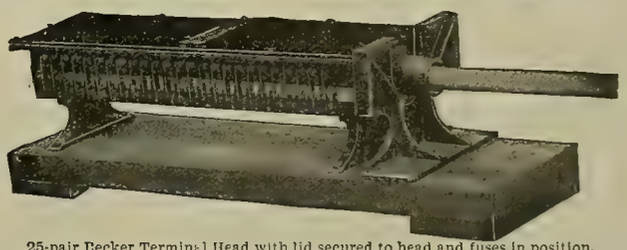

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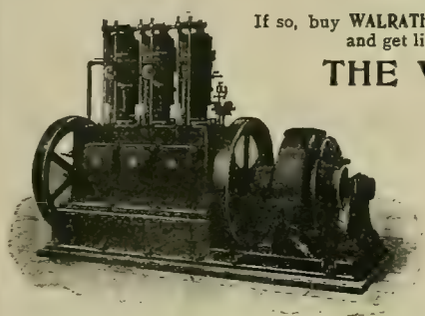

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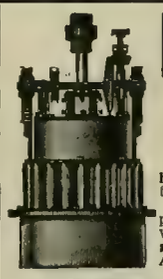

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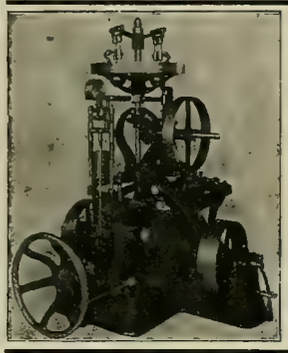

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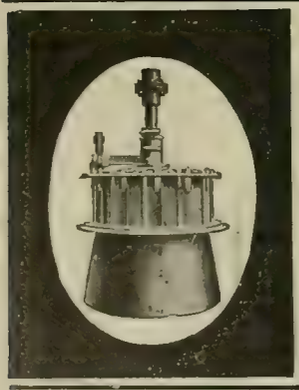

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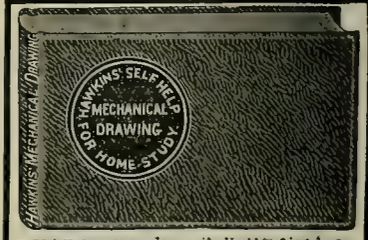

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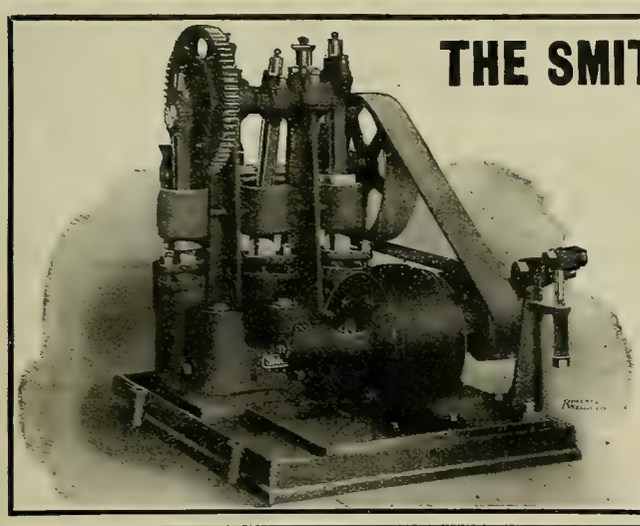

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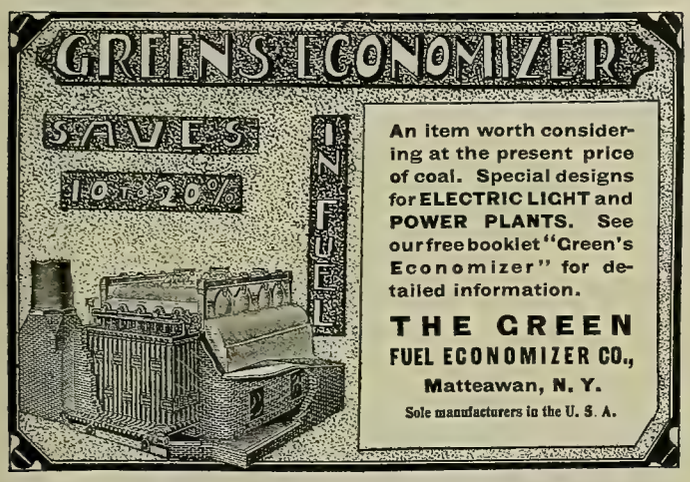

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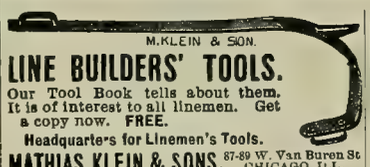

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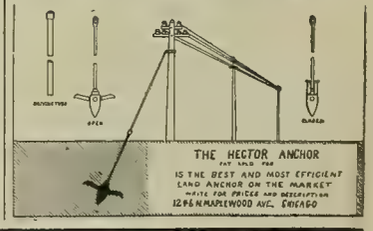

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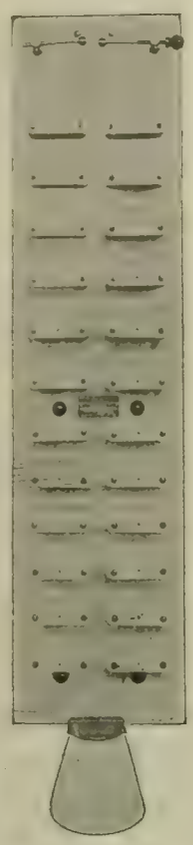

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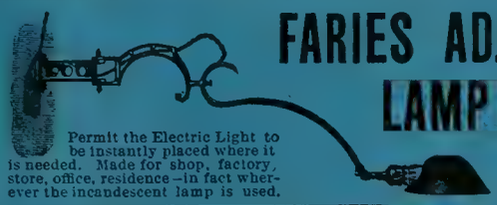

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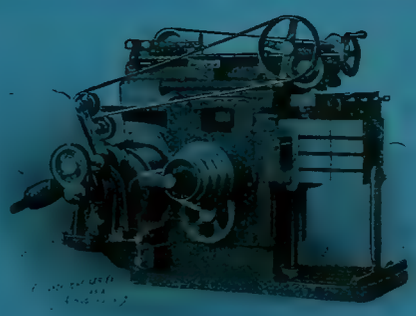

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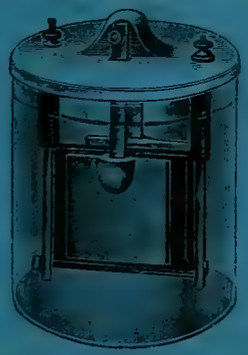

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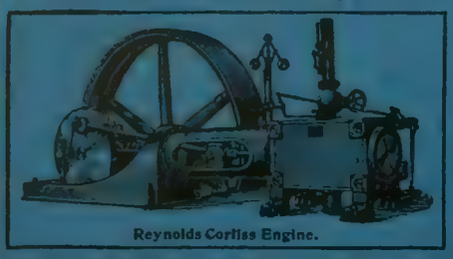
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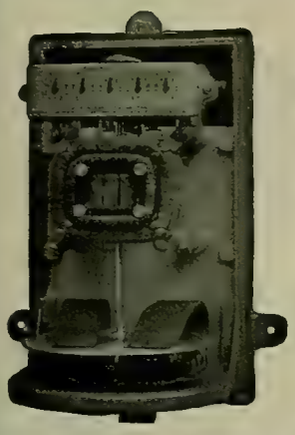

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Columbus Ins. Wire & Brass Co.
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General Electric Co.
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India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
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Western Electric Company.

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General Inc. Arc Light Co.

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Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
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General Inc. Arc Light Co.
Nernst Lamp Co.
Phelps Company.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Sterling Electrical Mfg. Co.
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Inc. El. Lt. Manipulator Co.

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Jeffrey Mfg. Co.
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Motors. (See Dynamos and Motors).

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Johnston, Thomas J.

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Berthold & Jennings.
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Worcester Co., C. H.

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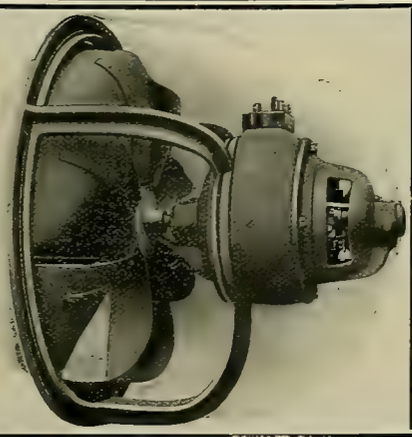

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THE OTHERS MUST COPY US.

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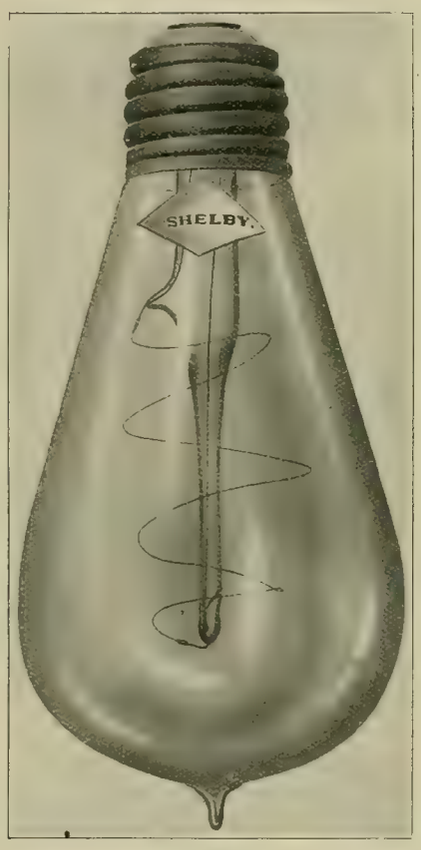
We will Introduce this Lamp next Fall.

$50.00 For a Name.



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WE WILL SOON TELL YOU ABOUT THEM.

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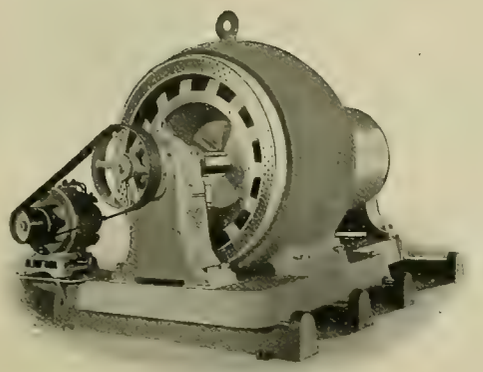
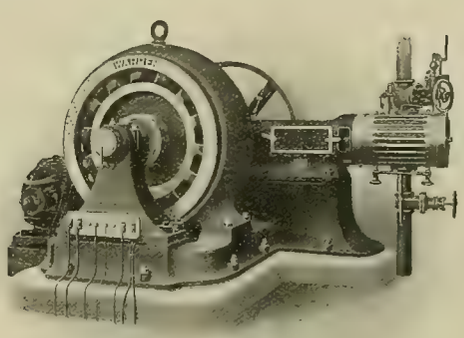
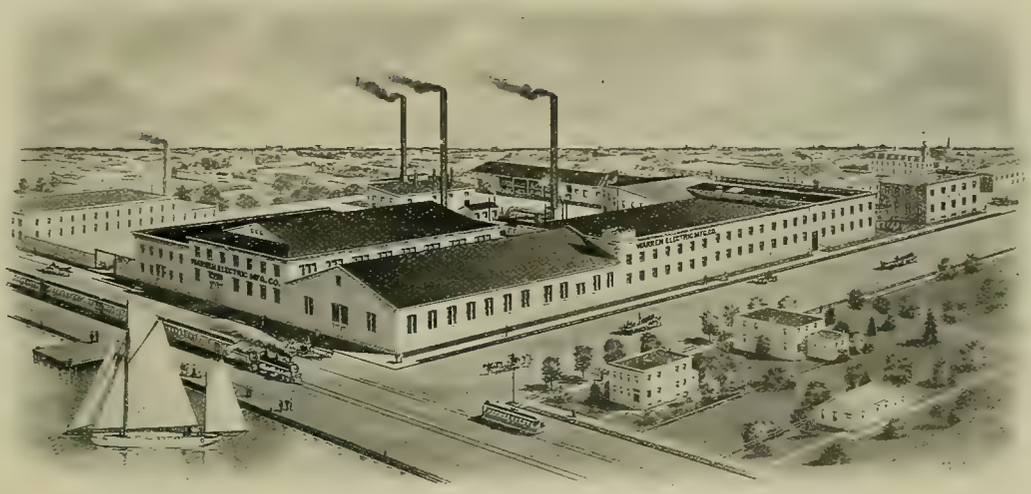


BELTED TYPE.



ENGINE TYPE.

OUR FACTORY.



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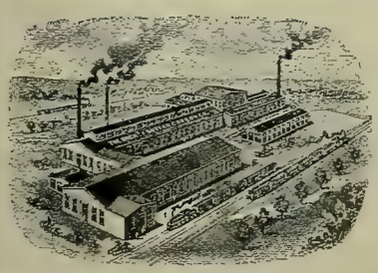

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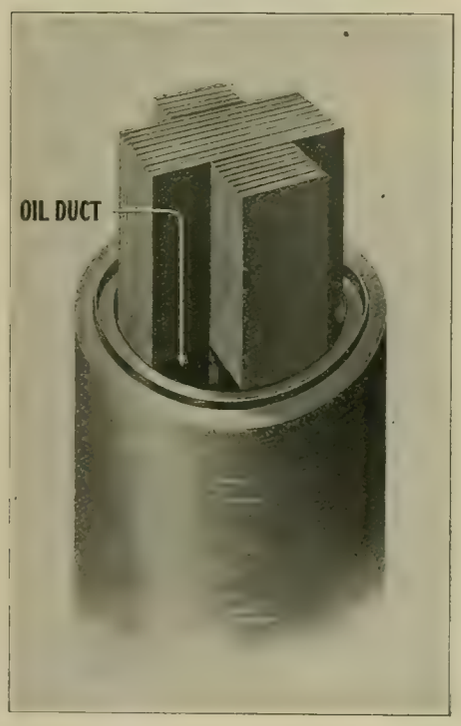

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CORE TYPE—OIL COOLED.

Expert designers, selected materials, and the most approved methods of manufacture — and consequent durability and high efficiency — have made Type H Transformers famous in all respects.

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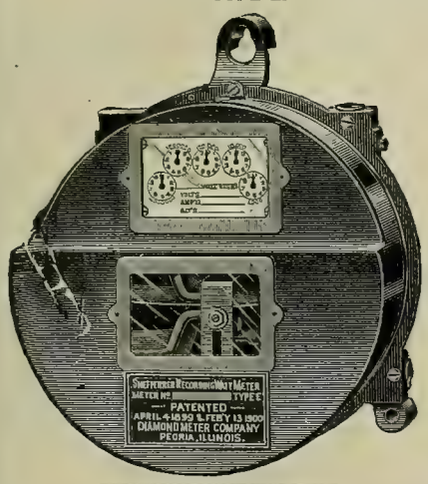

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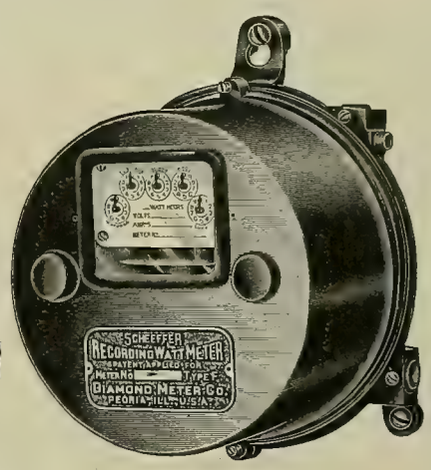

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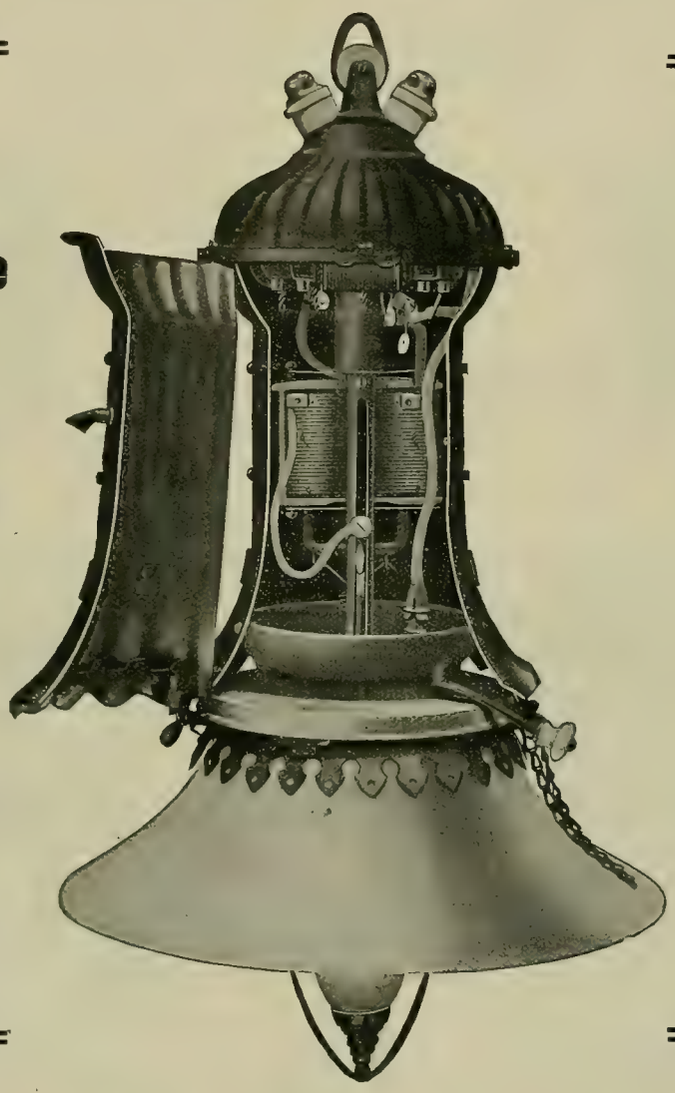
Inside and Out, Electrically and Mechanically, the best lamp on the market. It's good to look at and built to stand the most severe service. Never has been beaten in a competitive test.



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UNEQUALED IN
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PRODUCE EXCELLENT, UNIFORM,
STEADY AND BRILLIANT LIGHT.

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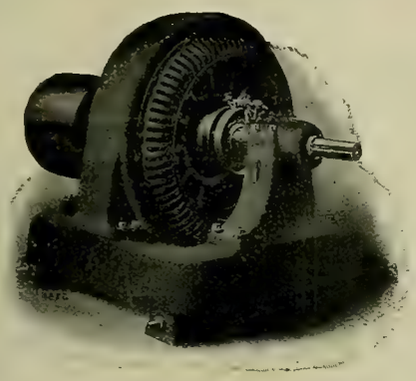

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Old Central Station Men know. They specify "O. K." and they get it, too, or ask the reason why.

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The Standard for Visual Signals.

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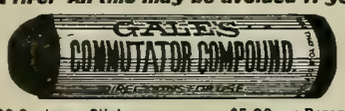

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Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

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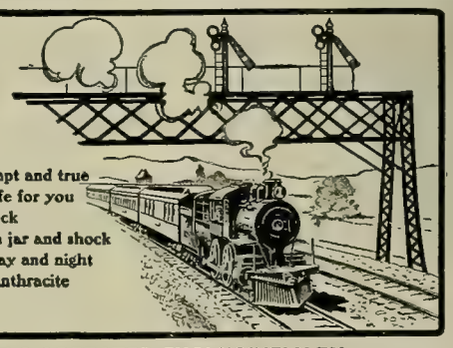

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That make the journey safe for you
Over the bed of ballast rock
That keeps the trains from jar and shock
That smoothly run both day and night
On the dustless Road of Anthracite

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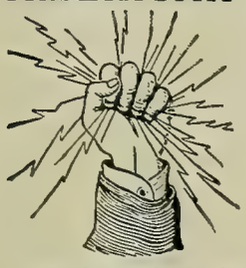

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ELECTRIC LIGHT LINE WIRE, INCANDESCENT AND FLEXIBLE CORDS,

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

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SIMPLEX ELECTRIC HEATING CO.,
Cambridgeport, Mass.
CHICAGO, Monadnock Block.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

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WE PROTECT YOU
EVER SPILL YOUR ACID BOTTLE?
Full Size ALLEN Stick Free for Trial.
BY THIS on a pink Label
Beware of Imitations. L. B. Allen. None Genuine without Signature.
You Protect Yourself.
L. B. ALLEN CO., Inc. Sole Manufacturers, 1334 Columbia Ave. CHICAGO.

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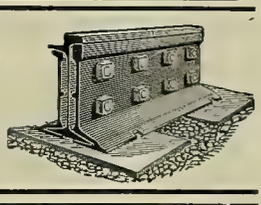
Over FIFTEEN THOUSAND (15,000) miles in use. Received the highest award in its class at Paris Exposition, 1900 and Pan-American, Buffalo, 1901.



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THE SAFETY INSULATED WIRE & CABLE CO.,
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ELECTRIC SUPPLIES AND CONSTRUCTION.
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We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Mechanical Drawing, etc. at your home, by mail. Institute indorsed by Thos. A. Edison.
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

"HOW'S YOUR LINE GUYED?"

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GUY ELECTRIC LIGHT POLES BEST
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CHEAPEST FIRST. CHEAPEST LAST.

WRITE US FOR INFORMATION.
WE LIKE TO BE ASKED QUESTIONS.

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VERTICAL OR HORIZONTAL

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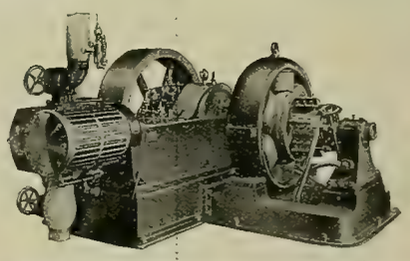

Self Oiling. For Direct-Connected or Belted Service.
High Speed—High Pressures. Units from 6 to 200 H P.

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New York, Philadelphia,
New York Safety Steam Power Co.
60 So. Canal Street, Chicago, Ill.
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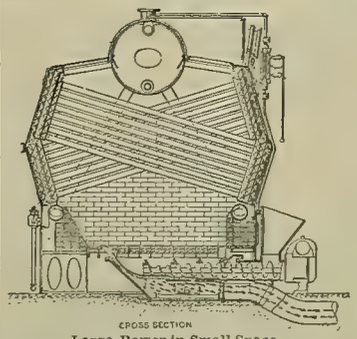
WATER-TUBE BOILERS
NO BRICKWORK—BENT TUBES—SCREWED JOINTS—GASKETS.
WORTHINGTON SECTIONAL
End-Fired Type, 20 to 125 H. P.
Side-Fired Type, 100 to 360 H. P.



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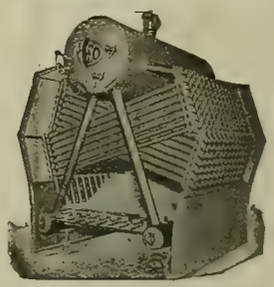
Large Power in Small Space.
Being sectional can be delivered through an ordinary window or sidewalk opening.



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WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED.

As superintendent, in constructing and equipping exchanges, farmers' systems and toll lines. 16 years' experience; first class work guaranteed; A1 references. Address LOCK BOX 635, Alexandria, Ind.

POSITION WANTED.

As chief engineer and electrician, thoroughly practical and technical in all types of steam and electrical apparatus, also the economical operation of same. Own reliable and accurate indicating and testing instruments, married, strictly sober, references A-1. Southwest preferred. Address BOX 188, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED AT ONCE.

One second-hand multipolar 220-volt generator, automatic oiler, 18 to 23 K. W. Must be cheap for cash. Address PLEASANT HILL LIGHT CO., Pleasant Hill, Mo.

WANTED

One 60 or 75 K. W. Alternator, 125 Cycle, 1100 Volt, Single Phase.
One 60 or 75 K. W. Alternator, 60 Cycle, 1100 Volt, Single Phase.

Send description of machine, price, and date shipment can be made.

L. B. 382, CALLIPOLIS, O.

PROPOSALS

For the Construction of an Electric-Lighting Plant for the City of Mankato, Minn.

Sealed proposals will be received by the city recorder of the city of Mankato, Minn., for the furnishing and installing of a municipal electric-lighting plant, in and for the city of Mankato, Minn., in strict accordance with the plans and specifications prepared therefore by W. I. Gray & Co., engineers. Plans and specifications are now placed on file at the following places for the convenience and use of bidders: At the recorder's office, Mankato, Minn.; W. I. Gray & Co.'s office, 804 Sykes Block, Minneapolis, Minn., and Geo. Cutter Co.'s office, Union and Fulton Streets, Chicago, Ills. Proposals will be received up to 2 o'clock p. m., Monday, March 30th, 1903, at which time they will be opened and made public. The common council reserves the right to reject any and all bids, as in the opinion of the council will be most advantageous to the city of Mankato.

Dated at Mankato, Minn., March 14th, 1903.

J. B. HODAPP, City Recorder.

GUNS $1.00 EACH.

U. S. Army guns, as curiosities, for cosey corners, dens, etc.

Walsh's Sons & Co., 261 Washington St., Newark, N.J.

REPAIRS

Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices.

MIDLAND ELECTRIC CO., Des Moines, Iowa.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings), Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
6— 60 K. W. General Electric A. 60.
2— 60 K. W. Westinghouse.

Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

IT'S UP TO YOU.

We pay highest market prices for

SCRAP COPPER, BRASS AND PLATINUM, ALSO Incandescent Lamp Bases, Etc.

WRITE US.

We Manufacture Copper Hard Babbitt

the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.

GREAT WESTERN SMELTING AND REFINING CO., CHICAGO.

FOR SALE—Immediate Delivery

3500 Horse Power BABCOCK & WILCOX AND HEINE SAFETY WATER TUBE BOILERS

Two B. & W., 285 H. P. each, 150 lbs.
Three B. & W., 275 H. P. each, 140 lbs.
One B. & W., 175 H. P. 125 lbs.
Above six boilers in Waterbury, Conn.
Two B. & W., 275 H. P. each, 140 lbs.
Now operating at Slater Cotton Company, Pawtucket, Rhode Island.
Two B. & W., 150 H. P. each, 140 lbs.
In Davenport, Iowa.
One Heine, 310 H. P. 140 lbs.
Two Heine 325 H. P. each, 140 lbs.
Now operating at L. Hoster Brewing Company, Columbus, Ohio.

Whitehead Machinery Company
DAVENPORT, IOWA.

STREET LIGHTING CITY OF WEBSTER GROVES, MISSOURI.

Sealed proposals for lighting the streets and public places of the city of Webster Groves, Mo., with approximately 200 20 c. p. incandescent lamps, for a period of ten years beginning September 1, 1903, will be received at the office of the City Clerk, Webster Groves, until 8 p. m. Monday, April 6th, 1903, to be opened immediately thereafter, at an open meeting of the Board of Aldermen.

The successful bidder will be granted a 20-year franchise for private lighting.

Plans and specifications may be seen at the office of the City Clerk, also at the office of William H. Bryan, Consulting Engineer, 706 and 707 Lincoln Trust Building, St. Louis, Mo.

Each proposal must be accompanied by a certified check payable to the City Treasurer of Webster Groves, for $500.00.

The right is reserved to reject any or all bids, and to waive informalities.

C. O. TWINING,
Chairman Committee on City Lighting.
Webster Groves, Mo., March 11, 1903.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

RY. GENERATORS.
4-500 K. W. Gen'l Electric.
1-120 K. W. C. & C., 6 pole.
1-100 K. W. C. & C., 6 pole.
2—150 K.W. Edison Bi-polar.
2—100 K.W. Gen'l Electric.
2—100 K.W. Edison Bi-polar.
4—60 K.W. Edison Bi-polar.

BOILERS.
3—350 H. P. Climax Watertube.
1-375 H. P. National watertube
3-267 H. P. Abendroth & Root
1-250 H. P. Sterling watertube
2—66x15 ft. Horiz'l Tubular.
2—48x14 ft. Horiz'l Tubular.
4—44x16 ft. Horiz'l Tubular.

ENGINES.
3-18x30x16 Westinghouse.
1-15x23x17 McI. & Seymour.
2-15x24x18 Armington & Sims
1-22x33 Buckeye (new).
1—25x32 Sturt'v't, Slide Valve
1—18x36 Cummer, 4 Valve.
1—18x30 E. P. Hampson.
1—20x42 Brown Corliss.
1-14x36 Allis Corliss.
1-18½x18 McI. & Seymour
1—16x18 Lake City.
1—14x14 Weston Automatic.
2-13x12 Armington & Sims.
1—11x16 Straightline.
1—9x9 New York Safety.
3—7½x7 Westinghouse.

ALTERNATORS.
1—400 K.W. Wood, 140 cyc.
2—150 K.W. Wood, 140 cyc.
2—120 K.W. G. E., 125 cyc.
1—150 K.W. St'nley 2 phase
4—60 K.W. G. E. S'gle phase
2—220 K.W. Wes. 133 cyc.
2—30 K.W. Wes. S'gle phase

DIRECT CON'CTED.
80 K.W. Jenney 110 v., and Russell 4-valve engine.
50 K.W. Western Elec. and Ball & Wood engine.
50 K. W. Walker & Russell engine (new)
43 K. W. Westinghouse & Russell engine.
30 K.W. C. & C. & Atlas.
5 K.W. Perritt & Sturtevant.

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114-118 Liberty Street, NEW YORK.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 18 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD.

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POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.

FOR SALE.

180 K. W. 60 cycle G. E., 2,000 volt.
150 K. W. 60 cycle Ft. Wayne, 1,100 volt.
120 K. W. 60 cycle G. E., 2,000 volt.
90 K. W. 60 cycle G. E., 2,000 volt.
200 K. W. 60 cycle Stanley, 2 phase.
150 K. W. 60 cycle Stanley, 3 phase.
175 K. W. Edison bipolar railway generator.
100 K. W. Edison 140 volt.
65 K. W. Jenny 140 volt.
500 H. P. Cooper Corliss Engine.
28x48 Allis Corliss Engine.
10x13 Frost Automatic Engine.

Also Motors, Boilers, Pumps, etc.

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CHASE NIPPLE COMBINATION

IN YOUR JUNCTION AND OUTLET BOXES.

IT SAVES IN { COST, LABOR OF INSTALLING, ECONOMY OF SPACE IN BOX.

It Makes Rigid Connection Between Box and Conduit. No Other Combination Leaves so Much Working Space in the Box.—This is of Great Importance in Switch Boxes.

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(SOLE MANUFACTURERS.)
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WESTERN REPRESENTATIVE.

THE BEST **VERMONT SLATE** FOR Electrical Purposes.

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EDWARD BONVILLE
P. O. Lock Box 24, FAIR HAVEN, VERMONT.
Manufacturer of all kinds of **Slates for Electrical Purposes**
All Sizes of Slate Switchboards.
Best Black Enameled and Marbleized Finishes in Vermont.

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76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.

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FIRST-CLASS EQUIPMENT THROUGHOUT.

Machine and Carpenter Work of All Kinds. Correspondence Solicited.

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

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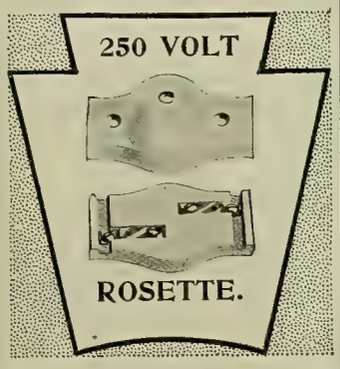

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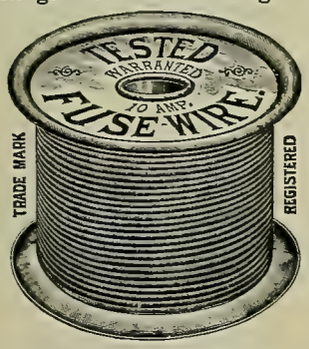

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SENT UPON REQUEST.

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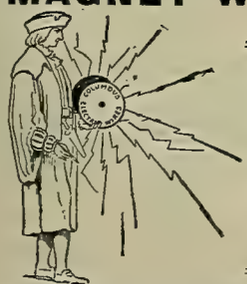
MAINE FOR SLATE ELECTRICAL PURPOSES PLAIN OR ENAMELED.
THE MONSON BURMAH SLATE CO.
PORTLAND, ME.

MAGNET WIRE



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TRADE MARK.
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Columbus Insulated Wire and Brass Co.
COLUMBUS, OHIO.

WE BUY AND SELL ALL KINDS

Electrical and Steam MACHINERY

DIRECT-CONNECTED UNITS.

300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

200 kw , Westinghouse, M. P. 8, 500-550-volt Generator, direct connected to 18 and 30x16 Westinghouse Engine; generator entirely rewound and engine in excellent condition.

187½ kw., Westinghouse, M. P. 8, 120-volt Generator, direct connected to Westinghouse Compound Engine.

50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½ and 13x12 Armington & Sims Tandem Compound Engine. One year old.

50 kw., Eddy Compound Generator, 125 volts, direct connected to 13x13 Harrisburg Ideal Engine.

25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

25 kw., General Electric, 110 volts, 4-pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1—60 kw , G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.

RAILWAY GENERATORS.

2—500 kw., 6-pole General Electric.
2—225 kw., 6 pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw , M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., General Electric.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

ENGINES.

1—14x14 Rice Automatic.
2—13 and 23x17 Tandem Compound McIntosh & Seymour.
2—10 and 18x20 Payne Compound.
1—13x12 Armington & Sims.
1—12 and 20x12 Westinghouse Compound.
1—7x8 Payne.
1—18x48 Geo. H. Corliss.
1—16x42 Greene.
1—10½ and 16½x12 Cross Compound Armington & Sims.
2—26x48 Providence-Greene.
2—18 and 30x16 Westinghouse Compound.
3—18½x18 Armington & Sims.
1—18½x18 New York Safety.
1—20x48 Harris-Corliss.

BOILERS.

7—163 H. P. Babcock & Wilcox.
5—250 H. P. Climax.
1—600 H. P. Climax.
2—66x16 Return Tubular.
2—66x18 Return Tubular.

ARC GENERATORS.

No. 12 Brush, 150 light, 9.6 amp.
No. 11 Brush, 125 light, 9.6 amp.
No. 9B Brush, 120 light, 6.6 amp.
M. D. 2 T.-H., 50 light, 9.6 amp.
L. D. 12 T.-H., 75 light, 6.6 amp.
M. 12 T.-H., 45 light, 6 6 amp.

A large assortment of Arc Lamps all in good working order, for direct and alternating currents, series and multiple circuits. Also a fine lot of Transformers, especially General Electric Type H. and Thomson-Houston Type F.

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We Buy or Sell

Generators and Motors

Engines and Boilers

REPAIR SHOP
OPEN DAY AND NIGHT

TELEPHONE US.

Armature Fields Rewound

FOR SALE.

GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
Six Edison, No. 60, 175 K. W.
Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

ALTERNATING GENERATORS.

One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

STREET CAR EQUIPMENT.

One hundred and eighty 25 H. P. motors, new and complete with pinions, gear and gear cases.
One hundred and eighty "K" Controllers.
Twenty-five K-2 Controllers.

ENGINES.

Six 36 and 60x60, Cooper cross-compound, non-condensing, new, never shipped from factory.
One 30x54 St. Louis Corliss.
Two 24x60 Lane & Bodley, designed for rolling mill work.
One 28x60 Pennsylvania Iron Works Co.
One 20x48 Wheelock.
One 20x48 Double Wheelock.
One 20x42 Wheelock.
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
One 14x17 Fisher, new.

BOILERS.

Four 66x18 with 66 4-inch tubes. A complete battery at a great bargain.
Three 66 x 14, with 66 4-inch tubes.
Two 72 in. x 18 ft., with 66 4-inch tubes.
Five 60x16 ft. high pressure boilers.
Two Sterling Water Tube Boilers, 250 H.P. each.
Two 500 H. P. Hazelton.

FERRIS WHEEL.

One 60 ft. Ferris Wheel, electrically driven.

AT A BARGAIN — A complete Edison 3-wire plant of 300 K. W. capacity.

It will be profitable to wire or write us giving requirements of machinery wanted or for sale.

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Offices: 430 Sycamore St. Factory and Warehouse: LUDLOW, KY.

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Engineers, Contractors for Complete Electric Plants. Results Guaranteed.
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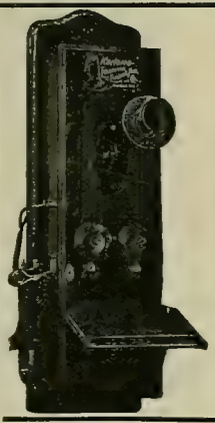

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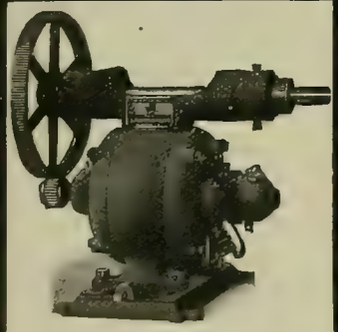

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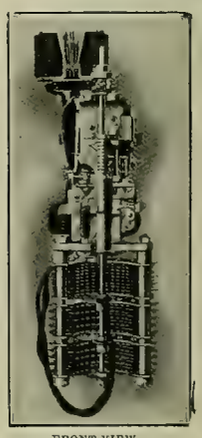

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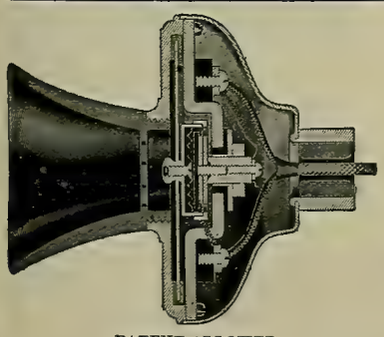

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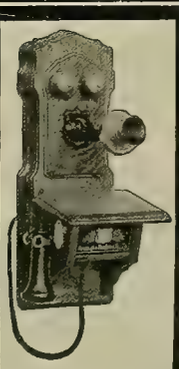

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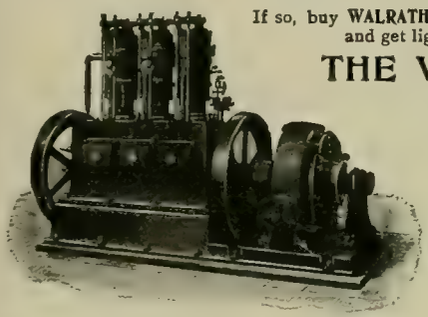

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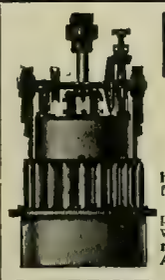

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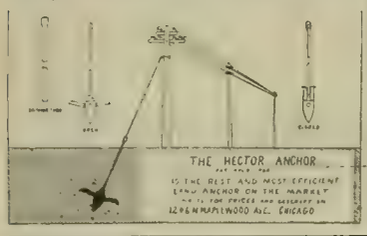

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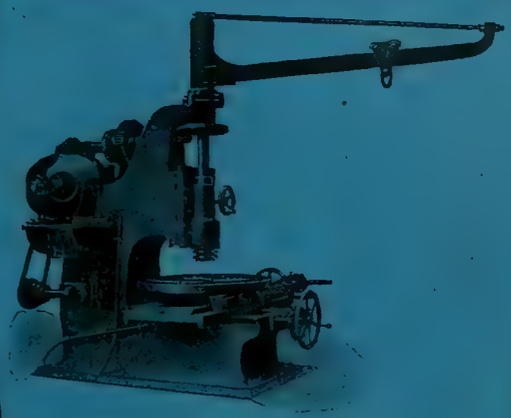

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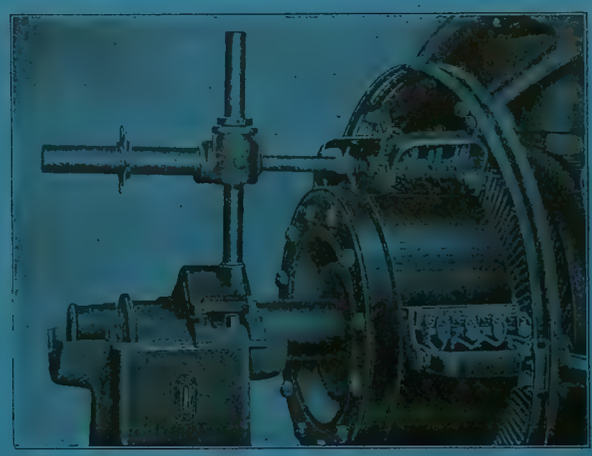

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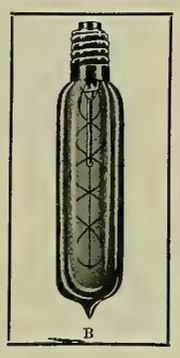

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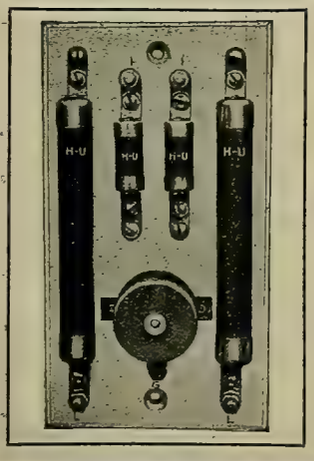

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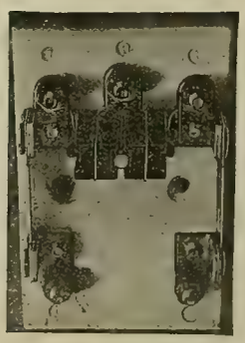

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Simplex Electrical Co.
Standard Underground C. Co.
Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Amer. Insul. Wire & Cable Co.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
Empire Wire Co.
General Electric Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
Western Elec. Supply Co.
Western Electric Company.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lamps, Arc.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Bryan-Marsh Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
Jaeger Miniat. Lamp Mfg. Co.
McCandless & Co., H. W.
Nernst Lamp Co.
Phelps Company.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Sterling Electrical Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Inc., Adjusters.
Inc. El. Lt. Manipulator Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Lamps, Nernst.
Commercial Elec. Supply Co.
Nernst Lamp Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Minnesota Electric Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Draft.
Sturtevant Co., B. F.

Metal Boxes.
Lyon Metallic Mfg. Co.

Meters.
Diamond Meter Co.
Duncan Electric Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Scheeffer Instrument Co.
Stanley Instrument Co.
Westinghouse El. & Mfg. Co.

Mica.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Name Plates.
Murdock Parlor Grate Co.

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

Phosphor Bronze.
Phosphor BronzeSm.Co.,Ltd.

Platinum Bought and Sold.
American Platinum Works.
Baker & Company.

Poles and Ties.
Beidler & Co., Francis.
Berthold & Jennings.
Brooks, Hall L.
Carney Bros. Co.
Chicago Lumber & Coal Co.
Coolidge, Marshall H.
Fowler, John H.
Fulmer Lumber Co., D. M.
Holcomb-Lobb Co.
Hopkins & Co., A. P.
Huebel Company, C. J.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Lumber Co.
Medora Milling Co.
Morse Cedar Co.
O. C. Lumber Company.
Pendleton & Gilkey.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Standard Pole & Tie Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Vreeland, B. F.
Whitmore, A. E.
Wolcott Bros.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain.
Akron Smoking Pipe Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Pulleys.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Refiners.
Gt.West.Sm.and Refining Co.

Reflectors and Shades.
American Refl.& Lighting Co.
Faries Manufacturing Co
Western Electric Co.

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Chicago Edison Co.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Midland Elec. Co.
Schureman & Hayden.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Schools and Colleges.
Electrical Engineer Inst.
Internat'l Corresp. Schools.

Second-Hand Mach'y.
Dustin Co, Chas. E.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
Matthews & Bro., W. N.
Schureman & Hayden.
Stewart Electric Co., John A.
Thompson, Son & Co.
Walsh's Sons & Co.
Whitehead Machinery Co.

Slate.
Bonville, Edward.
Maley, Martin.
McNamara Brothers.
Monson Burmah Slate Co.
Young A B.

Sockets & Receptacles.
Paiste Co., H. T.

Soldering Sticks, Salts and Paste.
Allen Co., L. B.
Western Electric Co.

Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Weston Electrical Inst Co.

Springs.
American Steel & Wire Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.

Switchboards (Slate and Marble).
Bonville, Edward.
Maley, Martin.
McNamara Brothers.

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Automatic Electric Co.
Central Electric Co.
Central Tele. & Elec. Co
Fahnestock Transmitter Co.
Farr Tel. & Const. Supply Co
International Tel. Mfg. Co
Kellogg Switchb. & Sup. Co
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Monarch Tel. Mfg. Co.
Moon Mfg. Co., The.
Sterling Electric Co.
Stromberg-Carlson Tel.M. Co
Swedish American Tel. Co.
Vought Berger Co.
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La Crosse Cabinet Co.

Time Stamps.
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Therien Tool Works.
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Turner Brass Works.

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Crocker-Wheeler Company.
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General Electric Co.
Gregory Electric Co.
Wagner Electric Mfg. Co.
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Western Elec. Supply Co.
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General Electric Co.
Westinghouse El. & Mfg. Co

Turbines, Water Wheels
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle

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Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Water Wheel Governors
Replogle Governor Works.

Wires, Copper.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
Empire Wire Co.
General Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Waclark Wire Co.
Western Electric Company.

Wire, Bare.
American Steel & Wire Co
Central Electric Co
Chicago Insulated Wire Co.
Electric Appliance Co.
Empire Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co

Woodwork, Electrical
Noblett, Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

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MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

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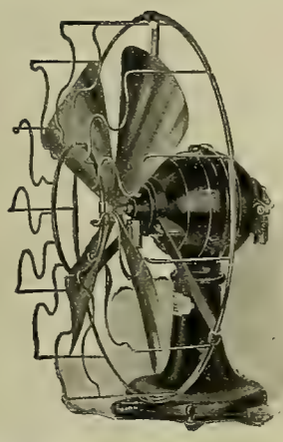

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ARE COPIED BUT NEVER EQUALED

The breeze from a Lundell Fan is greater than from any other make of fan on the market, for the same amount of power consumed. Highest efficiency, greatest durability and best commercial value. They are universal favorites. Write for catalogue No. 03304.

SPRAGUE ELECTRIC COMPANY

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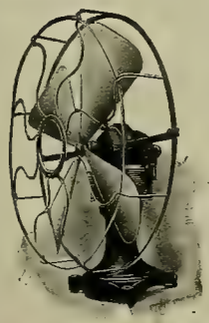
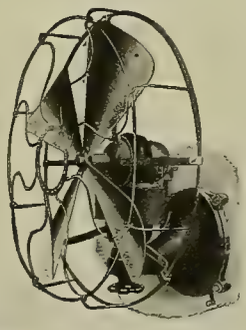
FAN MOTORS



Desk, Bracket and Ceiling Styles

For all Circuits and Voltages.

Artistic in Design and Finish.



High Efficiency, Minimum Current Consumption

Western Electric Company

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Saint Louis Denver Philadelphia

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UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, 66,000 VOLTS.

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,

MANUFACTURERS OF

ELECTROLYSIS PROOF CONDUIT

BITUMINIZED FIBRE. (Patented.)

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822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

FACTORIES:
Chester, Pa.
Chicago, Ill.
Los Angeles, Cal.

STROMBERG-CARLSON SWITCHBOARDS

(1 SECTION MULTIPLE LAMP SIGNAL SWITCHBOARD READY FOR SHIPMENT)

The foundations of successful telephone exchanges *are built of the best grade of material throughout*

NOTE CONSTRUCTION OF SECTIONS SHOWN

Will Stand Critical Examination

WHY?

Because no hidden part is used unless it is absolutely perfect.

Because each part can be explained and illustrated to the minutest detail.

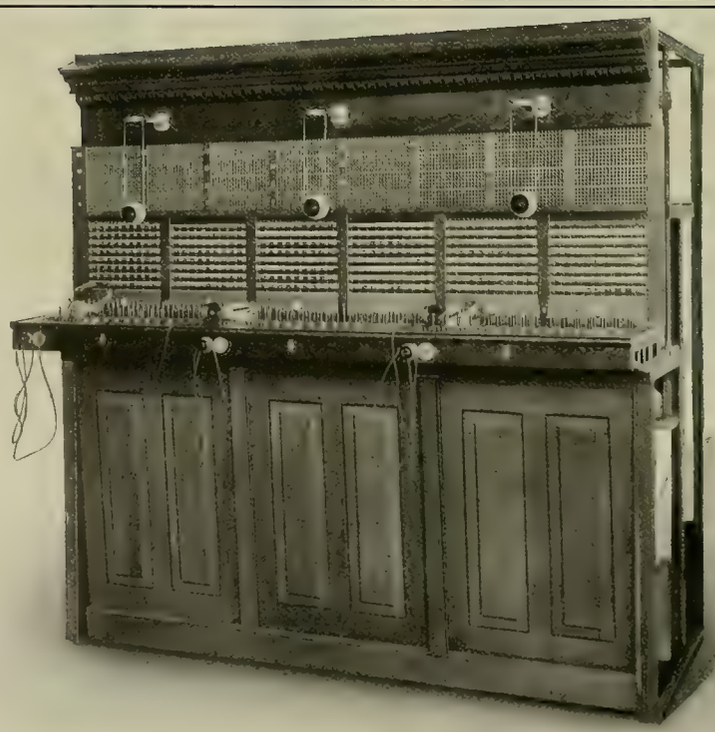
Because they have been purchased for many of the largest telephone systems.

Mention this paper and we will mail bulletins on various lines of our apparatus as fast as they are published.

Stromberg-Carlson Telephone Mfg. Co.

General and Eastern Sales Office
ROCHESTER, N. Y.

Sales Department **Chicago, Ill.**



(1 COMPLETE SECTION MULTIPLE LAMP SIGNAL BOARD)

The Kellogg Switchboard & Supply Company

Has set a new standard in telephones
—both common battery and magneto

AT FIRST SIGHT

ONE CAN OBSERVE SUPERIOR POINTS

IN KELLOGG APPARATUS

And upon rigid examination it is impossible in all fairness not to see that

The Kellogg is superior in every particular to any other telephone ever produced

Kellogg Switchboard and Supply Company

Green and Congress Streets, Chicago

New York Office
346 Broadway

Cleveland Office
Electrical Building

Philadelphia
Keystone Telephone Bldg.

FARR

In United States, Canada, Mexico and So. America

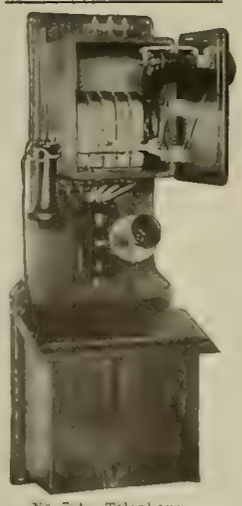
FROM 1896 TO 1903. EVERY TELEPHONE GUARANTEED.

We make high-grade Telephones and Switchboards. All styles and shapes.
We sell separate Transmitters, Receivers, Magneto Bells, Backboards, Hooks and Coils.
We sell everything used to build an exchange or farmer's lines. All kinds of tools and supplies.

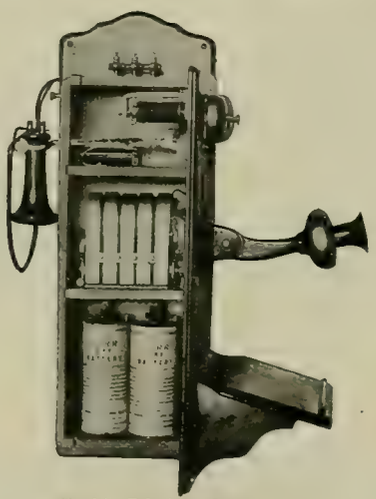
SEND FOR OUR NEW CATALOGUE No. 16. GIVE US A TRIAL ORDER. WE SOLICIT.

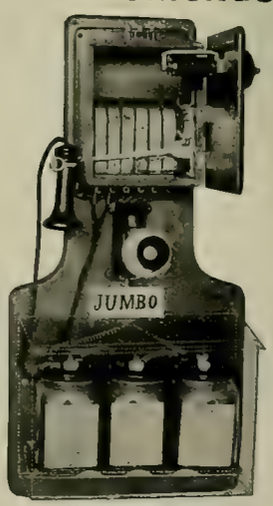
FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY

118 - 120 West Jackson Boulevard - - - CHICAGO


No. 7-A. Telephone.

No. 14. Telephone.

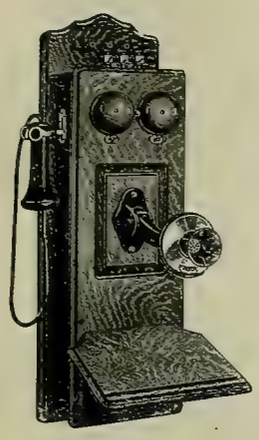

No. 14. Telephone Open.



No. 15. Telephone.

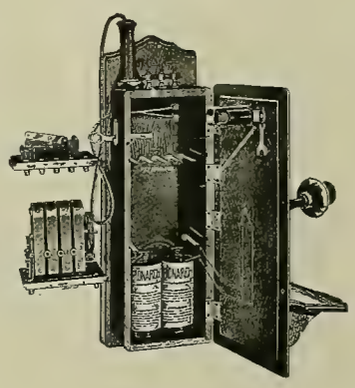
WE KNOW

MONARCH TELEPHONES WILL GIVE PERFECT SERVICE



They are built to do it. They will do it. We guarantee that they will. . . All parts used are of our own manufacture and are assembled by us. Our telephone embodies new features which give it real advantages over other makes. A full description of the instrument would interest you and will gladly be sent upon request.

WE OFFER SPECIAL TERMS ON TRIAL ORDERS.



MONARCH TELEPHONE MFG. CO.

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EDISON TELEPHONE LAMPS

ARE THE

STANDARD FOR VISUAL SIGNALS.

They save the exchange time and money because every lamp is perfect—sure to fit—sure to burn. The life is extremely long—running into years.

Be sure to get the EDISON.

EDISON DECORATIVE & MINIATURE LAMP DEPARTMENT

GENERAL ELECTRIC COMPANY,

Harrison, N. J.

We Make All Kinds of Boxes and Cabinets for the Electrical Trade.

WE CAN ACCURATELY DRILL THEM FOR YOU SO THAT THEY ARE ALL READY FOR THE ASSEMBLING OF THE METAL PARTS. SEND US YOUR SPECIFICATIONS AND LET US QUOTE YOU.

LA CROSSE CABINET CO.

LA CROSSE, WIS.

These two cuts show our new Compact Cabinet with nickel-plated brackets supporting the paper shelf. The paper shelf and nickel-plated brackets are removed in shipping. Doing this saves room, avoids scratching, and facilitates shipping.

The nickel-plated brackets make a handsome contrast with he highly finished quarter-sawed oak front and paper shelf.

WE CAN FURNISH THESE CABINETS ALL DRILLED

READY FOR THE WORKING PARTS.

In addition to the above cabinet, we make all of the standard styles including

CENTRAL ENERGY, MAGNETO BOXES, CABINETS FOR RESIDENCE PHONES, ETC.

Our Specialty is HIGH-GRADE FINISH AND ACCURATE WORK.

SOMETHING NEW

SELF-CONTAINED DESK TELEPHONE

Instant accessability to every part, contact, etc., by the simple unscrewing of one milled thumb nut, shown just above hook—neither hook nor frame in circuit. Self-cleaning contacts of platinum.

Solid nickeled brass frame.

Write for our new Artistic Catalogue.

Swedish-American Telephone Co.

CHICAGO, ILLINOIS.

THE PENDENT TELEPHONE.

Our Specials

THE PENDENT is the most convenient type of telephone both for offices and residences.

Write for one on 30 days' approval.

THE "TWO BALLS" ADJUSTER is the most convenient form of adjustable light on the market for use in offices, factories and residences.

Order through your dealer or direct.

Our apparatus contains the best of material only and represents skilled workmanship.

Write for pamphlets A and B containing full particulars and prices.

THE "TWO BALLS" ADJUSTER.

Get a Pendent

THE VOUGHT-BERGER COMPANY

Makers of Telephones and Switchboards, La Crosse, Wis., U. S. A.

Get a Pendent

OUR BATTERY DEPARTMENT

has just published a most complete and compact catalogue upon the leading

PRIMARY BATTERIES

which takes in all forms of Dry and Wet Batteries. This catalogue greatly clears up the battery situation, giving in a concise, clear manner the true value of "Leading Batteries."

THE NUNGESSER NO. 3 CELL

is really a wonderful battery, taking the place of many other forms at less cost and TO MUCH GREATER ADVANTAGE. The catalogue covers the details which are well worth knowing.

Address **BATTERY DEPARTMENT,** Electric Appliance Company,

92 and 94 West Van Buren Street, CHICAGO.

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TRADE MARK

THE OKONITE COMPANY, Ltd.

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NEW YORK

MANUFACTURERS OF

OKONITE WIRES and CABLES
CANDEE PAT'D. POTHEADS or CABLE TERMINALS
MACE FIREPROOF BRAID

OKONITE TAPE
MANSON TAPE

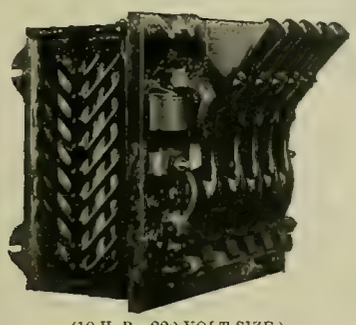
"OKONITE"

THE STANDARD FOR RUBBER INSULATION

OKONITE
TRADE MARK

C & H

MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.

CHICAGO, 1232 MONADNOCK BLDG. NEW YORK, 136 LIBERTY ST. PITTSBURG, 319 FRICK BLDG.

H. W. McCandless & Co.

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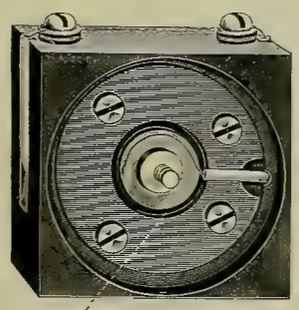
IT WILL INTEREST YOU SURELY

SETS A NEW STANDARD



FULL SIZE

MICA

THE "BUTTON" TYPE TELEPHONE TRANSMITTER

THE first successful departure from the stereotype "solid back" principle. Working parts entirely self-contained and removable without taking the instrument from the wall. Absolutely non-packing. Moisture proof. No cloth, no felt, or other perishable material used in its construction. Concealed cords. Enamel finish. Of great tone volume and sharp, clear articulation. Right in every way.

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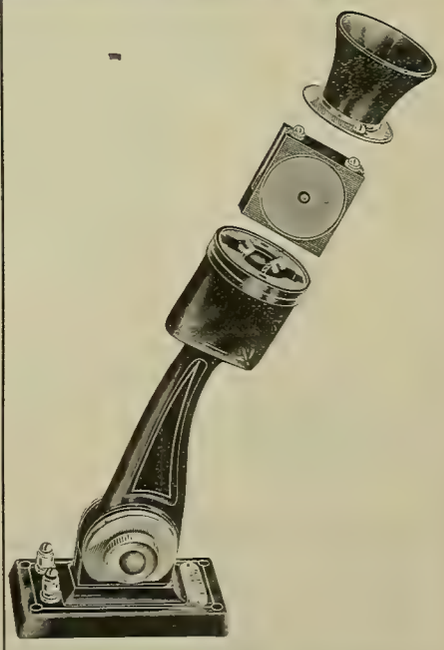

THE FAHNESTOCK TRANSMITTER CO.,
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TRADE EVERBEST MARK.

Seven Big Floors Filled With Things Electrical Which Wait Your Order in Person, By Mail Or By Wire.

TRADE EVERBEST MARK.

At your Service Ever With the Goods to Deliver, The Price Right And Promptness Guaranteed in Every Shipment.

TRADE EVERBEST MARK.

Arc and Incandescent Lamps, Dynamos, Motors, Watchman's Registers, Telephones, Signal Apparatus and every conceivable article and material used by Lighting Stations, Street Railways, Engineers, Contractors and Builders.

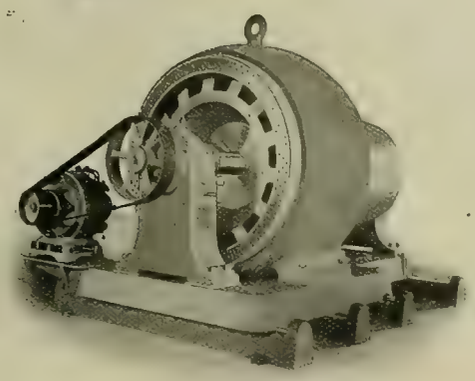
TRADE EVERBEST MARK.

EWING-MERKLE ELECTRIC CO

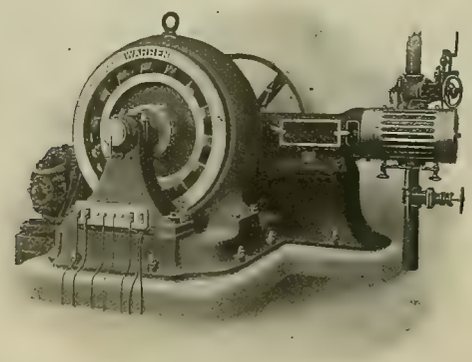
SAINT LOUIS, - MO.

The Warren Alternator.

OUR PRODUCT.

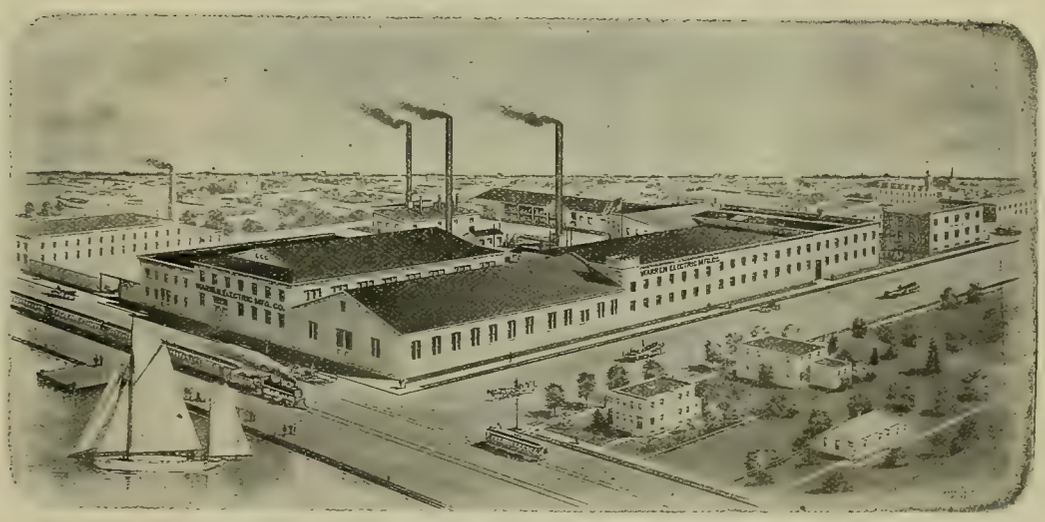


BELTED TYPE.



ENGINE TYPE.

OUR FACTORY.



Recent additions to our shop plant, new tools, electric crane, etc., afford us increased capacity to manufacture sizes up to

1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

BULLETINS ON APPLICATION—THEY TELL YOU ABOUT IT.

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SANDUSKY, OHIO, U. S. A.

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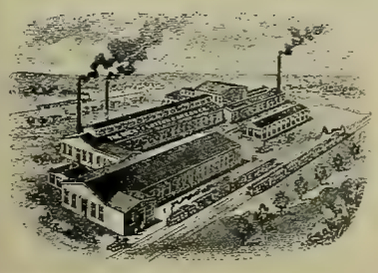
C. W. Hobson, Waco, Texas.
Kilbourne & Clark Co., 815-817 Second Ave., Seattle, Wash., Pacific Coast Agts.
A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.



CARBONS

THE DICKEY-SUTTON CARBON COMPANY,
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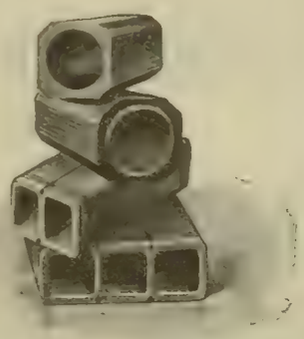

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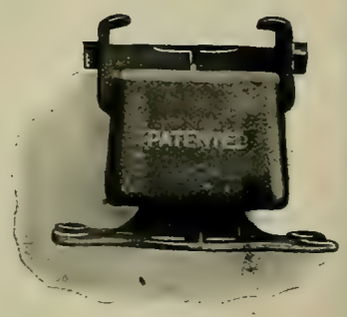

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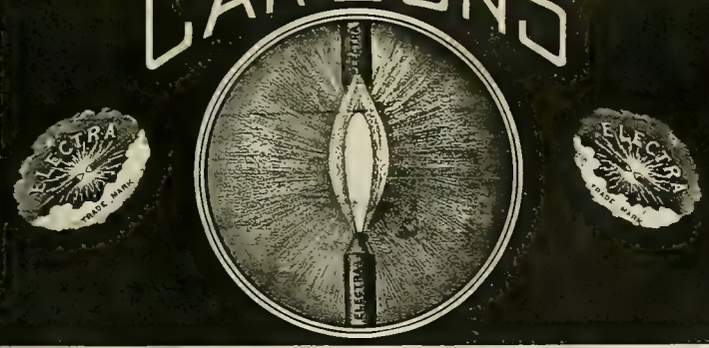

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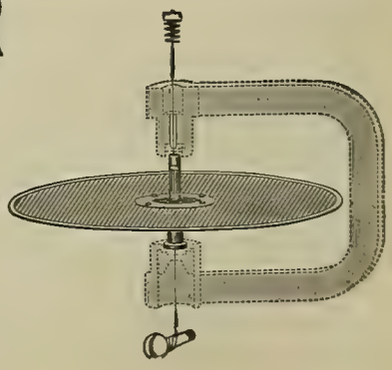

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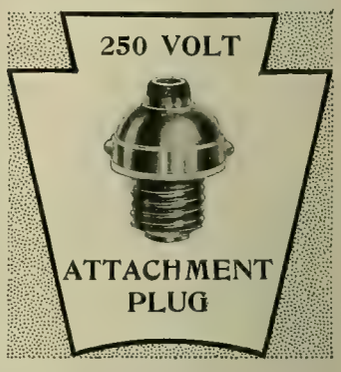

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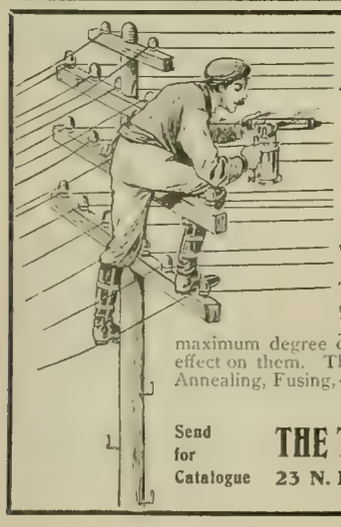

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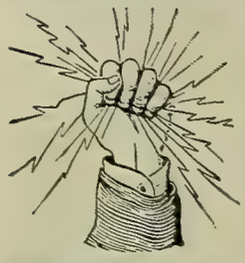

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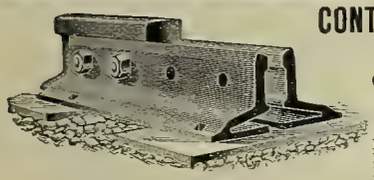

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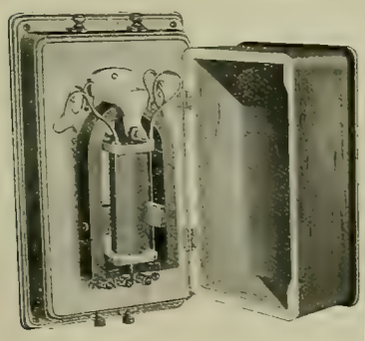

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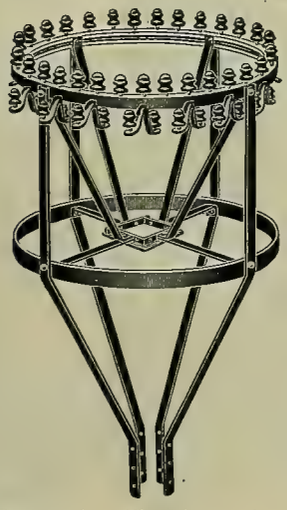
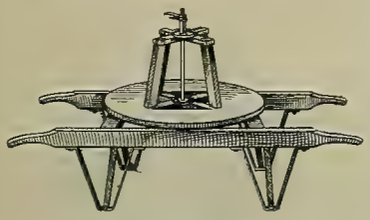


Forty wire Circle can be increased to eighty wires by using bracket shown in above cut.

Made in all sizes.

Suitable for Electric and Telegraph as well as Telephone distributors.

150 in use in Minneapolis and St. Paul.



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300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

200 kw., Westinghouse, M. P. 8, 500-550-volt Generator, direct connected to 18 and 30x16 Westinghouse Engine; generator entirely rewound and engine in excellent condition.

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25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

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2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1—60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.

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2—500 kw., 6-pole General Electric.
2—225 kw., 6 pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., General Electric.
2— 80 kw., Detroit.
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1—14x14 Rice Automatic.
2—13 and 23x17 Tandem Compound McIntosh & Seymour.
2—10 and 18x20 Payne Compound.
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1—12 and 20x12 Westinghouse Compound.
1—7x8 Payne.
1—18x48 Geo. H. Corliss.
1—16x42 Greene.
1—10½ and 16½x12 Cross Compound Armington & Sims.
2—26x48 Providence Greene.
2—18 and 30x16 Westinghouse Compound.
3—18½x18 Armington & Sims.
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7—163 H. P. Babcock & Wilcox.
5—250 H. P. Climax.
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No. 12 Brush, 150 light, 9.6 amp.
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Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
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Six Edison, No. 60, 175 K. W.
Six T. H., D62.
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GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
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One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
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Two 100 K. W., G. E., 1100 volts monocyclic, complete.
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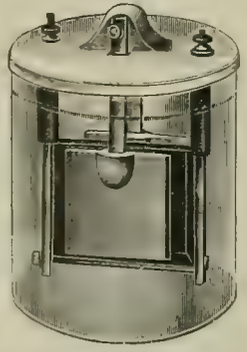

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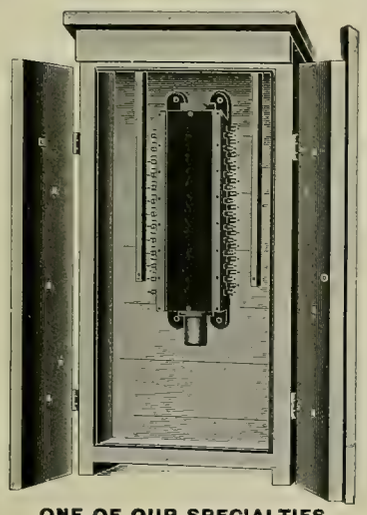

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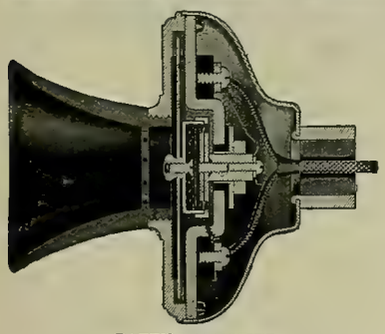

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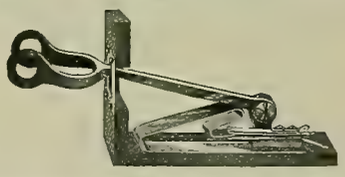

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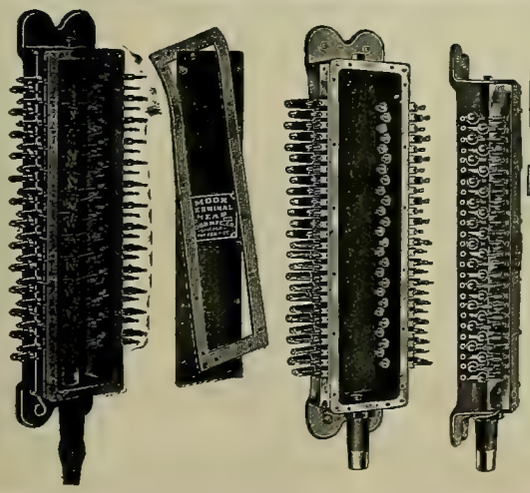
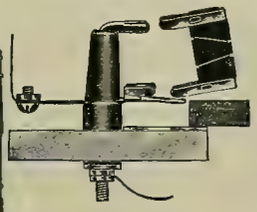


Carbon Arrester in Detail.



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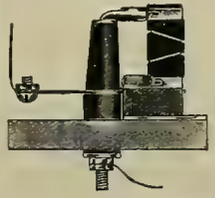

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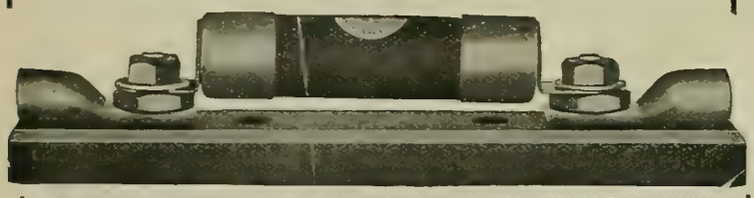

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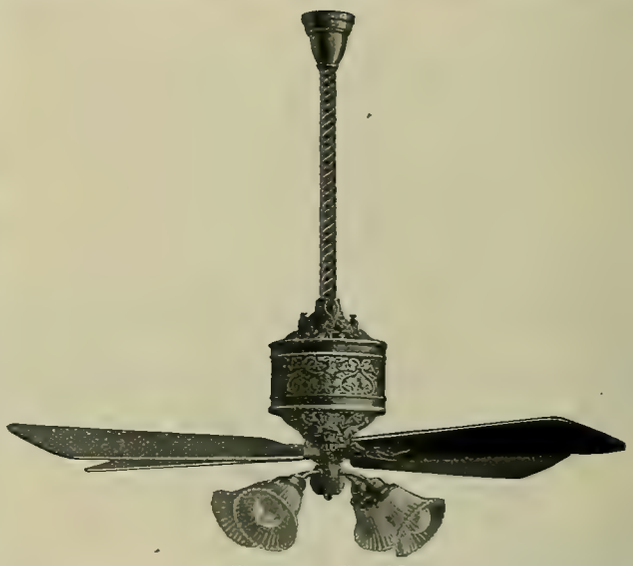

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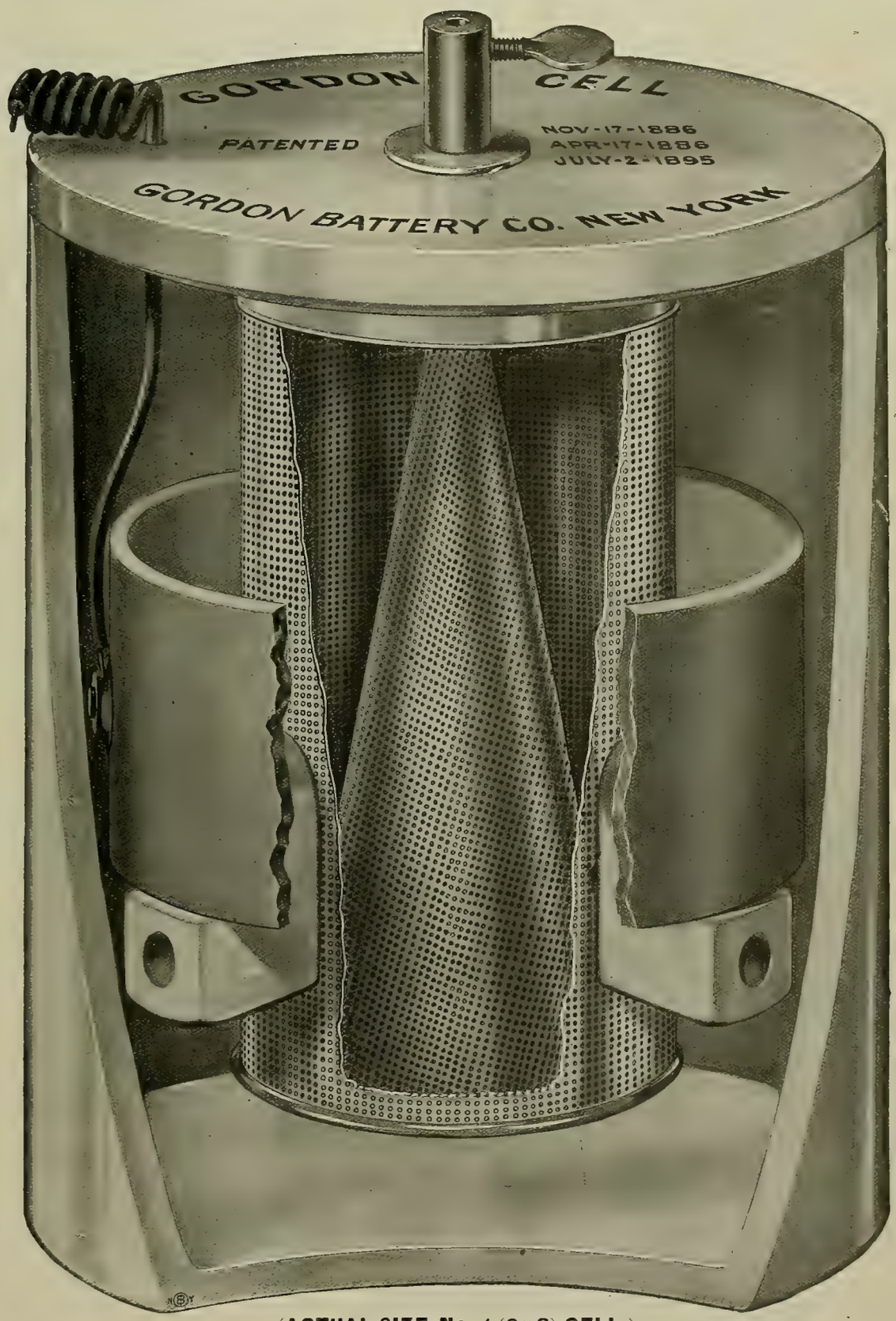

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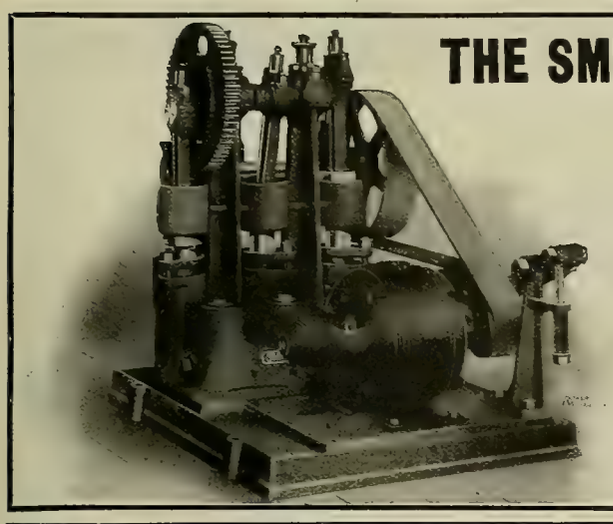

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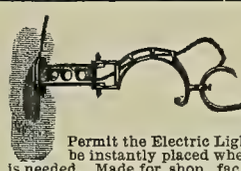

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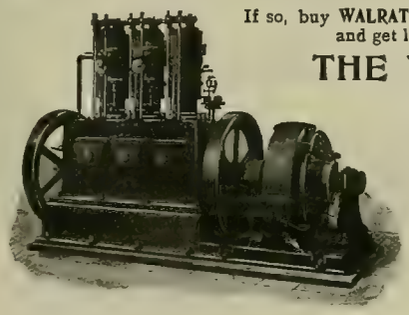

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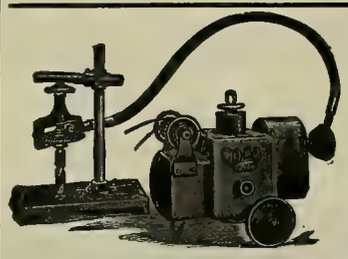

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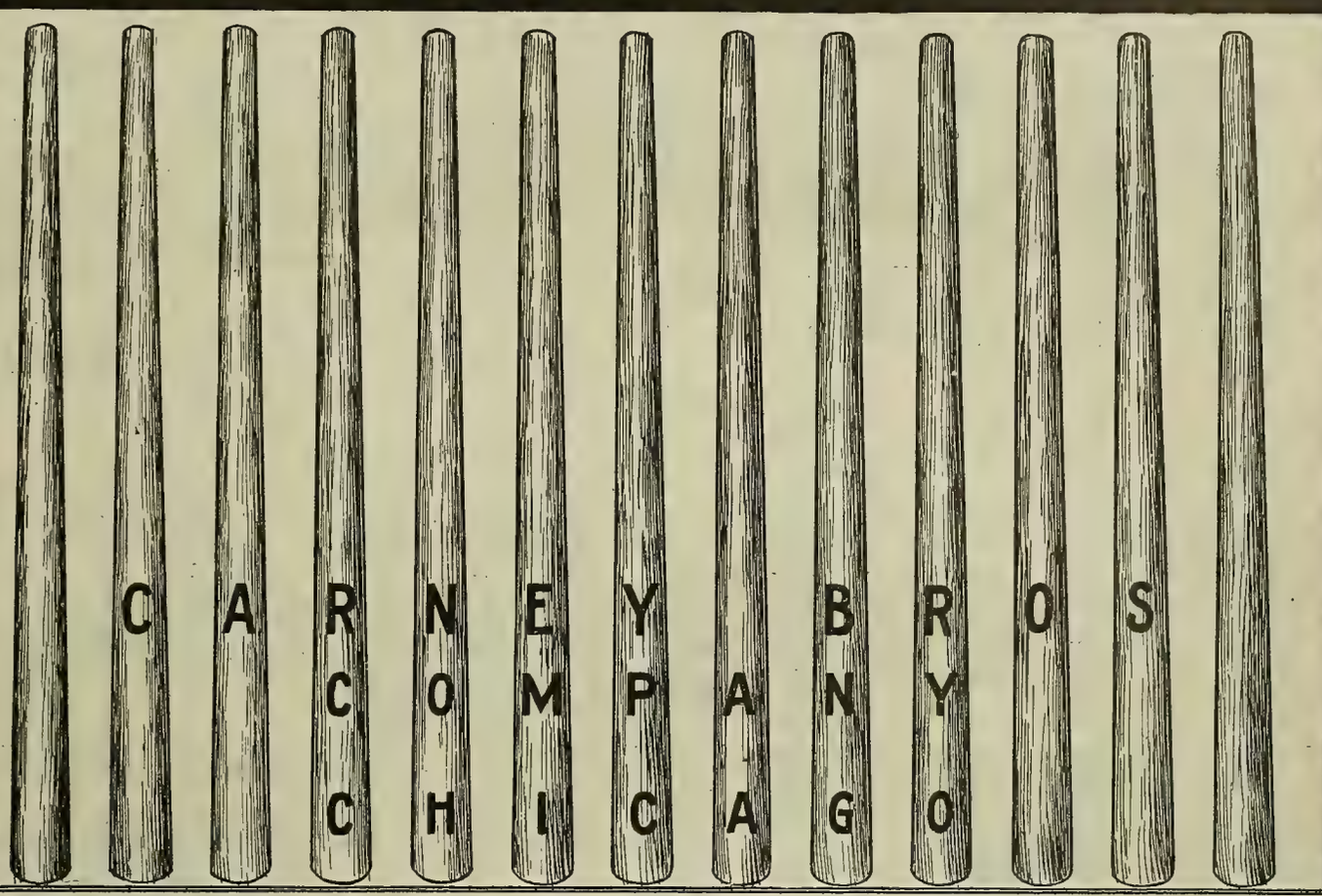

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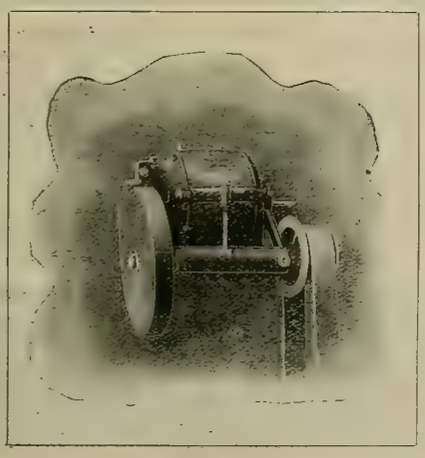

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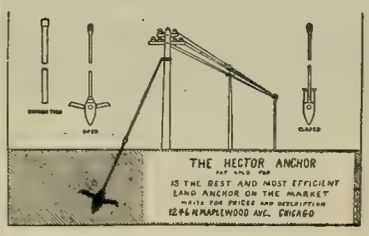

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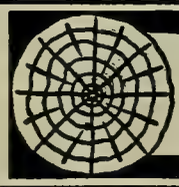

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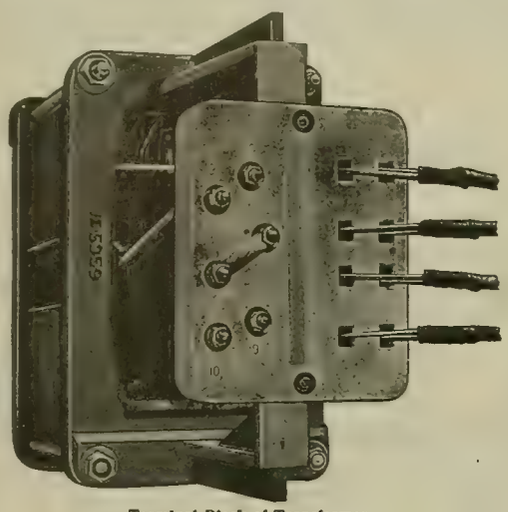
The number of secondary voltages of Westinghouse O. D. and Type N Transformers is a distinctive feature. Besides those tabulated below, other primary values will give proportional secondary voltages.



Terminal Block of Transformer.

Primary	Secondary: Class 200	Secondary: Class 400
1050	52½, 105, 210	105, 210, 420
	58, 116, 232	116, 232, 464
2100	52½, 105, 210	105, 210, 420
	55, 110, 220	110, 220, 440
	58, 116, 232	116, 232, 464

Class 200 Transformers will supply 50, 100 and 200 volt incandescent lamps, 200 volt Nernst lamps, or 200 volt power circuits.

Class 400 Transformers will supply 100 and 200 volt incandescent lamps, 200 volt Nernst lamps, or 400 volt power circuits; also 400 volt 3-wire service for 200 volt Nernst and incandescent lamps.

Close adjustments of secondary voltage permit the same transformer to be used near the station where the voltage is high, or at the end of a long feeder where the voltage is low.

In the manufacture of incandescent lamps many vary slightly from standard voltages. These lamps,—of high efficiency,—are always in stock. Type N and O. D. Transformers permit their use.

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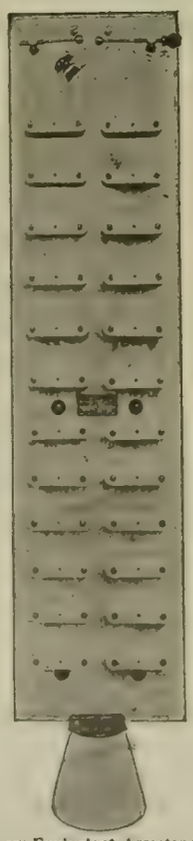

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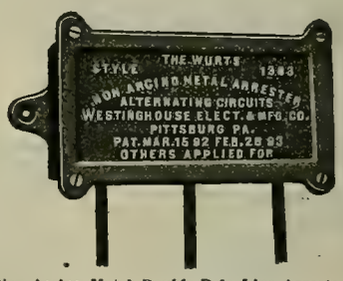

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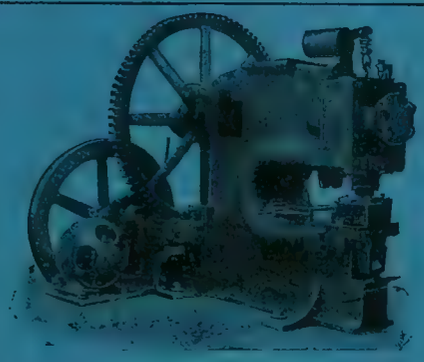

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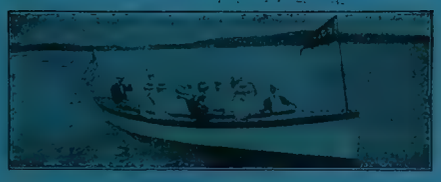

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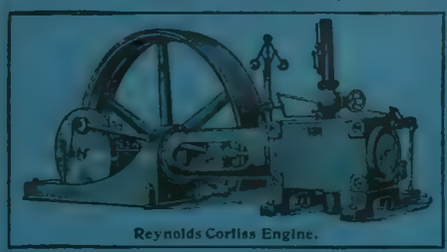
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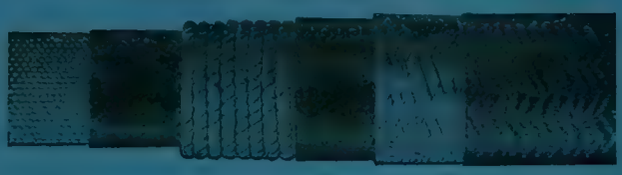

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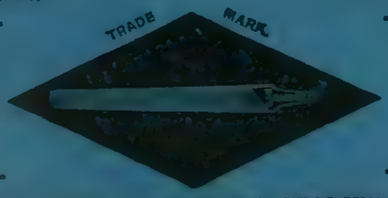

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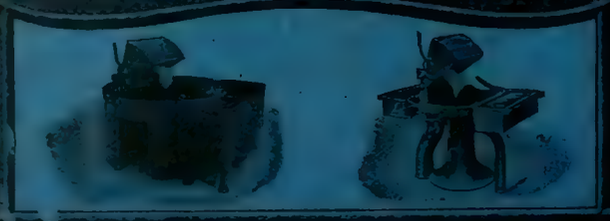

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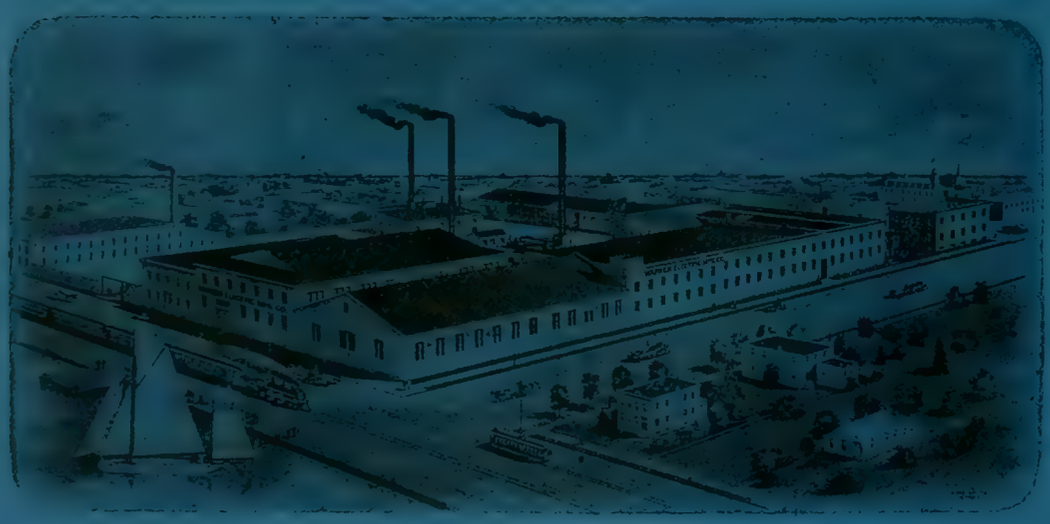

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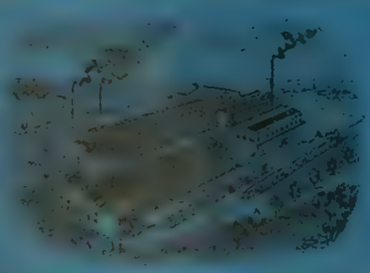

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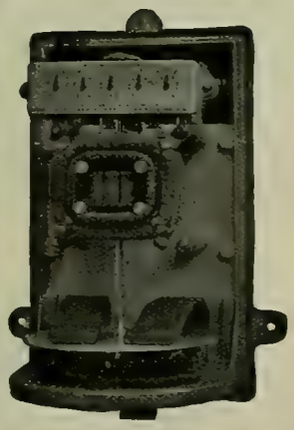

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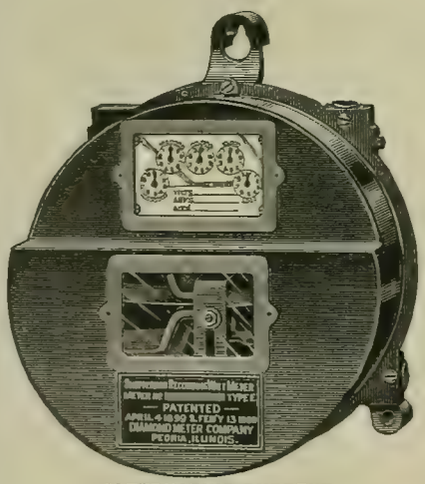

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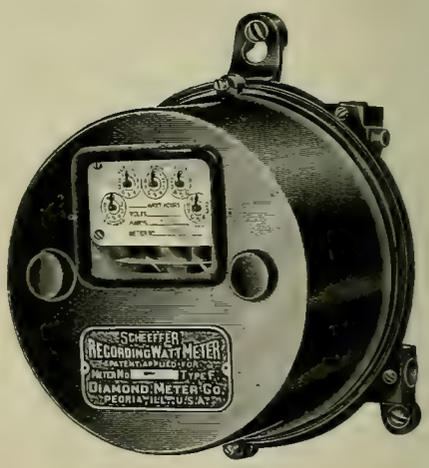

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There is no condition on our regular two years' guarantee; on the five years' guarantee a bill for all repairs made after the two years will be rendered, but will be cancelled upon a statement from your company that all purchases of transformers by your company since the date of the original invoice have been made from the Kuhlman Electric Co.

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There are no Carbons better than the "Electra" and none "just as good."

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To the Consumer and Central Station Manager Alike—They Please the Former and Increase the Business of the Latter.

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Western Electric Company.
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Fisher Electric Company.
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Western Electric Co.
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Kartavert Mfg. Co.
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Water Wheel Governors
Replogle Governor Works.

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Okonite Co., The.
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MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

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WIND HAS NO EFFECT ON THE TURNER DOUBLE JET GASOLINE TORCHES

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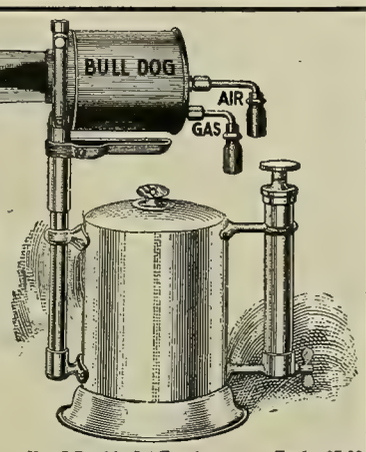

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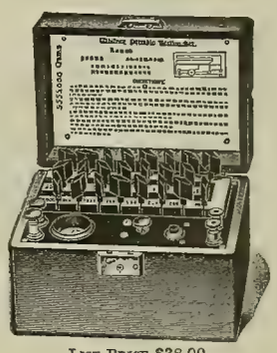

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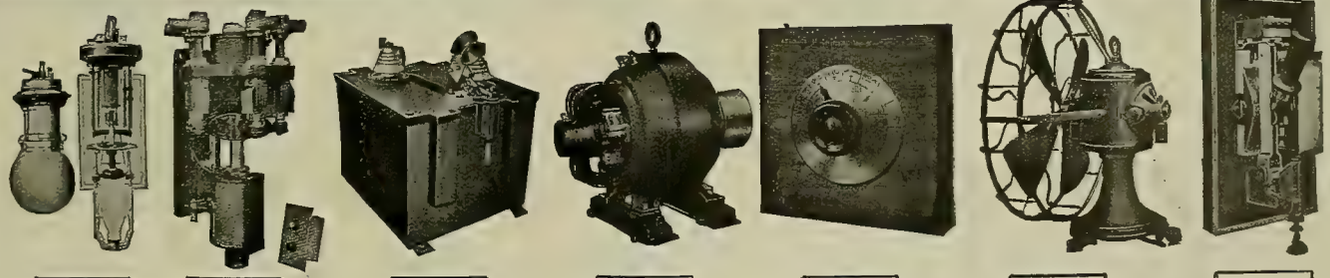

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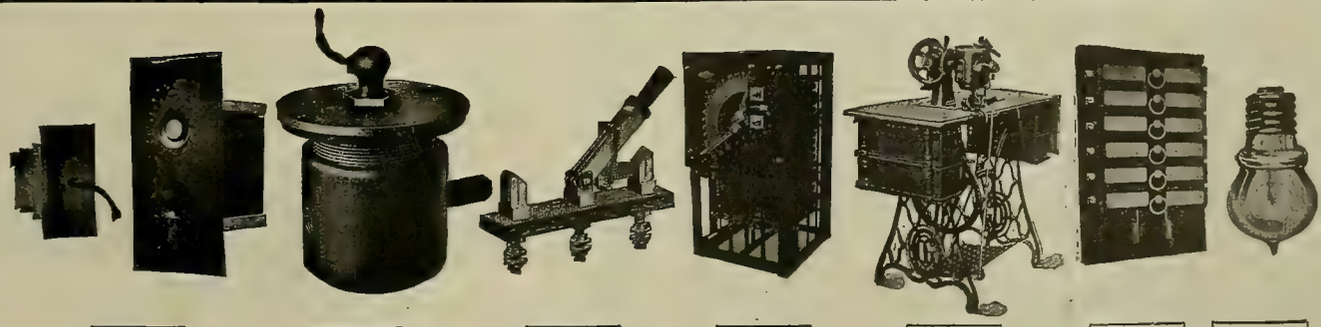

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Ceiling Fan Motors

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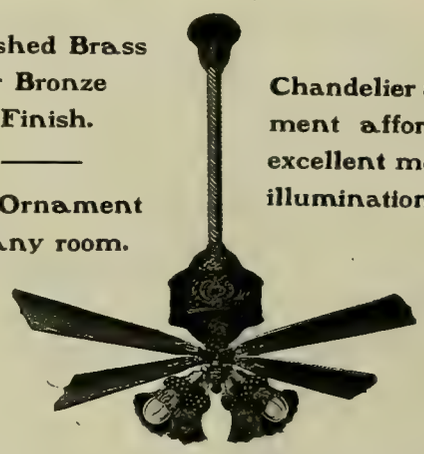

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Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

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NOW USED IN CONNECTION WITH PRACTICALLY EVERY

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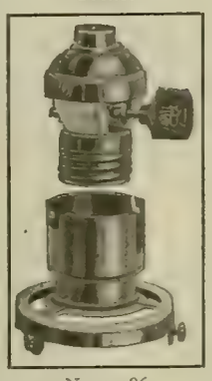

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P=K "HOLOSHADE" SOCKET

This was suggested by a member of our firm AFTER seeing the name "Holdshade" as sent in by four (4) different persons. We will, therefore, take great pleasure in dividing the $50.00 between these four, and can only wish it was more for each.

"HOLO" IS GREEK

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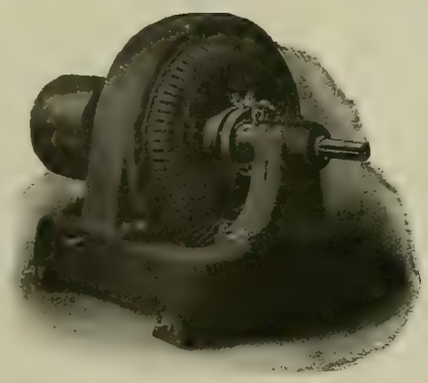

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Electrical Machinery includes:

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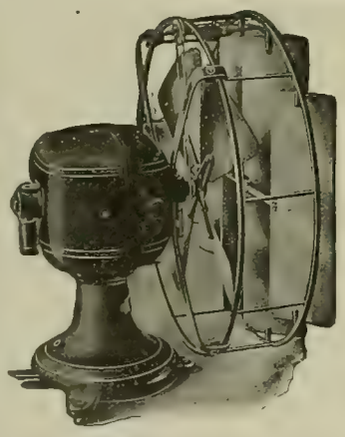

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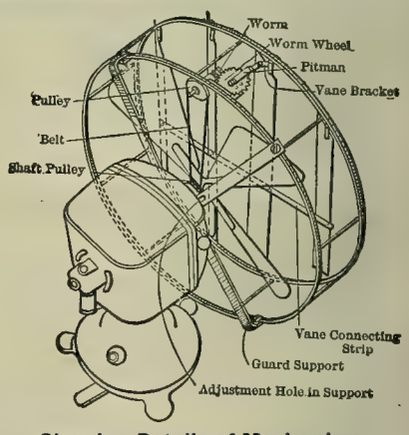

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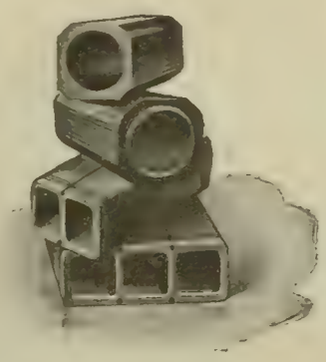

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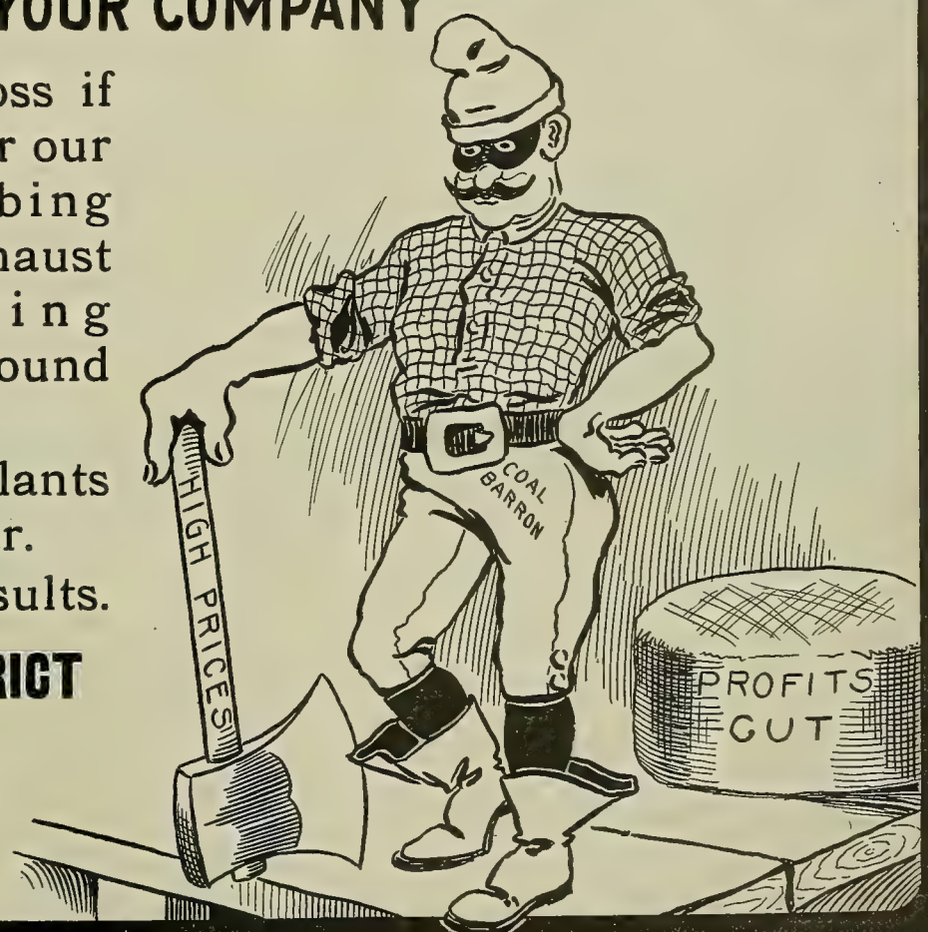

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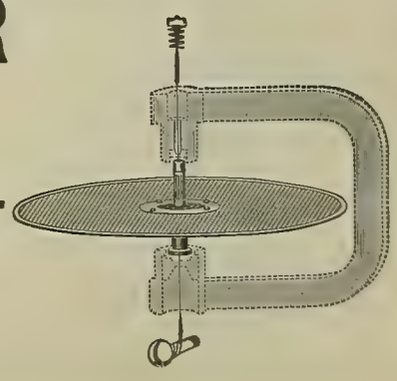

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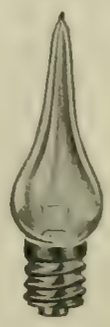

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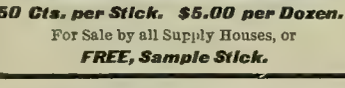

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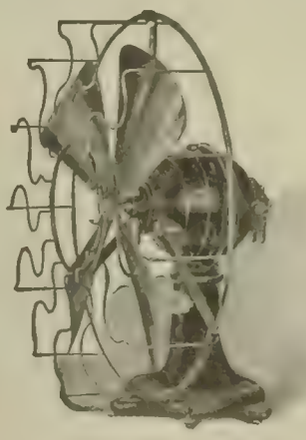

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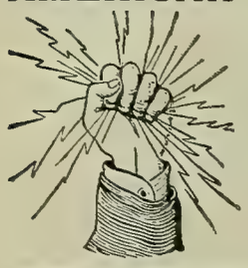

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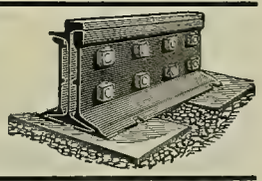

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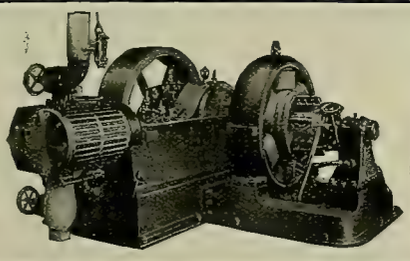

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THE STERLING VARNISH CO., Pittsburg, Pa., U. S. A.
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Sample, 3-in Nickel, 50c Enameled, 45c
By mail, prepaid. Made in sizes 2 to 8-inch. Dealers send for prices. We also make Inventors' Models and Special Electrical Devices. Write us for prices.
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TURN-DOWN LAMP
Teaches people to use more current by turning lamps down instead of out.
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NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

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CHEAPEST FIRST. CHEAPEST LAST.

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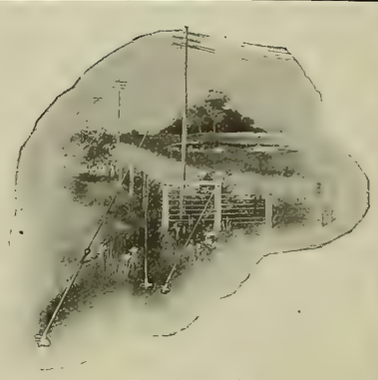
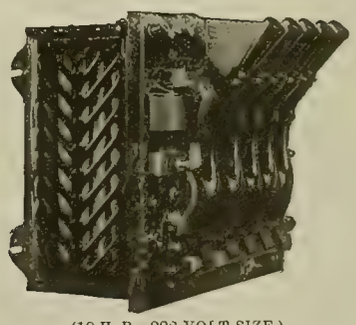


Worm's-eye View.

C & H
MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER
Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.
THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.
CHICAGO, 1232 MONADNOCK BLDG. NEW YORK, 136 LIBERTY ST. PITTSBURG, 319 FRICK BLDG.

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As superintendent of electric-light or water-works plant. 15 years' practical experience in this business. Results guaranteed. Am now employed as superintendent of large plant but desire a change. References. Address BOX 192, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED.

A good practical engineer who can read indicator cards intelligently, and has experience in line, house wiring and dynamo tending, superior education and a student in electrical engineering, desires position as engineer or second electrician. No invalid or has been. Nebraska preferred. Can manage moderate plant. Address BOX 190, care Western Electrician, 510 Marquette Building, Chicago.

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By technical graduate in light, railway or construction work. Have had 3 years' practical experience in direct and alternating-current work. Can give good recommendation. Strictly sober. Address BOX 189, care Western Electrician, 510 Marquette Building, Chicago.

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As general superintendent or manager with light or power company; educated in mechanical and electrical engineering, seven years' experience in management and operation with first-class companies in the lighting business as well as street railway and interurban work. Experience covers work of the latest in high tension transmission, three-phase and sub-station distribution, steam and water-power generating stations. Engaged at present with a leading electrical concern from whom first-class references can be had. Address BOX 191, care of Western Electrician, 510 Marquette Building, Chicago, Ill.

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1 40 H. P. Motor 3-phase, 60-cycle, 220-volt Form L.
1—20 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
1 15 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
Manufactured by General Electric Co., practically new and in perfect condition.
BADGER BOX & LUMBER CO., Grand Rapids, Wis.

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Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices.

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U. S. Army guns, as curiosities, for cosey corners, dens, etc.
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Immediate Returns.

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All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

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Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings), Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
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2— 60 K. W. Westinghouse.
1 Large stock of direct-current machines.
Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

IT'S UP TO YOU.

We pay highest market prices for **SCRAP COPPER, BRASS AND PLATINUM,** also **Incandescent Lamp Bases, Etc.**

WRITE US.

We Manufacture Copper Hard Babbitt the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.

GREAT WESTERN SMELTING AND REFINING CO., CHICAGO.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

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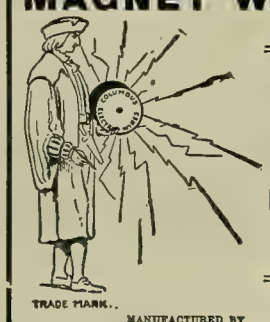
MAGNET WIRE



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ROUND, SQUARE AND RECTANGULAR.

MANUFACTURED BY

Columbus Insulated Wire and Brass Co.

COLUMBUS, OHIO.

MANUFACTURERS

Contemplating establishing plants in the West should take advantage of a location on

THE NORTH-WESTERN LINE

Chicago & North-Western Ry.

which reaches the famous

WATER POWERS, COAL FIELDS, IRON ORE RANGES, HARD AND SOFT LUMBER DISTRICTS

of the West and Northwest, and affords the best means of transportation to the markets of the world.

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WACLARK WIRE CO. COPPER WIRE

NEW YORK, ELIZABETH, N.J. — CHICAGO, 1201 MARQUETTE BLDG.

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34x60 950-H. P. International Power Corliss.
28x48 750-H. P. Harris Double Eccentric Corliss
23x60 450 H. P. George H. Corliss.
20x48 300-H. P. Harris Corliss.
18x42 250-H. P. Greene Corliss, Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
24x48 500-H. P. Buckeye Automatic.
15 and 23x17 300-H. P. McIntosh & Seymour Tandem Compound Railway Engine.

BOILERS.
1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

HEATERS, ETC.
500-H. P. Excelsior Heater.
300-H. P. Wheeler Heater.
300-H. P. Baragwanath Heater.
200-H. P. Kroeschell Heater.
150-H. P. Berryman Heater.

WHITEHEAD MACHINERY CO., Davenport, Iowa.

RY. GENERATORS.
4—500 K. W. Gen'l Electric.
1—250 K. W. Walker.
2—150 K. W. Edison bi-polar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole.
4—100 K. W. Gen'l Electric.
3—100 K. W. Edison bi-polar.
4—60 K. W. Edison bi-polar.
6—D62 K. W. T. H. bi-polar.
1—50 K. W. Detroit, M. P.
1—45 K. W. Ft. Wayne, M. P.

BOILERS.
6—200 H. P. Heine watertube.
1-375 H. P. National watertube
3—350 H. P. Climax watertube.
1—267 H. P. Abendroth & Root.
1-250 H. P. Sterling watertube
1—100 H. P. locomotive type.
2—150 H. P. tubular.
2—90 H. P. tubular.
2—50 H. P. tubular.

ENGINES.
3—18x30x18 Westinghouse.
1—Twin Engine 16x38 Watts Campbell.
2—15x23x17 McI. & Seymour.
1—22x33 Buckeye (new).
1—18½x18 McI. & Seymour
1—16x18 Erie City slide valve.
1—20x42 Fitchburg Corliss.
2—16x16 Erie Ball.
1—14x36 Allis Corliss.
2—13x21 Buckeye Automatic.
1—18x36 Cummer, 4 valve.
1—14x14 Weston Automatic.
2—13x12 Armington & Sims.
1—12x12 Harrisburg.
1—11x16 Straightline.
1—9x9 New York Safety.
3—7x7½ Westinghouse.

ALTERNATORS.
1—400 K.W. Wood, 2 phase.
2—150 K.W. St'nley 2 phase
2—120 K.W. G. E. S. phase.
2—75 K.W. Stanley 2 phase.
4—60 K. W. G. E. S. phase.
2—30 K. W. Westinghouse.

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13 and 20½x15 Armington & Sims, cross compound, 250 H. P.
12 and 24x18 Williams tandem compound, 250 H. P.
20x18 Ball, 250 H. P.
12x12 Ideal, 90 H. P.
10x13 Frost automatic.
180 K. W. and 120 K. W. G. E., 60 cycle, A. S. type 1,100 or 2,200 volt alternators.
150 K. W. 60 cycle Ft. Wayne, 2,000 volt alternator.
120 K. W. and 60 K. W. G. E., 133 cycle, 1,100 volt alternators.
Direct current 110 volt generators all sizes.

Write for our complete stock list No. 51.

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"SAFETY" RUBBER COVERED WIRE AND CABLE

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On account of the dedication ceremonies, Louisiana Purchase Exposition, St. Louis, Mo., the Wabash Railroad will sell round-trip tickets to this point for one fare. Tickets sold April 29 to May 1, 1903. Good to return not later than May 4, 1903. For further information, write

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Machine and Carpenter Work of All Kinds Correspondence Solicited.

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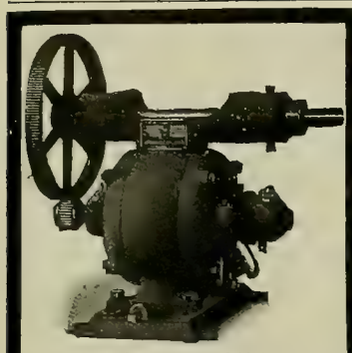
FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.



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Built on five frames for ⅛, ¼, ½, ¾, 1, 1¼, 1½, 2 and 3 horsepower with speed reductions of from 5 to 1.

Multi-polar type with cast dynamo steel frames and ventilate form coil wound armatures.

An efficient, durable motor built for lasting and severe use.

We build special motors and dynamos for special purposes.

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MILWAUKEE.

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Manufacturers of

Fuse Wire, Fuse Links, Telephone Fuses and Supplies, Wire Joints.

We make a Specialty of FUSE WIRE and STRIP for TELEPHONE fuses, instrument fuses, and in fact anything requiring a very LOW FUSING point.

Our fine fuse wires are made with the same degree of accuracy which we have always maintained for all our product, and they have sufficient TENSILE STRENGTH to be handled without difficulty.

We are in position to take care of orders, large or small, regular or special, and can make prompt shipments.

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DIRECT-CONNECTED UNITS.

300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

200 kw., Westinghouse, M. P. 8, 500-550-volt Generator, direct connected to 18 and 30x16 Westinghouse Engine; generator entirely rewound and engine in excellent condition.

187½ kw., Westinghouse, M. P. 8, 120-volt Generator, direct connected to Westinghouse Compound Engine.

50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½ and 13x12 Armington & Sims Tandem Compound Engine. One year old.

50 kw., Eddy Compound Generator, 125 volts, direct connected to 13x13 Harrisburg Ideal Engine.

25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

25 kw., General Electric, 110 volts, 4-pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1—60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.

RAILWAY GENERATORS.

2—500 kw., 6-pole General Electric.
2—225 kw., 6 pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., General Electric.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

ENGINES.

1—14x14 Rice Automatic.
2—13 and 23x17 Tandem Compound McIntosh & Seymour.
2—10 and 18x20 Payne Compound.
1—13x12 Armington & Sims.
1—12 and 20x12 Westinghouse Compound.
1—7x8 Payne.
1—18x48 Geo. H. Corliss.
1—16x42 Greene.
1—10½ and 16½x12 Cross Compound Armington & Sims.
2—26x48 Providence-Greene.
2—18 and 30x16 Westinghouse Compound.
3—18½x18 Armington & Sims.
1—18½x18 New York Safety.
1—20x48 Harris-Corliss.

BOILERS.

7—163 H. P. Babcock & Wilcox.
5—250 H. P. Climax.
1—600 H. P. Climax.
2—66x16 Return Tubular.
2—66x18 Return Tubular.

ARC GENERATORS.

No. 12 Brush, 150 light, 9.6 amp.
No. 11 Brush, 125 light, 9.6 amp.
No. 9B Brush, 120 light, 6.6 amp.
M. D. 2 T.-H., 50 light, 9.6 amp.
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A large assortment of Arc Lamps all in good working order, for direct and alternating currents, series and multiple circuits. Also a fine lot of Transformers, especially General Electric Type H. and Thomson-Houston Type F.

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Armature Fields Rewound

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GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
Six Edison, No. 60, 175 K. W.
Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

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One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

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One hundred and eighty 25 H. P. motors, new and complete with pinions, gear and gear cases.
One hundred and eighty "K" Controllers.
Twenty-five K-2 Controllers.

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Six 36 and 60x60, Cooper cross-compound, non-condensing, new, never shipped from factory.
One 30x54 St. Louis Corliss.
Two 24x60 Lane & Bodley, designed for rolling mill work.
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One 20x48 Double Wheelock.
One 20x42 Wheelock.
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
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One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
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One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
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Four 66x18 with 66 4-inch tubes. A complete battery at a great bargain.
Three 66 x 14, with 66 4-inch tubes.
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Five 60x16 ft. high pressure boilers.
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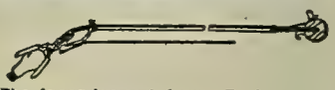
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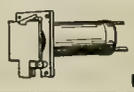
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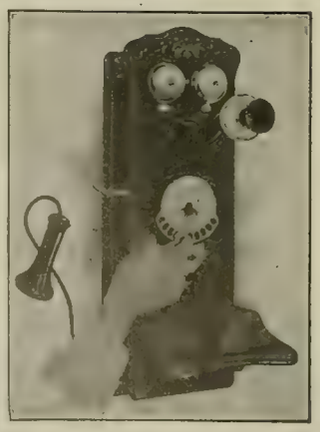
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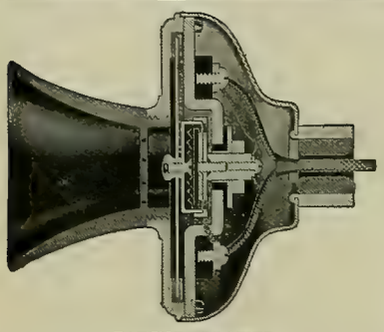

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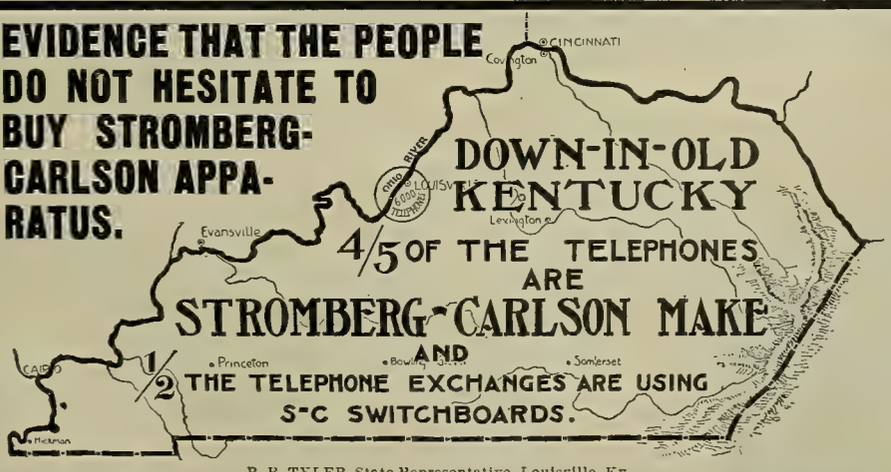

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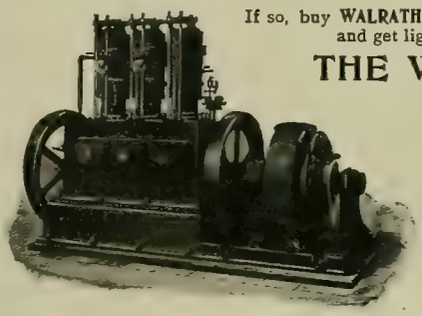

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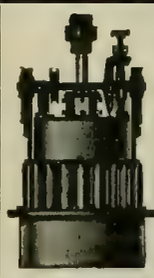

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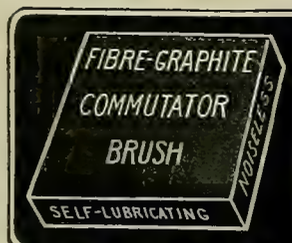

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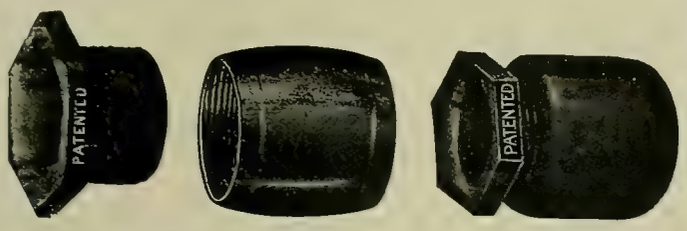

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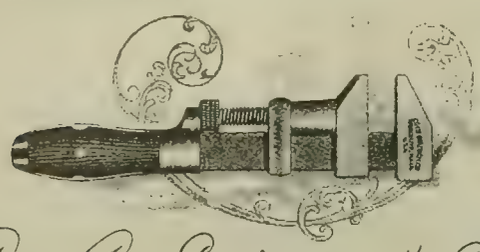

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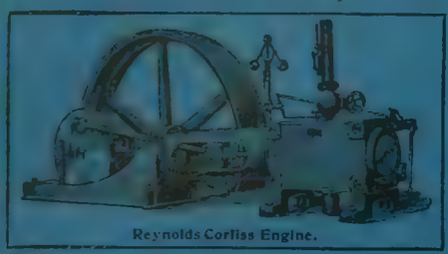
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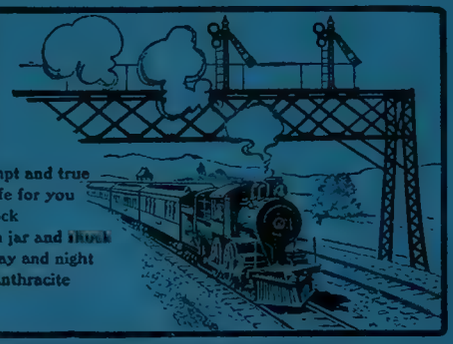

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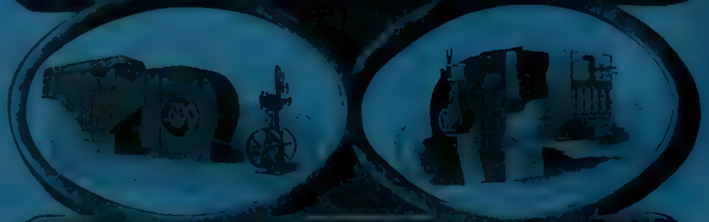

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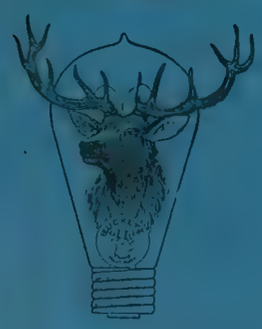

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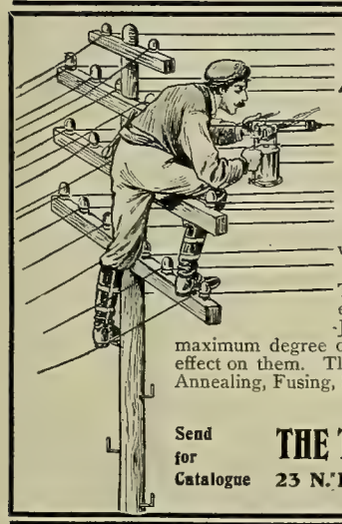

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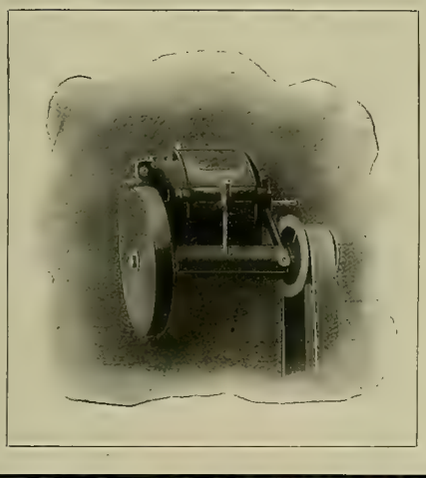

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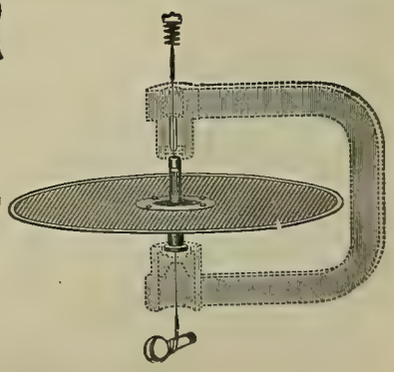

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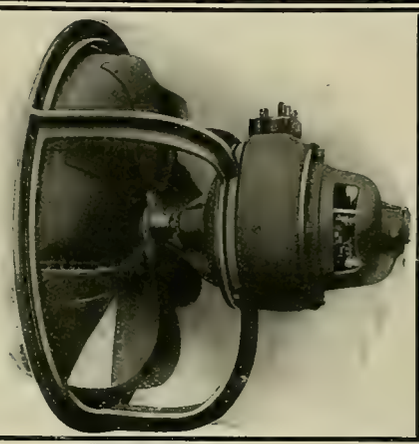

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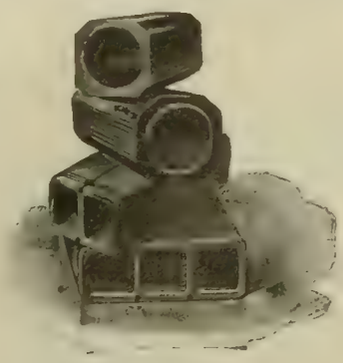

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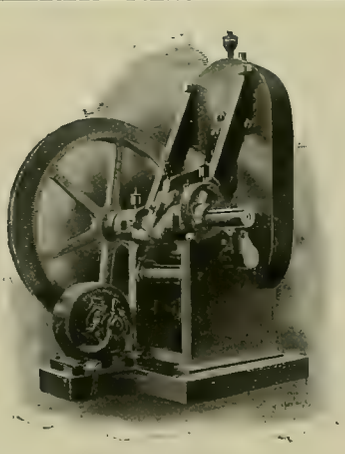

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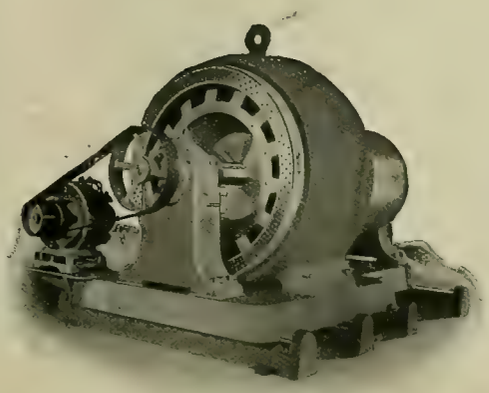

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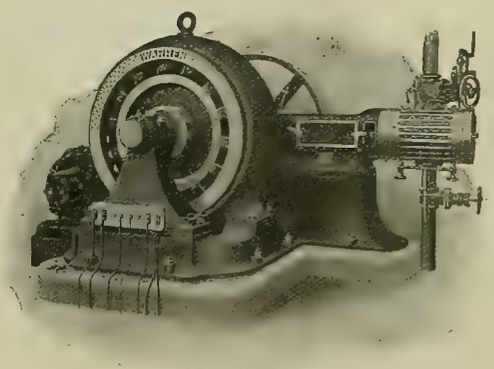

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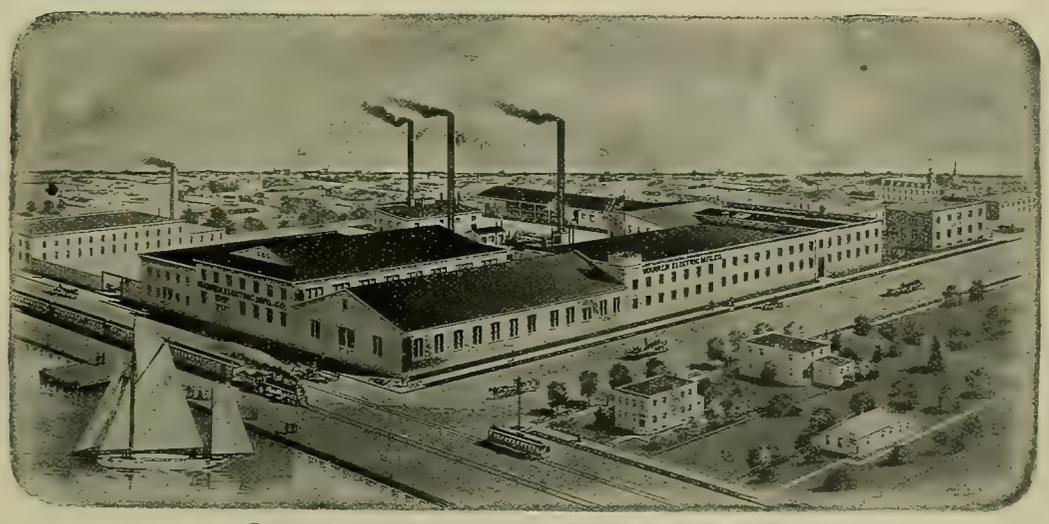

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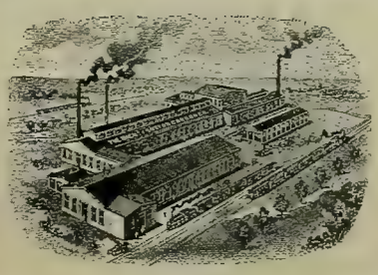

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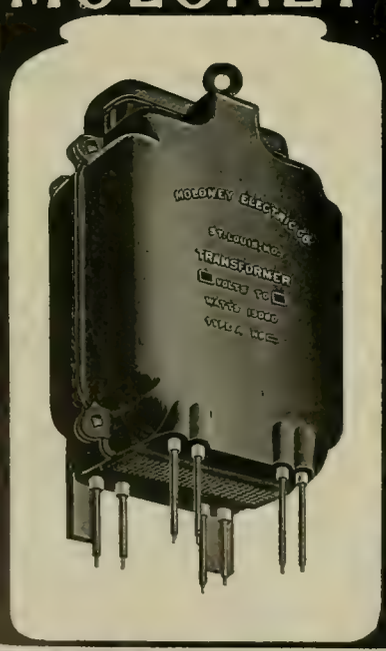

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Electrically and Commercially
Lowest Possible Core Losses
Regulation and Ventilation Perfect

We will ship them on thirty days' trial, should they not be what we claim for them, return and we will pay freight both ways.

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ST. LOUIS, MO., U. S. A.
General Sales Agents

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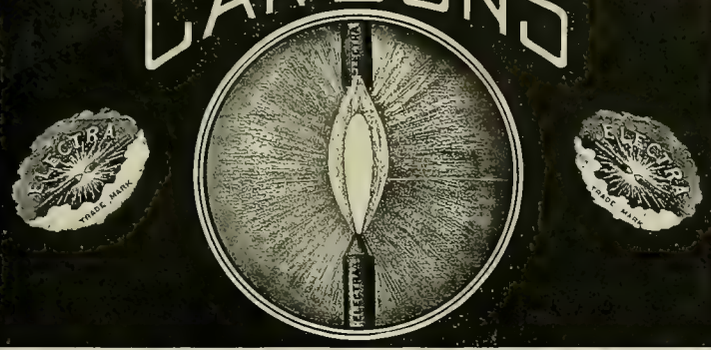
MARVELOUS EFFECT

"ELECTRA" Flame Light Carbons are suitable for all types of Open Arc Lamps, either direct or alternating current, with slight charge in regulation of lamp.



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The intensity and brilliancy of light is three times that of regular "ELECTRA," and five times that of other carbons, making them eminently suitable for all special lighting purposes.

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For ELECTRIC LIGHTING and RAILWAY CENTRAL and SUB-STATIONS, POWER STATIONS, TELEPHONE, TELEGRAPH, RAILWAY CAR LIGHTING and all other purposes to which Storage Batteries are applicable.

We guarantee LOWEST FIRST COST, HIGHEST EFFICIENCY, MOST CONSERVATIVE RATING and CHEAPEST MAINTENANCE.

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It is not only the price of an arc lamp—that's not the end. Repairs, delays, inferior results, increased expense in maintaining and in operation—these all add to the cost.

The A-B is simple and correct in its mechanism —is a perfected and practical arc lamp.

It cuts out the trouble and saves money.

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Have been for twenty years
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POCKET SIZE.

For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
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Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

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It will put that high gloss on the Commutator you have so long sought after.

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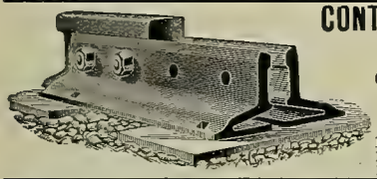

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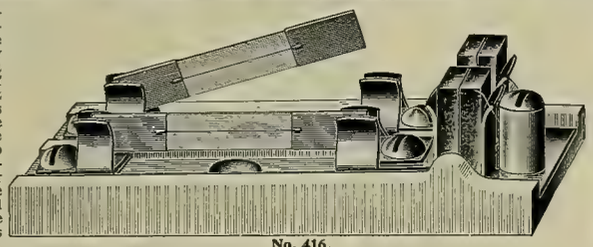

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Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

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1—20 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
1—15 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
Manufactured by General Electric Co., practically new and in perfect condition.

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All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

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Alternators 125-133 cycles, 1,100 volts.
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Large stock of direct-current machines.
Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

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Notice is hereby given that the undersigned, the Receiver for The Plymouth Electric Light Company, pursuant to the order and decree of the Marshall Circuit Court of Marshall County, Indiana, made on March 23, 1903, in the cause therein tried and determined, entitled The Fort Wayne Trust Company vs. The Plymouth Electric Light Company, will sell at public auction, at the north door of the power house of said Light Company, in the City of Plymouth, said County, on the 20th day of April, 1903, at 2 o'clock p. m., the following described real and personal property, to wit:

All that part of out lot fifty-six (56) in Niles and Sering's Partition of out lots in the town, now city, of Plymouth, that is not now used by said City for its water works building and plant, together with the entire electric-lighting plant thereon situated and therewith connected, including all the buildings, machinery, fixtures, appliances, poles, wires, lamps, tools, fuel and supplies of all kinds, also, all its rights, privileges and franchises for electric lighting, and all contracts held and owned by said Company.

Said sale will be made for cash.

FERDINAND EICH,
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GUNS $1.00 EACH.

U. S. Army guns, as curiosities, for cosey corners, dens, etc.

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PERFECTION IN TRANSPORTATION

IS FURNISHED BY THE

CHICAGO & ALTON RAILWAY

The heaviest steel rails, laid on a roadbed of crushed rock, make its tracks the smoothest. Over this dustless highway are run the most palatial trains in the world—the acme of luxury and comfort.

AMERICA'S MOST POPULAR RAILWAY—JUSTLY TERMED

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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, **as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.**

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STREET RAILWAY, LIGHTING AND POWER.
Write for List of Machines.
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34x60 950-H. P. International Power Corliss.
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20x48 300-H. P. Harris Corliss.
18x42 250-H. P. Greene Corliss. Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
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1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
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2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

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1—250 K. W. Walker.
2—150 K.W. Edison bi-polar.
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3—100 K.W. Edison bi-polar.
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3—18x30x18 Westinghouse
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1—14x14 Weston Automatic.
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1—12x12 Harrisburg.
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3—7x7½ Westinghouse.

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1—400 K.W. Wood, 2 phase.
2—150 K.W. Stanley 2 phase
2—120 K.W. G. E. S. phase.
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180 K. W. and 120 K. W. G. E., 60 cycle, A. S. type 1,100 or 2,200 volt alternators.
150 K. W. 60 cycle Ft. Wayne, 2,000 volt alternator.
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Direct current 110 volt generators all sizes.

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Multi-polar type with cast dynamo steel frames and ventilate form coil wound armatures.

An efficient, durable motor built for lasting and severe use.

We build special motors and dynamos for special purposes.

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MILWAUKEE.

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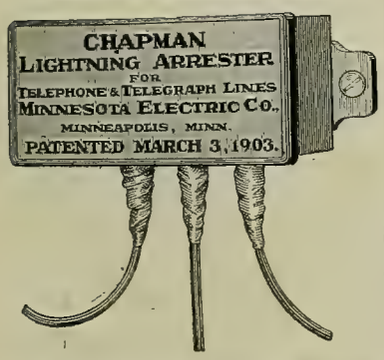

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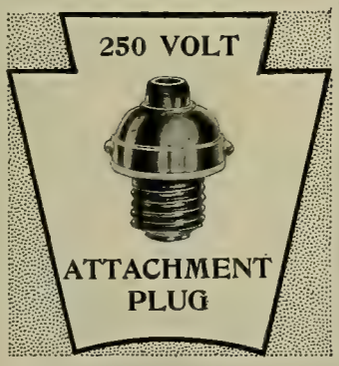

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WE BUY AND SELL ALL KINDS

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300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

200 kw., Westinghouse, M. P. 8, 500-550-volt Generator, direct connected to 18 and 30x16 Westinghouse Engine; generator entirely rewound and engine in excellent condition.

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50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½ and 13x12 Armington & Sims Tandem Compound Engine. One year old.

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2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

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2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
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1—60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.

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2—500 kw., 6-pole General Electric.
2—225 kw., 6-pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
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2— 90 kw., Thomson-Houston.
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1—14x14 Rice Automatic.
2—13 and 23x17 Tandem Compound McIntosh & Seymour.
2—10 and 18x20 Payne Compound.
1—13x12 Armington & Sims.
1—12 and 20x12 Westinghouse Compound.
1—7x8 Payne.
1—18x48 Geo. H. Corliss.
1—16x42 Greene.
1—10½ and 16½x12 Cross Compound Armington & Sims.
2—26x48 Providence-Greene.
2—18 and 30x16 Westinghouse Compound.
3—18½x18 Armington & Sims.
1—18½x18 New York Safety.
1—20x48 Harris-Corliss.

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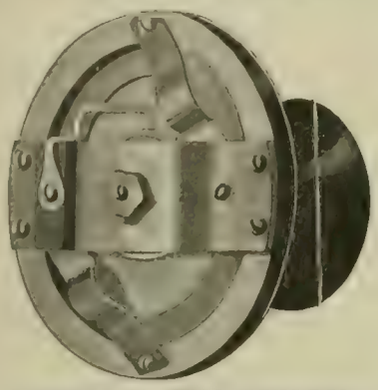
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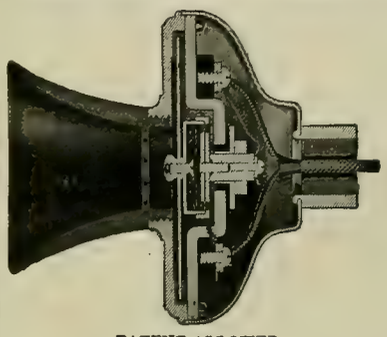
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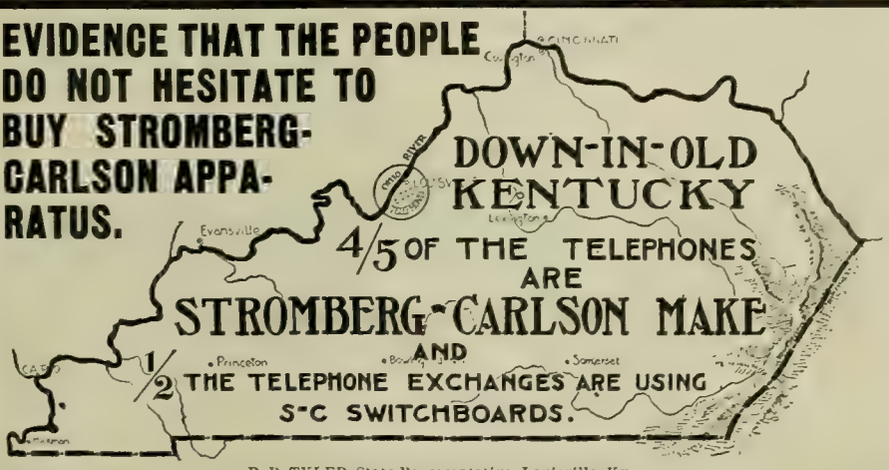

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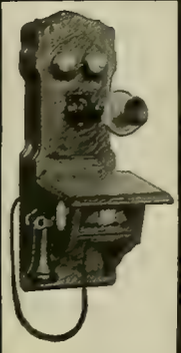

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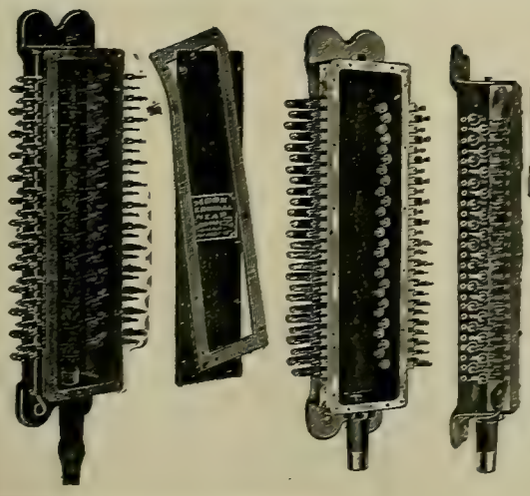

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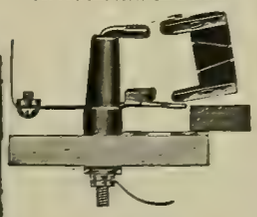

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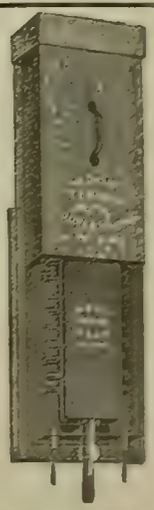

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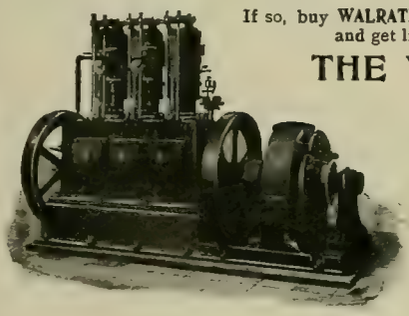

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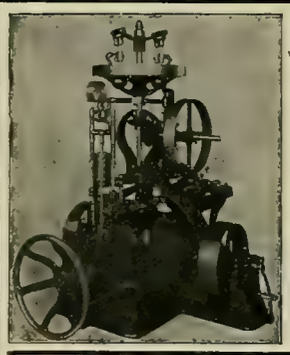

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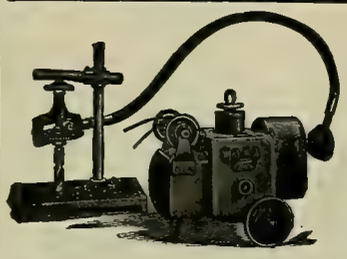

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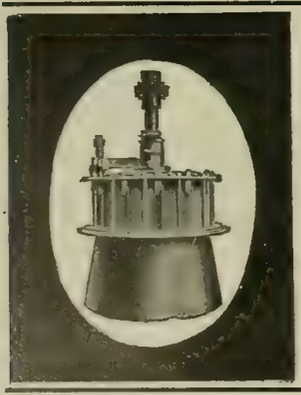

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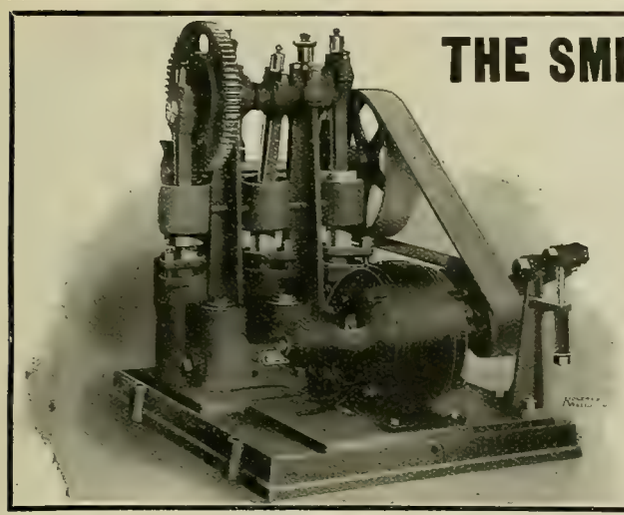

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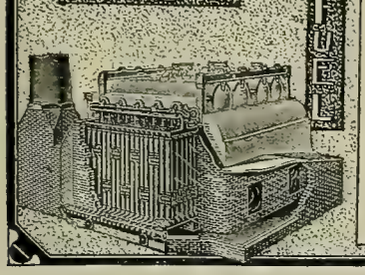

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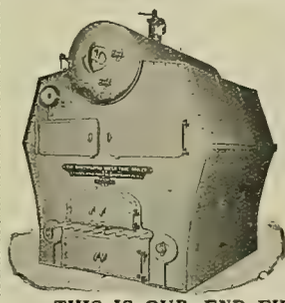

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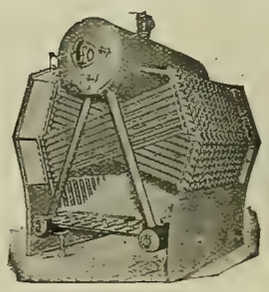

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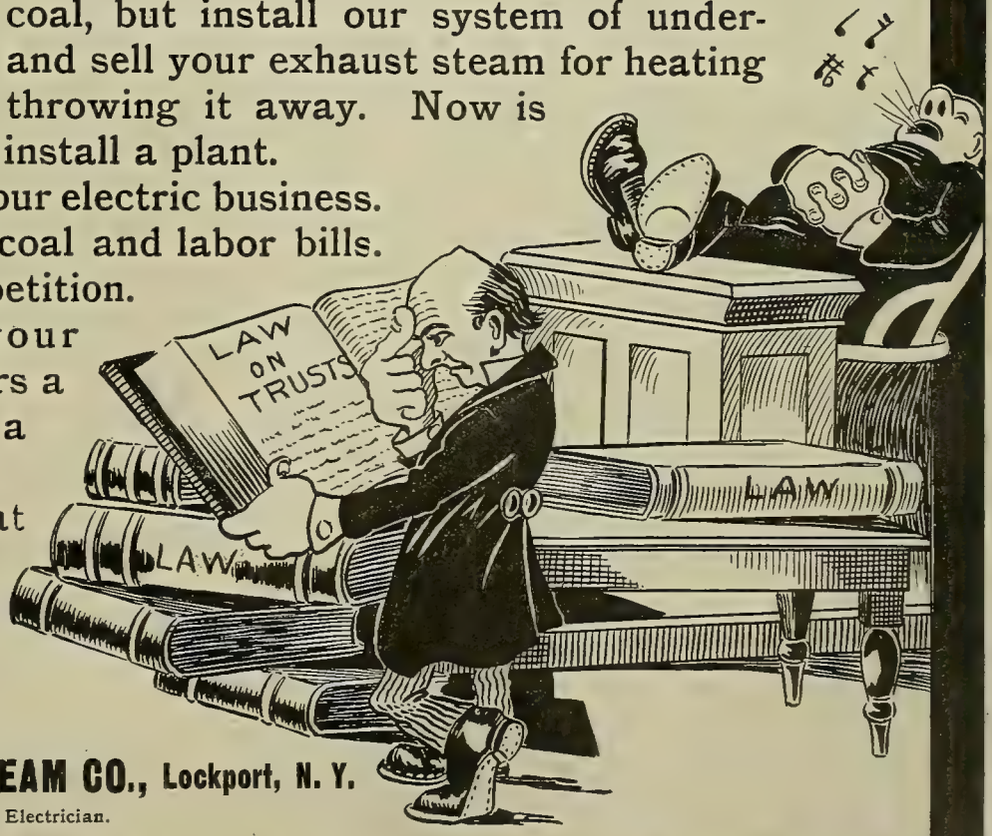

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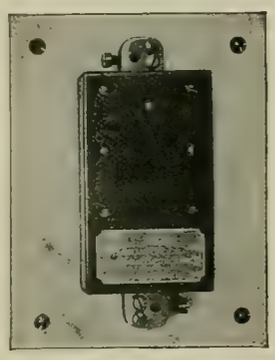

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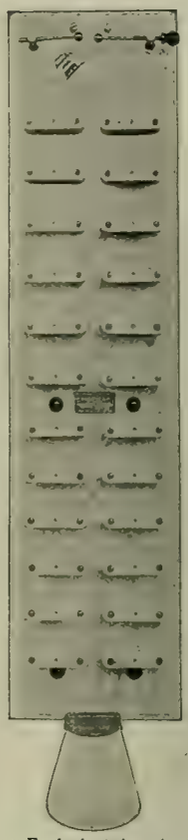

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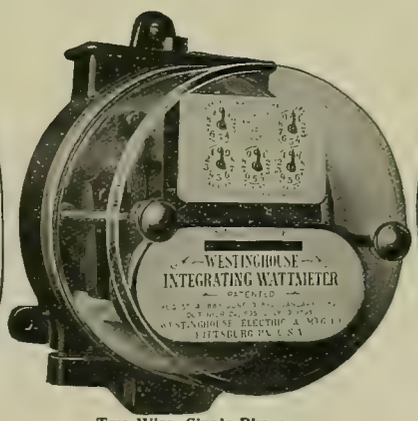

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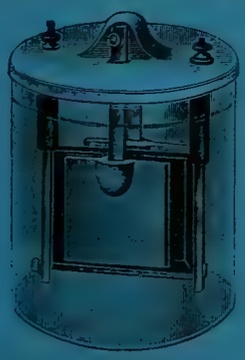

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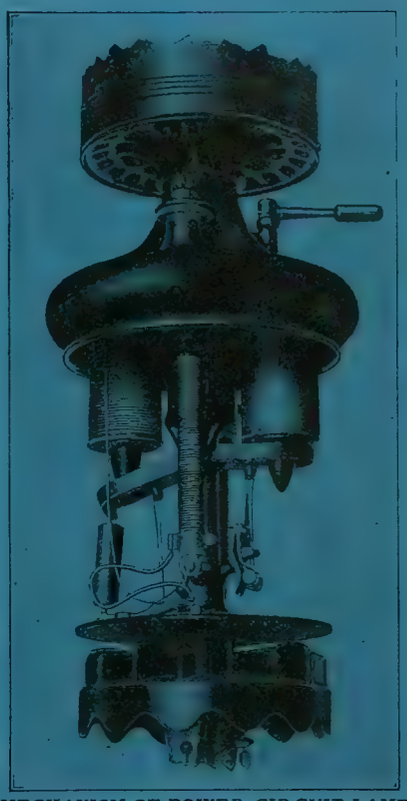

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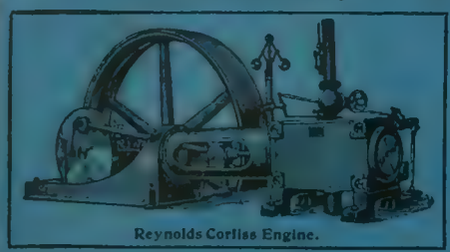
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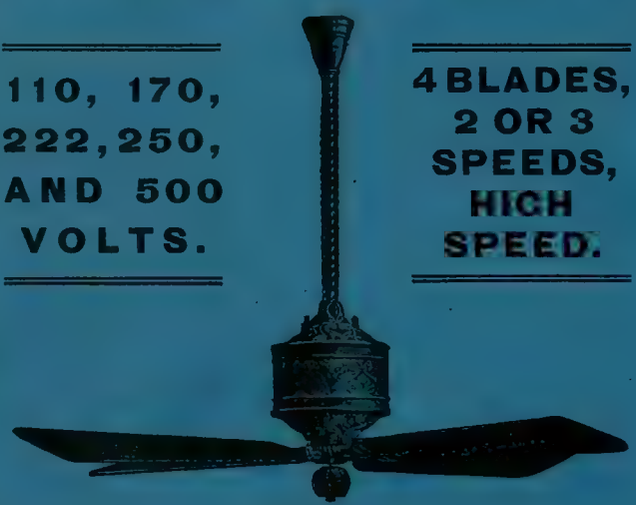

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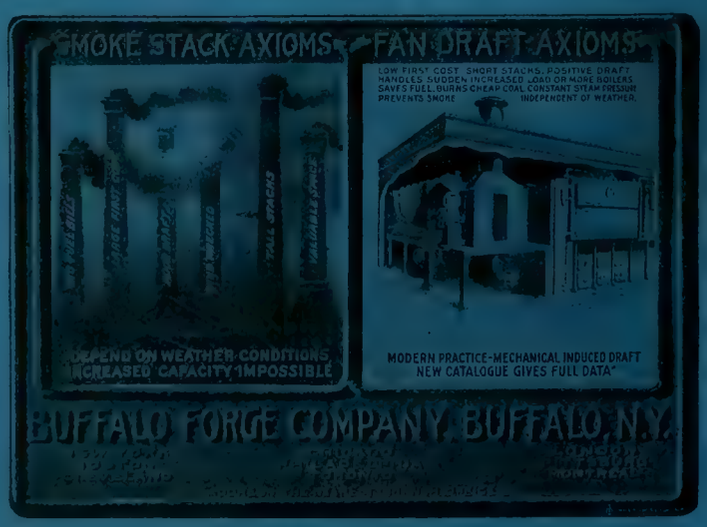

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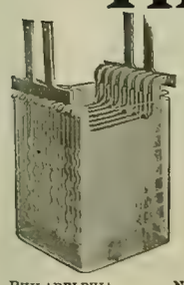

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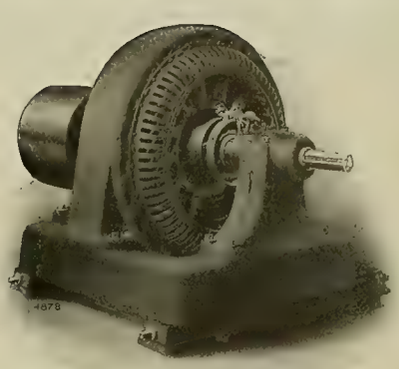

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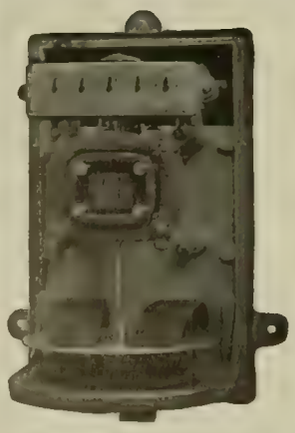

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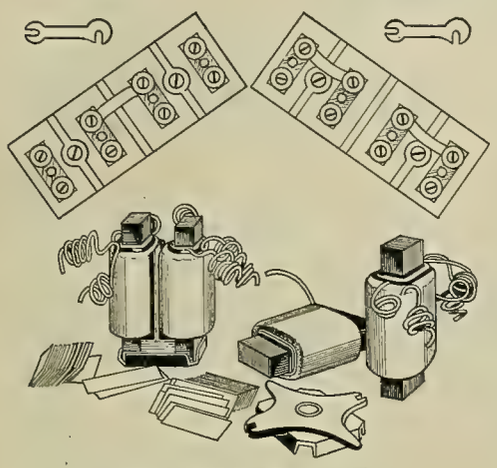

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Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
Western Elec. Supply Co.
Western Electric Company.

Woodwork, Electrical.
Noblett Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

THE H. B. CAMP CO.

MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

SALES OFFICES

Room 85 Hartford Building, Chicago. 170 Broadway, New York.

THE SHELBY ANGULATOR

THE FIRST SUCCESSFUL INSTRUMENT FOR DETERMINING THE TRUE VALUE OF INCANDESCENT LAMPS.

SIMPLE—RELIABLE—INEXPENSIVE.

By the aid of this device the horizontal candlepower can be determined and the lamp can then be turned so that the light can be measured at any angle.

IT DETERMINES THE SPECIAL CANDLEPOWER OF YOUR LAMPS AT ONE READING.

This device has been designed by us with a view of placing at the disposal of every owner of a photometer, a method of determining the value of his lamps regardless of whether the lamps are used for general or local illumination. Fits into the socket of any standard photometer. Price $2.50.

THE SHELBY ELECTRIC CO.,

SHELBY, OHIO.

Crimshaw.

Raven White Core.

Raven Black Core.

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

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A

NEW ARC LAMP!

SAME LAMP WORKS ON BOTH A. C. AND D. C. CIRCUITS

We also build arc lamps for ALL CIRCUITS

SEND FOR FULL DESCRIPTION. OSBORN-MORGAN CO., KELLY STREET, CLEVELAND, O.

1904 1904

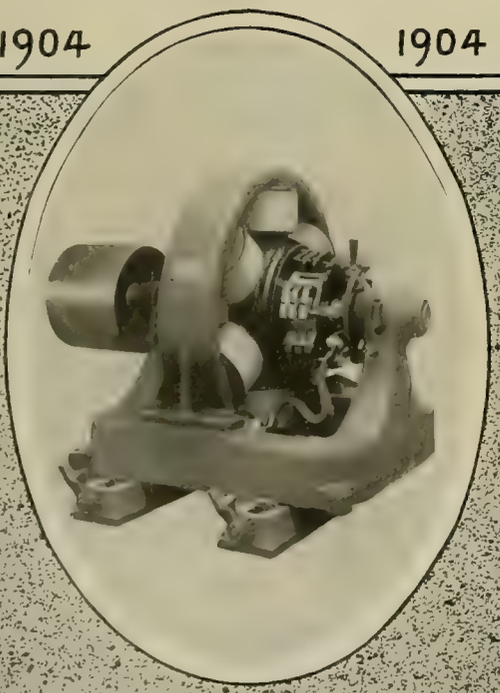
EVERY THING ELECTRICAL

From topmost floor to the cellar our great building is filled with new goods.

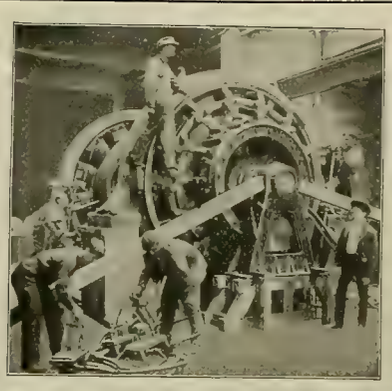
Dynamos, Motors, Fans, Telephones, Supplies, Watchman's Registers, in fact every thing needed by Lighting Stations, Electric Railways, Power Plants, Sawmills, Engineers, Factories. Contractors and Builders. Send for Catalog or Bulletins.

EWING-MERKLE ELECTRIC CO.
SAINT LOUIS.

1904 1904



GENERATORS
FOR
Power and Lighting



Bulletins No. 2003 and 2005 Free on Request.

WESTERN ELECTRIC COMPANY

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ELECTROLYSIS-PROOF
UNDERGROUND CONDUIT

OUR CONDUIT IS { Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator. }

Insulation Test, 66,000 VOLTS.

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,
MANUFACTURERS OF
ELECTROLYSIS PROOF CONDUIT
BITUMINIZED FIBRE. (Patented.)

OFFICES:
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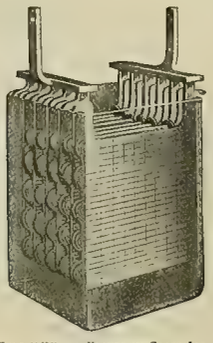
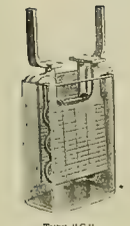
822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

FACTORIES:
Chester, Pa.
Chicago, Ill.
Los Angeles, Cal.

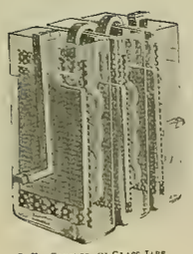


Type "E"—11 Plates in Glass Jar.

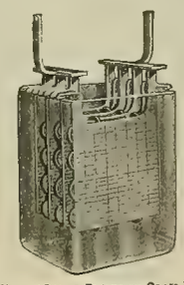


Type "C"
3 Plates, in Glass Jar.

Type "B"
3 Plates, in Glass Jar.



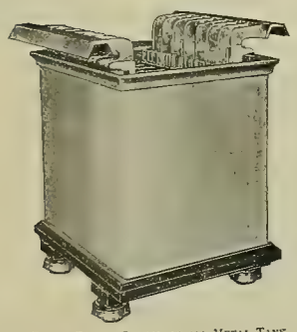
D. T.—Couples, in Glass Jars.



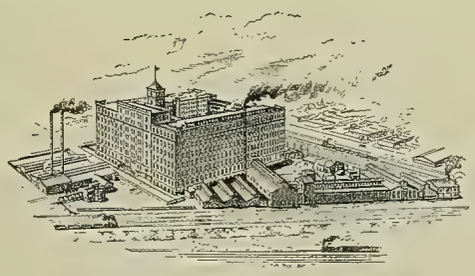
Type "D"—7 Plates in Glass Jar.

THE ELECTRIC STORAGE BATTERY CO.

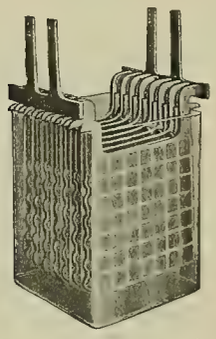
Philadelphia,



Type "F"—15 Plates in all Metal Tank



Works, Allegheny Avenue, 18th to 20th Streets, Philadelphia, Pa.



Type "F"—15 Plates, in Glass Jar.

MANUFACTURER OF THE

"Chloride Accumulator"

Registered September 11, 1894.

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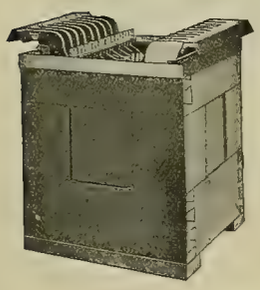
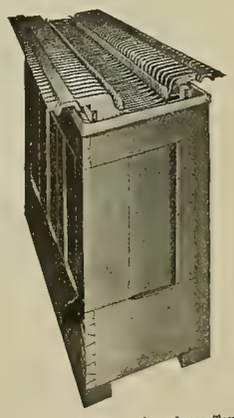
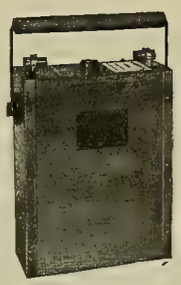
Baltimore: Continental Trust Bldg.
St. Louis: Wainwright Bldg
Cleveland: New England Bldg.
San Francisco: Nevada Block.
Detroit: Michigan Electric Co.
Havana, Cuba, C. F Greenwood, Mgr., 34 Empedrado Street.



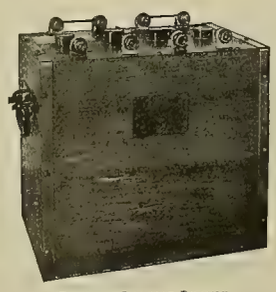
Type "G"—19 Plates, in Lead-Lined Tank.



Type "H"—87 Plates, in Lead-Lined Tank.



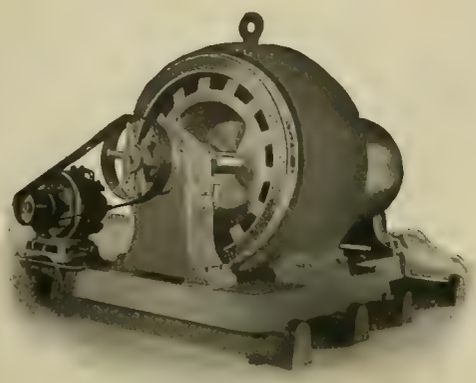
Type 501—Portable Battery.



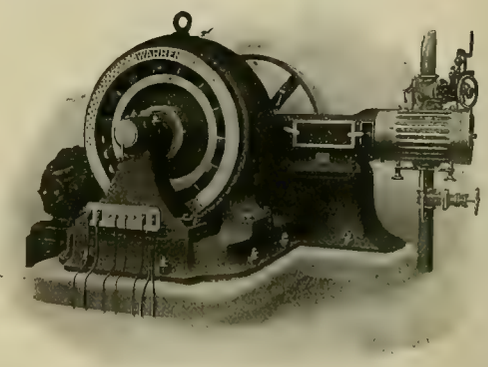
Type 504—Portable Battery.

The Warren Alternator.

OUR PRODUCT.

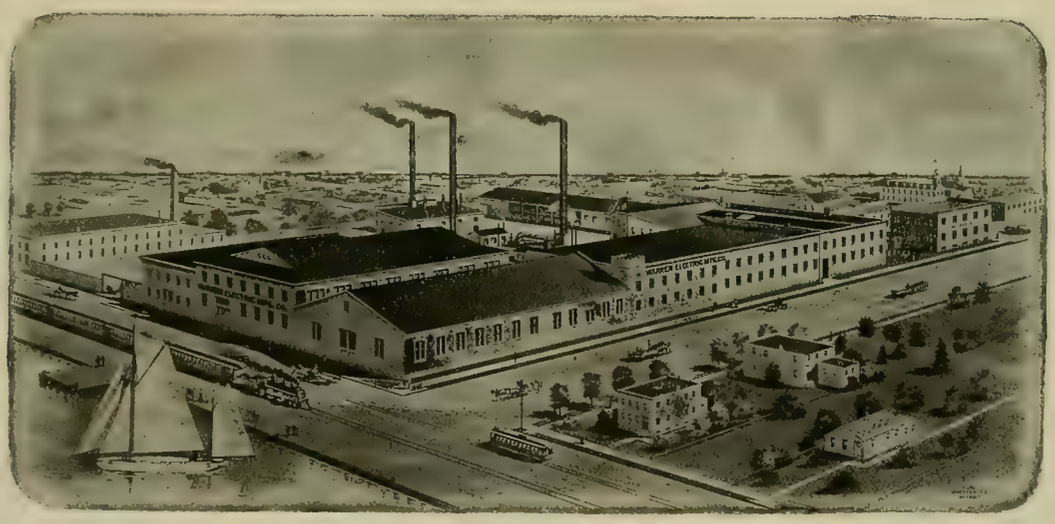


BELTED TYPE.



ENGINE TYPE.

OUR FACTORY.



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1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

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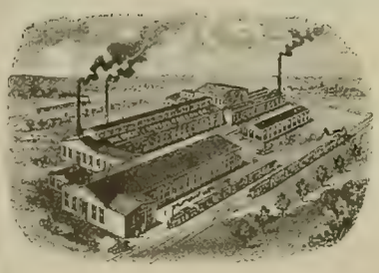
Thos. Muir & Son, Detroit, Mich.
Western Electrical Supply Co., St. Louis, Mo.
C. W. Hobson, Waco, Texas.
Kilbourne & Clark Co., 815-817 Second Ave., Seattle, Wash., Pacific Coast Agts.
A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.



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THE DICKEY-SUTTON CARBON COMPANY,
LANCASTER, O.

WE MANUFACTURE ELECTRIC LIGHT CARBONS OF ALL KINDS, DRY BATTERIES AND BATTERY CARBONS, CARBON BRUSHES AND SPECIALTIES, ELECTROLYTIC CARBONS.

BRYAN-MARSH

"IMPERIAL"

Incandescent Lamps

ARE LIGHTING MORE OF THE

UNITED STATES OF AMERICA

THAN THEY WERE THE LAST TIME YOU READ OUR ADVERTISEMENT IN THIS PAPER.

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NEW YORK: 136 Liberty Street.
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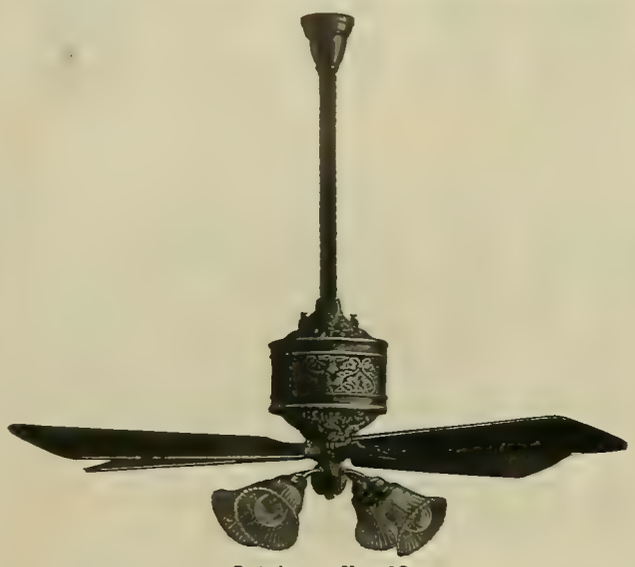
Diehl Fan Motors



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With or without lights; 2 or 3 speeds; special Nyssa wood blades; artistic design. Our 1903 catalogue shows 14 designs of ceiling, also new desk and the Coleman device. *Send for it.*

DIEHL MANUFACTURING CO.,

BRANCHES: New York, Philadelphia, Boston. **Elizabethport, N. J.**

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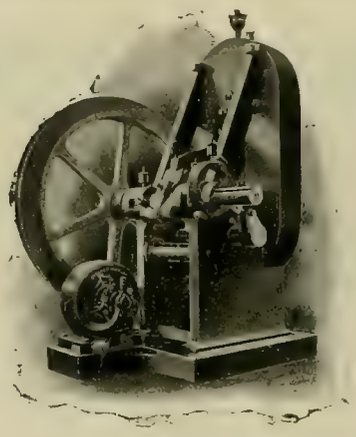


The C-W System of Electric Drive

uses a simple equipment of standard apparatus and gives Large Increases in shop output.

G. I. Co. PARAGON

MECHANICALLY AND ELECTRICALLY PERFECT.

NO REPAIRS! NO NOISE! NO TROUBLE!

DESK BRACKET

TRUNION FANS

MAXIMUM VOLUME OF AIR

MINIMUM COST OF CURRENT

BULLETIN 262.

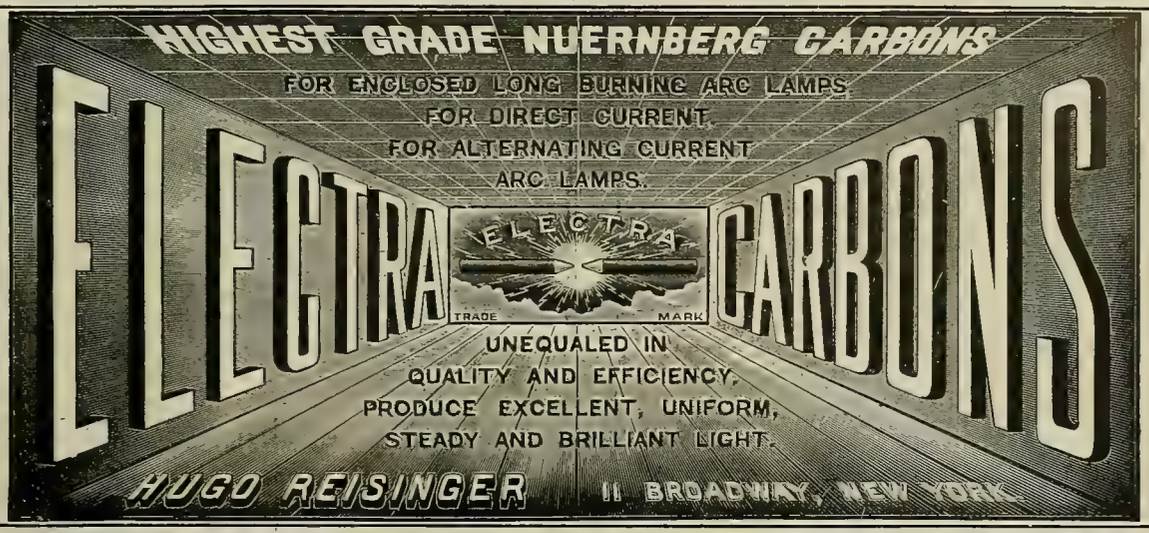
Manufactured by

General Incandescent Arc Light Co.

NEW YORK, U. S. A.

CHICAGO. CLEVELAND. CINCINNATI. ST. LOUIS. DENVER. BOSTON. SAN FRANCISCO. PHILADELPHIA.

The "Electra" Carbons are the recognized standard all the world over.



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We guarantee LOWEST FIRST COST, HIGHEST EFFICIENCY, MOST CONSERVATIVE RATING and CHEAPEST MAINTENANCE.

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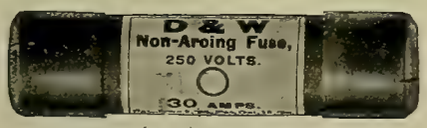
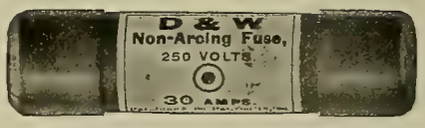


Type C indicating fuse before blowing.

D. & W.



Type C indicating fuse after blowing.

BULL'S-EYE INDICATOR

An absolutely FLASHLESS device indicating the blown fuse instantly.

Watch the "TARGET" on the label of the fuse.

D. & W. FUSE COMPANY, PROVIDENCE, R. I.

A. HALL BERRY, New York Representative, 100 Williams Street.

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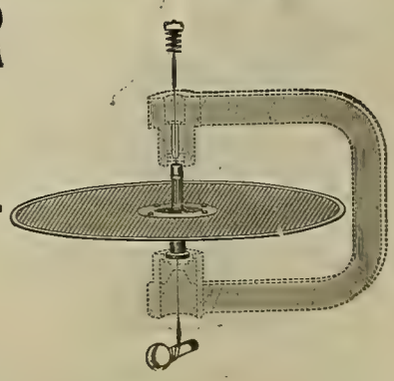
OF THE MOVING PARTS OF
STANLEY RECORDING WATTMETERS
FOR ALTERNATING CURRENT
IS ACCOMPLISHED BY

MAGNETIC SUSPENSION.



NO WEAR. NO LOST REVENUE.
NO FRICTION. ALL CURRENT USED RECORDED.
SEND FOR DESCRIPTION AND BOOK FULL OF GOOD INFORMATION
"ABOUT METERS."

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GREAT BARRINGTON, MASS., U. S. A.

PACIFIC COAST AGENTS:
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GLASS CASE

Gutmann Wattmeters are the neatest looking meters in the world. They are smallest in dimensions, lightest in weight and of a superior workmanship that guarantees maintenance of accuracy and service.

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Prompt shipment—in any quantity.

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Not a rubber friction tape, but a tape coated with linseed oil left slightly tacky. Ninety times the electrical restivity of friction tape. Send for samples and prices.

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VOLT - AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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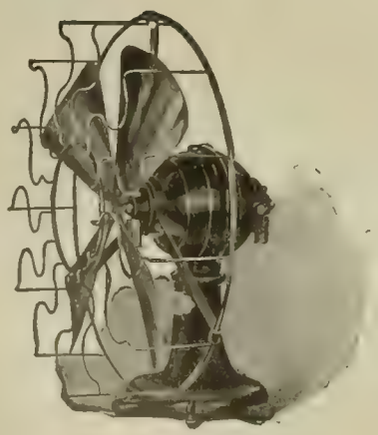
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,

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TO CARRY IN BELT WHEN PUTTING UP WIRES

LARGE SAMPLES FREE.

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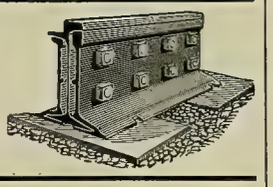

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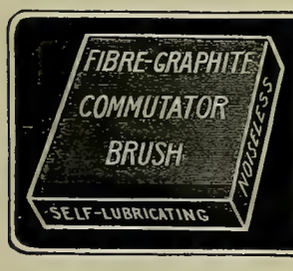
Over FIFTEEN THOUSAND (15,000) miles in use. Received the highest award in its class at Paris Exposition, 1900 and Pan-American, Buffalo, 1901.

The Bossert Electric Construction Co.
—MANUFACTURERS OF—
STEEL OUTLET AND JUNCTION BOXES,
SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.
UTICA, NEW YORK.



There's No Friction
with the Fibre-Graphite Commutator Brush. Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.
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STERLING EXTRA INSULATING VARNISH.
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

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CHEAPEST FIRST. CHEAPEST LAST.

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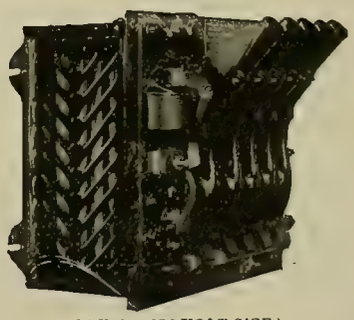
603 CARLETON BLDG., ST. LOUIS.

Worm's-eye View.

C & H
MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.
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POSITION WANTED.

As chief. Am thoroughly practical and technical in, and can install, figure to the best advantage on the economical operation of, or repair any and all types of steam and electrical apparatus. Own indicator and electrical testing instruments, etc. Married, strictly sober, good character and guarantee satisfaction. Address BOX 197, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED.

By an electrician and stationary engineer of 12 years' practical experience. Understands wiring, construction work, repairs in steam and general maintenance; will accept steady position; country plant preferred; good references. Address with particulars and salary paid. Address BOX 200, care Western Electrician, 510 Marquette Bldg., Chicago.

POSITION WANTED.

By a thoroughly competent, reliable and up-to-date young man as superintendent or manager of an electric-light or power plant. Technical education; 8 years' practical experience from lineman to manager. Address BOX No. 201, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

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By a large industrial manufacturing firm, a young or middle-aged man with technical and practical education in electrical engineering. State age, experience and salary expected, also when available. Address BOX 196, care Western Electrician, 510 Marquette Building, Chicago.

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Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

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Willyoung portable cable testing set, complete. D'Arsonval galvanometer with telescope and scale. Has a range of 5,000 megohms with 100 volts. Packed in rosewood case 22¾x10x7; weight 20 lbs. In use two months. Address BOX 195, care Western Electrician, 510 Marquette Building, Chicago.

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A complete electric-light plant in a growing town of over five thousand. Doing a good business. Seven years' city contract. Two boilers, one hundred horsepower each. One hundred and fifty horsepower engine. Alternating and direct current. Load enough for one boiler at present. Good reasons for selling. Address BOX 198, care Western Electrician, 510 Marquette Bldg., Chicago.

GREGORY ELECTRIC CO.
54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings). Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2—90 K. W. General Electric type A. S. 90.
1—90 K. W. Westinghouse.
4—75 K. W. Wood.
6—60 K. W. General Electric A. 60.
2—60 K. W. Westinghouse.

Large stock of direct-current machines.
Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

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WANT ADS
Bring Results.

IT'S UP TO YOU.
We pay highest market prices for
SCRAP COPPER, BRASS AND PLATINUM, ALSO Incandescent Lamp Bases, Etc
WRITE US.
We Manufacture Copper Hard Babbitt
the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.
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I hold large block of stock in well established, paying independent telephone plant, city 40,000. Don't want company to appear like "one man concern," and wish to exchange part for stock in other telephone companies, either city or state line. Prefer if near Chicago. T. B. HOOVER, 260 Wabash Ave., Chicago.

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One 300-light, 17 Kw., 120-volt, 4-pole D. C. Generator, 750 revolutions. Nearly new. Guaranteed.

STEPHENS & TYLER,
Monadnock Bldg., - Chicago.

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1—40 H. P. Motor 3-phase, 60-cycle, 220-volt Form L.
1—20 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
1—15 H. P. Motor 3-phase, 60-cycle, 220-volt Form K.
Manufactured by General Electric Co., practically new and in perfect condition.
BADGER BOX & LUMBER CO., Grand Rapids, Wis.

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Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices
MIDLAND ELECTRIC CO., Des Moines, Iowa.

GUNS $1.00 EACH.

U. S. Army guns, as curiosities, for cosey corners, dens, etc.
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WESTERN ELECTRICIAN.
Immediate Returns.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

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140 S. Clinton St., Chicago.

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1—22x33 Buckeye, style B.
1—20x20 Shidder (Auto.).
2—13x21 Buckeye (Auto.).
2—16x16 Erie Ball.
1—18x36 Cummer, 4 valve.
1—16x18 Erie City slide valve.
1—20x42 Fitchburg Corliss.
1—16x42 Hamilton Corliss.
1—14x36 Allis Corliss.
1—12x34 Brown Corliss.
2—13x12 Erie Ball.
2—13x12 Armington & Sims.
1—12x12 Harrisburg.
1—11x10 Ball & Wood.
1—9x9 New York Safety.
3—7x7½ Westinghouse.

BOILERS.
6—200 H. P. Heine, 150 lbs.
3—350 H. P. Climax, 150 lbs.
1—375 H. P. National, 150 lbs.
1—267 H. P. Abendroth & Root, 150 lbs.
1—250 H. P. Sterling, 150 lbs.
2—72x18, 120 lbs.
1—72x18 R. T., 26-6 in. tubes, 150 lbs.
2—125 H. P. tubular, 120 lbs.
1—100 H. P. locomotive type, 120 lbs.
2—66x15 tubular, 100 lbs.
2—42x14 tubular, 100 lbs.

RY. GENERATORS.
1—250 K. W. Westinghouse.
2—150 K. W. Edison bi-polar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole.
4—100 K. W. Gen'l Electric.
3—100 K. W. Edison bi-polar.
2—75 K. W. Westinghouse.
2—60 K. W. Edison bi-polar.
5—D62 K. W. T. H. bi-polar.
1—35 K. W. Ft. Wayne, M. P.
1—50 K. W. Detroit, M. P.

ALTERNATORS.
2—150 K. W. St'nley 2 phase
3—120 K. W. G. E. single ph.
2—75 K. W. Stanley 2 phase.
1—60 K. W. Westinghouse, 2 phase, 60 cycle.
2—60 K. W. Stanley 2 phase.
4—60 K. W. G. E. single ph.
2—30 K. W. Westinghouse.

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THOMPSON, SON & CO.
114-116-118 Liberty St.
NEW YORK CITY.

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34x60 950-H. P. International Power Corliss.
28x48 750-H. P. Harris Double Eccentric Corliss
23x60 450 H. P. George H. Corliss.
20x48 300-H. P. Harris Corliss.
18x42 250-H. P. Greene Corliss, Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
24x48 500-H. P. Buckeye Automatic.
15 and 23x17 300 H. P. McIntosh & Seymour Tandem Compound Railway Engine.

BOILERS.
1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

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300-H. P. Wheeler Heater.
300-H. P. Baragwanath Heater.
200-H. P. Kroeschell Heater.
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POLISHES ALL METALS. 8 BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND. GEO. W. HOFFMAN

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13 and 20½x15 Armington & Sims, cross compound, 250 H. P.
12 and 24x18 Williams tandem compound, 250 H. P.
20x18 Ball, 250 H. P.
12x12 Ideal, 90 H. P.
10x13 Frost automatic.
180 K. W. and 120 K. W. G. E., 60 cycle, A. S. type 1,100 or 2,200 volt alternators.
150 K. W. 60 cycle Ft. Wayne, 2,000 volt alternator.
120 K. W. and 60 K. W. G. E., 133 cycle, 1,100 volt alternators.
Direct current 110 volt generators all sizes.

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and many more are going to do likewise. Booklets that will help you to plan your vacation trip have just been published, and will be sent on receipt of postage, as follows:

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"In Lakeland" and "Summer Homes," six cents.
"Lakes Okoboji and Spirit Lake," four cents.

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which reaches the famous
WATER POWERS, COAL FIELDS, IRON ORE RANGES, HARD AND SOFT LUMBER DISTRICTS
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Machine and Carpenter Work of All Kinds. Correspondence Solicited.

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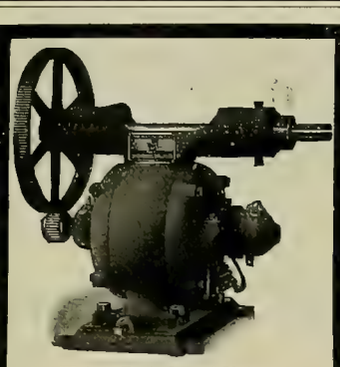

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Built on five frames for ⅛, ¼, ½, ¾, 1, 1¼, 1½, 2 and 3 horsepower with speed reductions of from 5 to 1.

Multi-polar type with cast dynamo steel frames and ventilate form coil wound armatures.

An efficient, durable motor built for lasting and severe use.

We build special motors and dynamos for special purposes.

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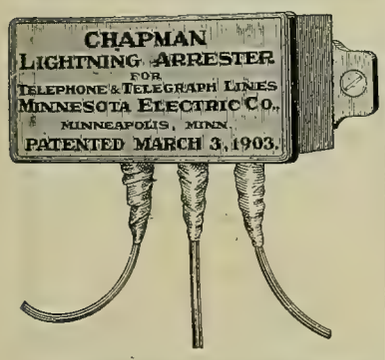
MILWAUKEE.

Send for Bulletin No. 55.



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are to be used with the best fan-motors; they are the neatest and safest. The short cut to your having the best in stock, when ordering, is to

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Electrical and Steam MACHINERY

DIRECT-CONNECTED UNITS.

300 kw., General Electric 500-550-volt Generator, direct connected to Tandem Compound, 16 and 30x48 Whetherill-Corliss Horizontal Left-hand Engine.

200 kw., Westinghouse, M. P. 8, 500-550-volt Generator, direct connected to 18 and 30x16 Westinghouse Engine; generator entirely rewound and engine in excellent condition.

187½ kw., Westinghouse, M. P. 8, 120-volt Generator, direct connected to Westinghouse Compound Engine.

50 kw., Commercial, M. P., 125 volts, Compound Wound Generator, with 8½ and 13x12 Armington & Sims Tandem Compound Engine. One year old.

50 kw., Eddy Compound Generator, 125 volts, direct connected to 13x13 Harrisburg Ideal Engine.

25 kw., 250-volt Westinghouse Generators, direct connected to self-oiling Ball Engines.

25 kw., General Electric, 110 volts, 4-pole, Compound Wound Generator, with 9½x10 Armington & Sims Engine.

2—25 kw., 125-volt General Electric Generators, direct connected to one Triple Expansion Marine Vertical Engine.

ALTERNATING.

2—250 kw., G. E., 2,400 volts, 50 cycles, 3-phase.
2—200 kw., G. E., 2,300 volts, 40 cycles, 3-phase.
1—150 kw., Stanley, 1,000 or 2,000 volts, 133 cycles.
2—120 kw., G. E., 2,000 volts, 125 cycles.
2—120 kw., G. E., 1,040 volts, 125 cycles.
1—100 kw., G. E., 2,080 volts, 60 cycles.
1—60 kw., G. E., 1,040 volts, 125 cycles.
1—A35 T.-H., 1,000 volts, 125 cycles.

RAILWAY GENERATORS.

2—500 kw., 6-pole General Electric.
2—225 kw., 6 pole General Electric.
2—200 kw., 4-pole General Electric.
1—200 kw., M. P. 6, Westinghouse.
1—175 kw., M. P. 4, Westinghouse.
2—150 kw., M. P. 6, Westinghouse.
2—110 kw., 4-pole Eddy.
1—100 kw., 4-pole Walker.
3—100 kw., 4-pole General Electric.
1—100 kw., Edison Bipolar.
2— 90 kw., Thomson-Houston.
1— 80 kw., General Electric.
2— 80 kw., Detroit.
5—D62 Thomson-Houston.

ENGINES.

1—14x14 Rice Automatic.
2—13 and 23x17 Tandem Compound McIntosh & Seymour.
2—10 and 18x20 Payne Compound.
1—13x12 Armington & Sims.
1—12 and 20x12 Westinghouse Compound.
1—7x8 Payne.
1—18x48 Geo. H. Corliss.
1—16x42 Greene.
1—10½ and 16½x12 Cross Compound Armington & Sims.
2—26x48 Providence Greene.
2—18 and 30x16 Westinghouse Compound.
3—18½x18 Armington & Sims.
1—18½x18 New York Safety.
1—20x48 Harris-Corliss.

BOILERS.

7—163 H. P. Babcock & Wilcox.
5—250 H. P. Climax.
1—600 H. P. Climax.
2—66x16 Return Tubular.
2—66x18 Return Tubular.

ARC GENERATORS.

No. 12 Brush, 150 light, 9.6 amp.
No. 11 Brush, 125 light, 9.6 amp.
No. 9B Brush, 120 light, 6.6 amp.
M. D. 2 T.-H., 50 light, 9.6 amp.
L. D. 12 T.-H., 75 light, 6.6 amp.
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A large assortment of Arc Lamps all in good working order, for direct and alternating currents, series and multiple circuits. Also a fine lot of Transformers, especially General Electric Type H. and Thomson-Houston Type F.

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Engines and Boilers

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OPEN DAY AND NIGHT

TELEPHONE US.

Armature Fields Rewound

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GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
Six Edison, No. 60, 175 K. W.
Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

ALTERNATING GENERATORS.

One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

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One hundred and eighty 25 H. P. motors, new and complete with pinions, gear and gear cases.
One hundred and eighty "K" Controllers.
Twenty-five K-2 Controllers.

ENGINES.

Six 36 and 60x60, Cooper cross-compound non-condensing, new, never shipped from factory.
One 30x54 St. Louis Corliss.
Two 24x60 Lane & Bodley, designed for rolling mill work.
One 28x60 Pennsylvania Iron Works Co.
One 20x48 Wheelock.
One 20x48 Double Wheelock.
One 20x42 Wheelock.
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
One 14x17 Fisher, new.

BOILERS.

Four 66x18 with 66 4-inch tubes. A complete battery at a great bargain.
Three 66 x 14, with 66 4-inch tubes.
Two 72 in. x 18 ft., with 66 4-inch tubes.
Five 60x16 ft. high pressure boilers.
Two Sterling Water Tube Boilers, 250 H.P. each.
Two 500 H. P. Hazelton.

FERRIS WHEEL.

One 60 ft. Ferris Wheel, electrically driven.

AT A BARGAIN—A complete Edison 3-wire plant of 300 K. W. capacity.

It will be profitable to wire or write us giving requirements of machinery wanted or for sale.

JOHN A. STEWART ELECTRIC CO.

Offices: 430 Sycamore St. **Factory and Warehouse: LUDLOW, KY.**

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SEE THE POINT?

Tungsten Magnet Steel
"Remy" Brand.
Best permanent magnet steel for high-grade telephones.
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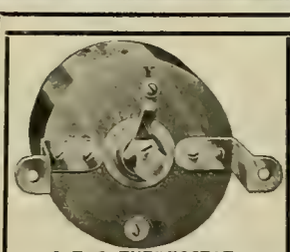
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Can furnish FIRE Protection in connection with your telephone service without the change of a circuit.
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CHICAGO.

LEICH FOUR-PARTY LINE SELECTIVE SIGNALING SYSTEM
CONDENSERS TO STOP THE BATTERY FLOW.
NO SPRINGS OR RELAYS TO GET OUT OF ORDER.
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610 WILSON AVE., CHICAGO, ILL.

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Automatic Electric Company
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HERBERT LAWS WEBB.
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A complete and practical work in handy pocket size.
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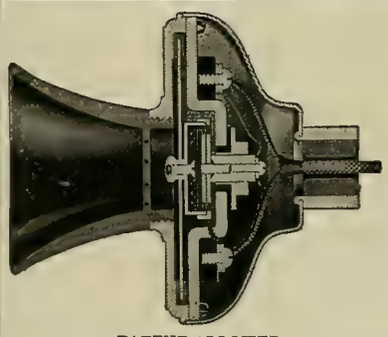
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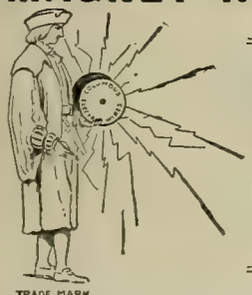
Workmanship,
Efficiency and
Durability.
It is Clear, Distinct and Powerful.
IMPOSSIBLE
to become packed or deadened.
We manufacture a full line of public exchange central energy and generator call Telephones and multiple and trunking switchboards. Correspondence solicited.
INTERNATIONAL TELEPHONE MFG. CO.,
HARRISON AND CLINTON STREETS, - - - CHICAGO, U. S. A.

MAGNET WIRE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Always Up-to-Date.
WE MANUFACTURE
SWITCHBOARDS, TELEPHONES
AND EVERYTHING FOR COMPLETE EXCHANGE.
Write for Catalog and Prices.
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PATENTED TELEPHONY
A review of patents pertaining to Telephones and Telephonic Apparatus by the
American Electrical Engineering Association.
CONTENTS: Introductory.—Percentage of Patents Sustained.—Supreme Court Decisions.—Berliner Case.—Induction Coil.—Drawbaugh Cases.—Hunnings Transmitter.—Subscribers' Calls.—Switchboards.—Law System.—Mann System.—Multiple Board.—Express System.—Raverot-Hess System.—Comparative Advantages, Multiple and Divided Board Systems.—Carney Plug Board.—Brief Mention.—Automatic Switchboards.—Conclusions.—Index.
ILLUSTRATIONS.
Patent of A. G. Bell, No. 174,465. Patent of Emile Berliner, No. 233,969. Patent of Emile Berliner, No. 463,569. Patents of Emile Berliner in Parallel Columns. Patent of C. A. Cheever, No. 208,468. Patent of H. H. Eldred, No. 303,714. Patent of Thos. A. Watson, No. 256,258. Patent of L. B. Firman, No 283,334 Patent of M. G. Kellogg, No. 247,199. Patent of C. E. Scribner, No. 330,058. Patent of C. E. Scribner, No. 300,144. Trunking Principle. Patent of Shaw & Childs, No. 319,856. Mann System. Patent of L. B. Firman, No 252 576. Western Union Pin Switch. Express System. Patent of Sabin & Hampton, No. 513,534. Subscriber's Automatic Signal. Raverot-Hess System. Patent of M. J. Carney, No. 258,886. Apostoloff System.
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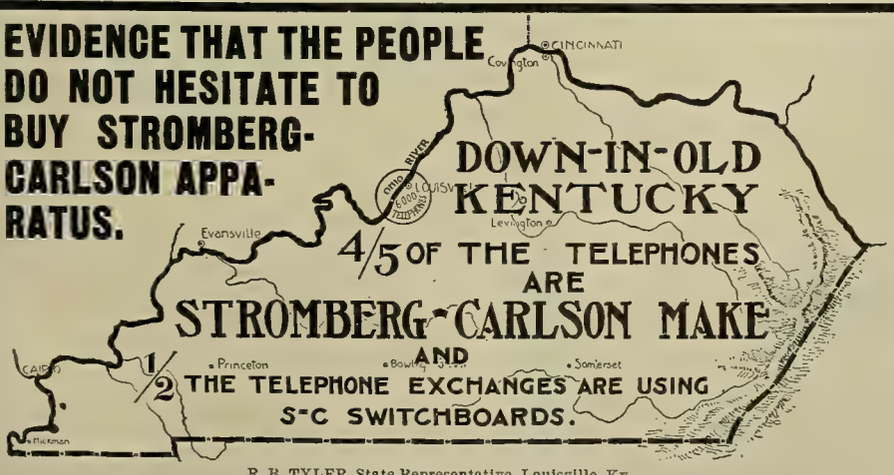

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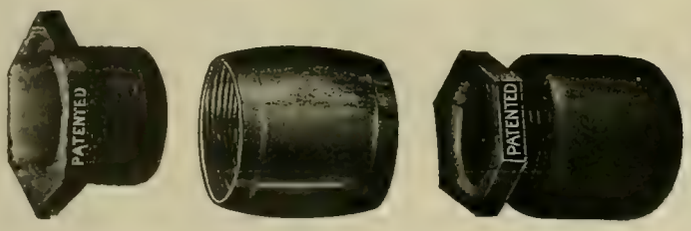

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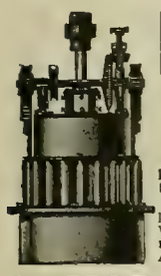

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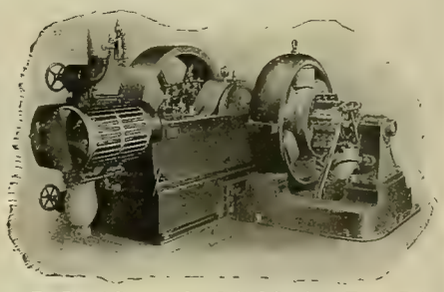

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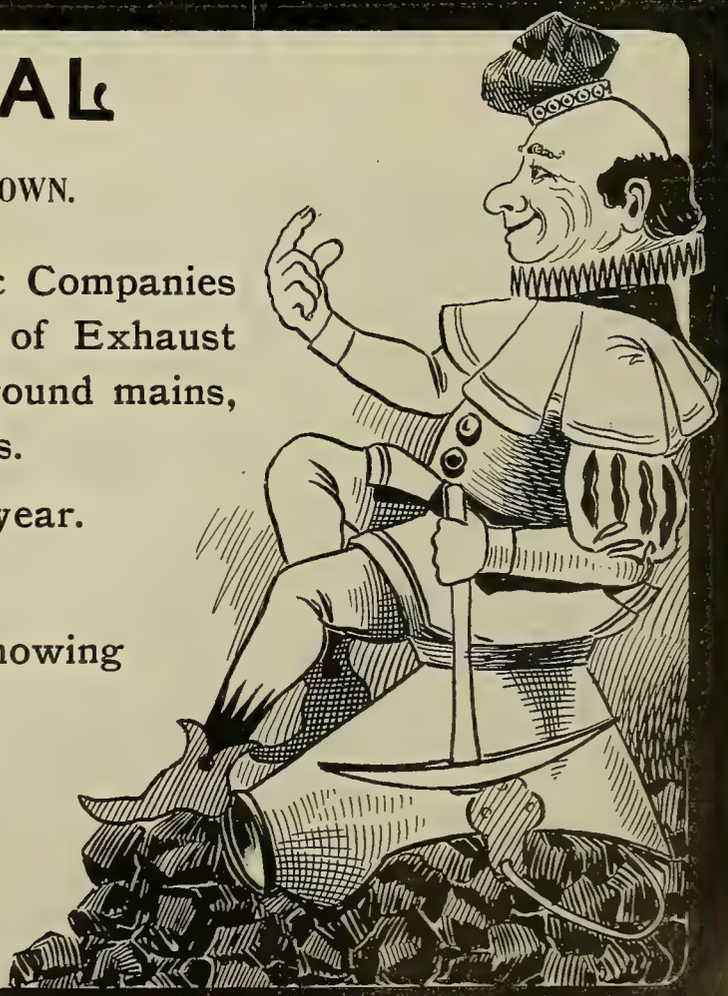

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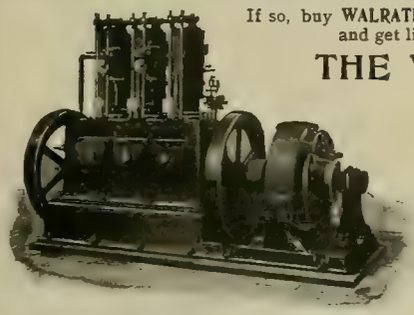

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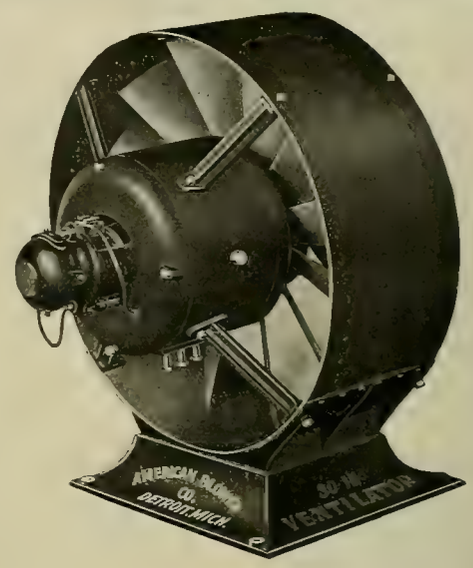

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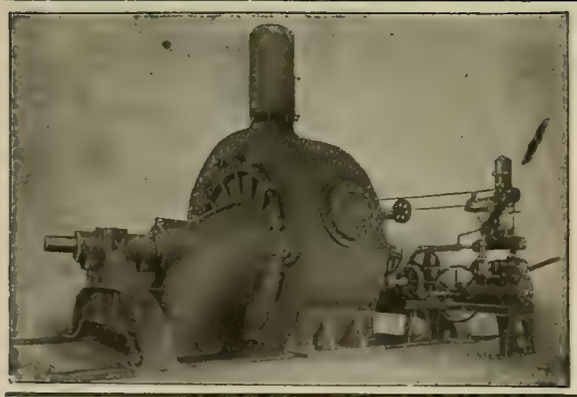

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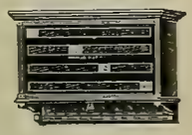
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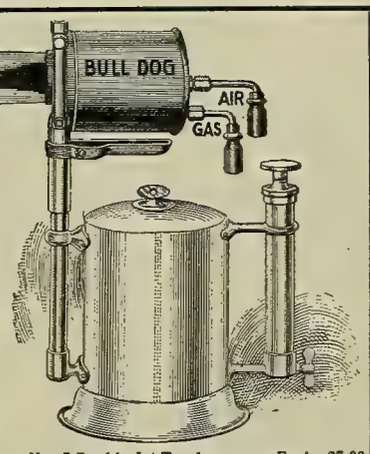

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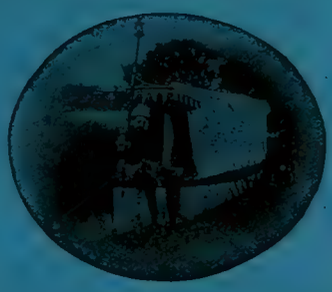

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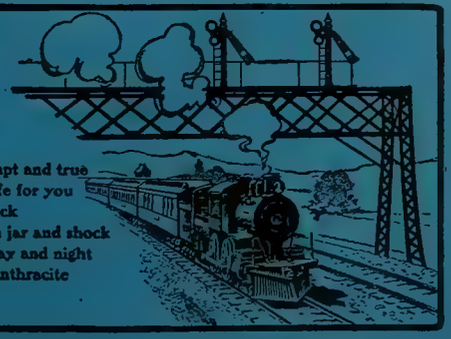

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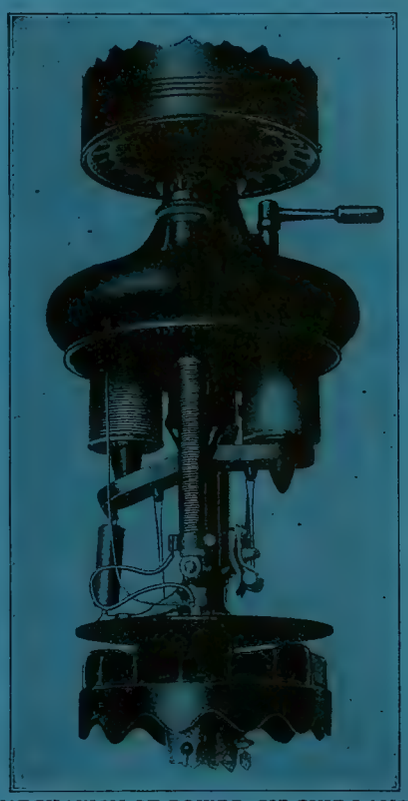

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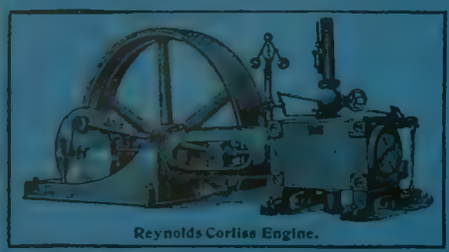
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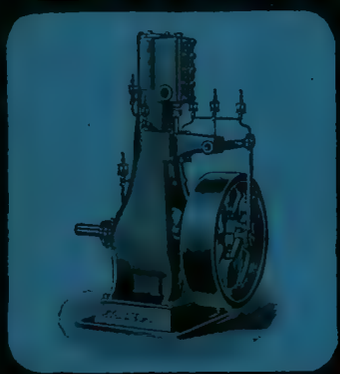

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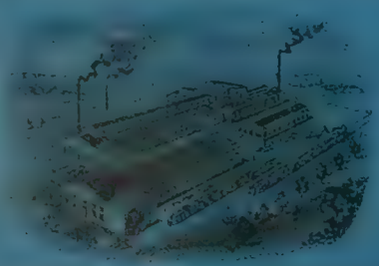

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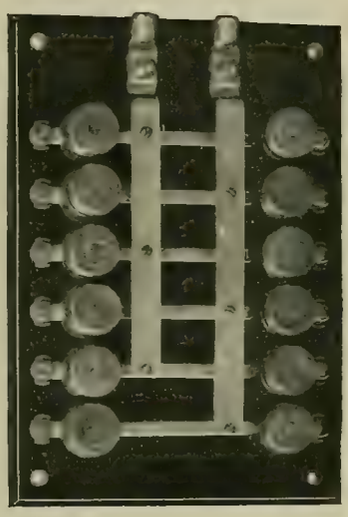

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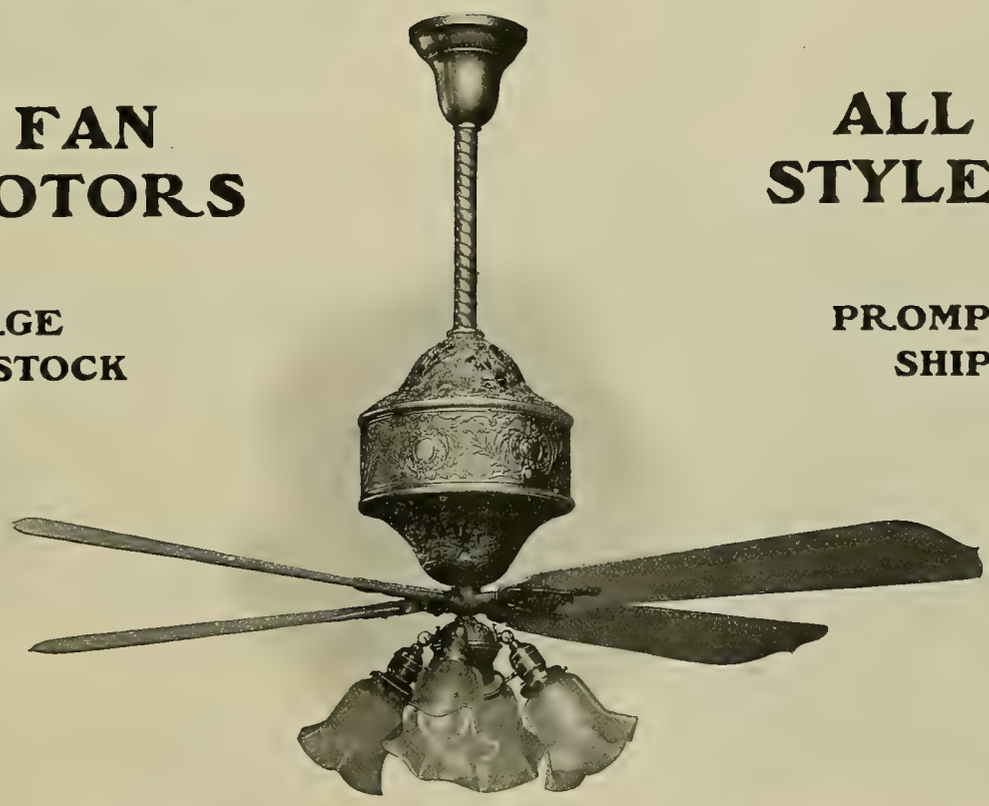

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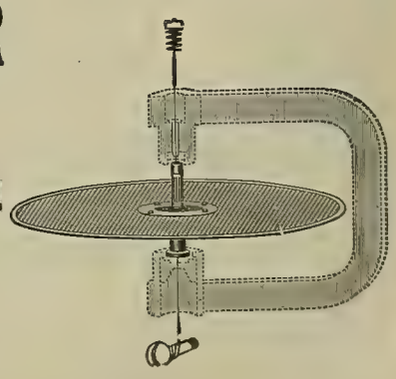

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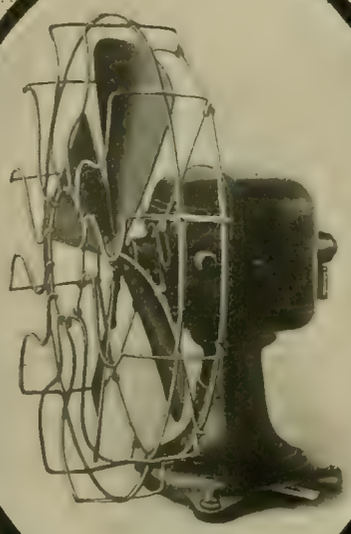

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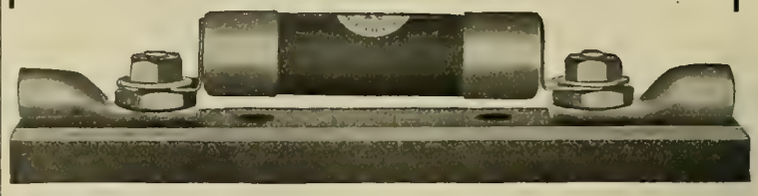

RE-STANDARDIZED TO DATE TO MEET THE LATEST REQUIREMENTS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS.

ABSOLUTE RELIABILITY.

THE NEW SHAWMUT INDICATING FUSE.

Indicating Type P fuse, showing red indicating disc.

Fuse, blown.

CHASE - SHAWMUT CO., Boston,
MANUFACTURERS,

New York Representative:
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THOMAS G. GRIER CO., 128 W. Jackson Blvd.
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ELECTROLYSIS-PROOF
UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely—*
Electrolysis-Proof,
Non-Abrasive,
Moisture-Proof,
Non-Corrosive,
Perfect Insulator. }

Insulation Test,
66,000 VOLTS.

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,
MANUFACTURERS OF
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BITUMINIZED FIBRE. (Patented.)

OFFICES:
720 Arcade Building, Philadelphia, Pa.
822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

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Chester, Pa.
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The Chip on his Shoulder.

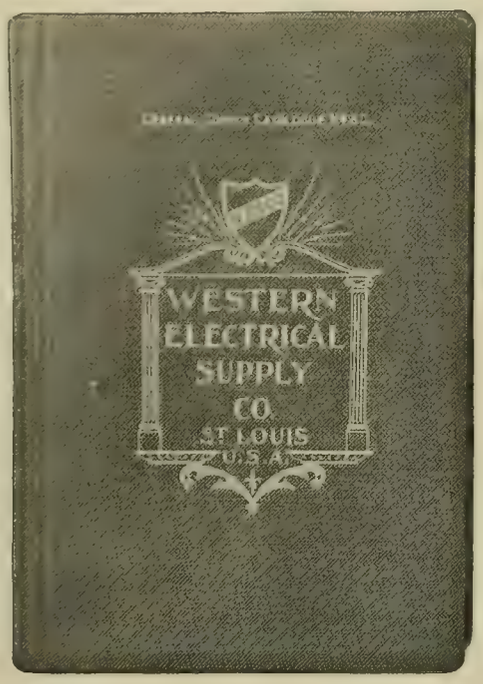
Independent—
And we are.

The boy tells his own story. We think there is room for one independent maker, who will make lamps, not with the immediate profit alone in view, but with repeat orders as the main vantage point. We want your first order only because we know that will mean your business hereafter. There has been too much short-sightedness, because the average buyer was not equipped to test or measure what he bought. Give us your confidence and we will not betray it.

We have made a fair start in the factory line, and have invested a respectable sum in lamp making only after repeated tests had shown our product was not excelled by any lamp in the market for long life and maintained brilliancy.

Remember we make a complete line of everything and ship no sample, picked lamps. What our first lamps promise our subsequent shipments will do. That is something not carried out everywhere. Try us.

THE INDEPENDENT INCANDESCENT LAMP CO. CLEVELAND, OHIO. - FACTORY: 78-84 SENECA ST. OFFICE: ROSE BUILDING



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Illustrates the most complete and up-to-date line of supplies and construction material ever listed. :: :: ::

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We carry in St. Louis the largest and best assorted stock in the U. S.

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"Ceco"

Alternators

37 to 1,500 K. W.

Write for Detailed Description.

Christensen Engineering Co.

Chicago: Old Colony Bldg. Milwaukee Pittsburg: Gellatly & Co., Times Bldg.

250 K. W. 3-Phase "Ceco" Alternator.

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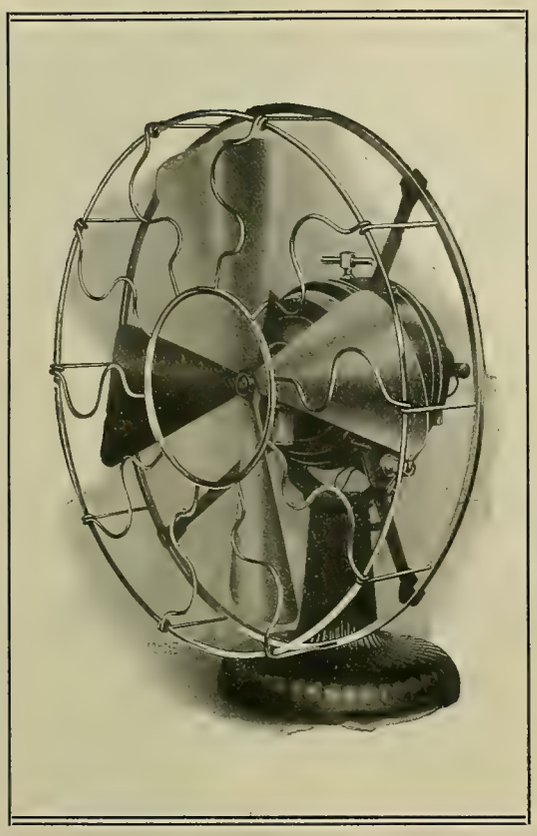
For ELECTRIC LIGHTING and RAILWAY CENTRAL and SUB-STATIONS, POWER STATIONS, TELEPHONE, TELEGRAPH, RAILWAY CAR LIGHTING and all other purposes to which Storage Batteries are applicable.

We guarantee LOWEST FIRST COST, HIGHEST EFFICIENCY, MOST CONSERVATIVE RATING and CHEAPEST MAINTENANCE.

HELIOS-UPTON CO., 222 Fullerton Ave., CHICAGO.



Peerless Direct Current Desk and Ceiling Fans

Made in all sizes and styles and for any voltage. Our "1903" models embody all the best and latest improvements known to good fan motor practice. We issue bulletins fully describing them. :: :: ::

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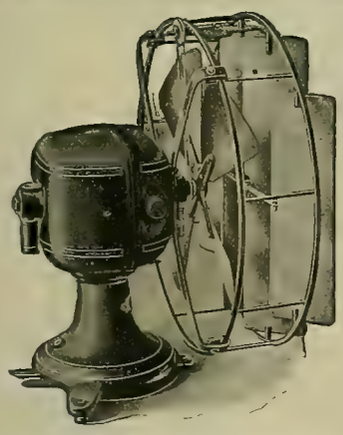
Get Our New General Supply Catalogue No. 50 Just Published.



12-inch Desk Fan with Coleman Guard and Deflector Attached.

THE DIEHL FAN CATALOGUE

FOR 1903

will describe the Coleman device for diffusing the air over nearly ½ of the circle. Can be attached to any make of Desk Bracket or Trunion Fan. Operates on any speed or angle. Positive in operation, attractive in appearance, simple in construction. Send for prices and catalogue. . . . . .

We will also describe a new CEILING FAN, with and without electrolier attachment. 4 blades, 2 or 3 speeds. . . . .

WRITE US AT ONCE.

Diehl Manufacturing Co.

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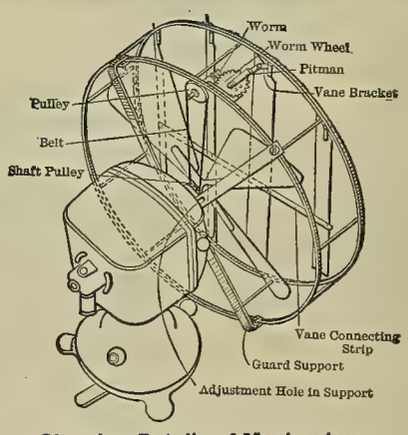
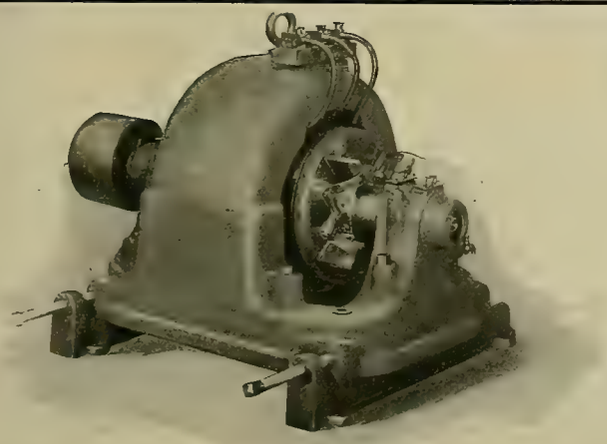


Showing Details of Mechanism. Cannot Get Out of Order.



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Probably the best way to do this is to secure a good motor load. Our motors are all single phase, self-starting, and will give equal satisfaction operated on single or multiphase circuits. Only one transformer required to operate them.

We will gladly tell you what they have done for others, and what they can be made to do for you. Have you got our latest Bulletins ?

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Single Duct. Multiple Duct.
2, 3, 4, 6 and 9 Duct.

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LARGEST FACTORIES IN THE WORLD
EXCLUSIVELY . CONDUIT . AND . INSULATORS

ANNUAL CAPACITY
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Manhattan
Third Rail Insulator.

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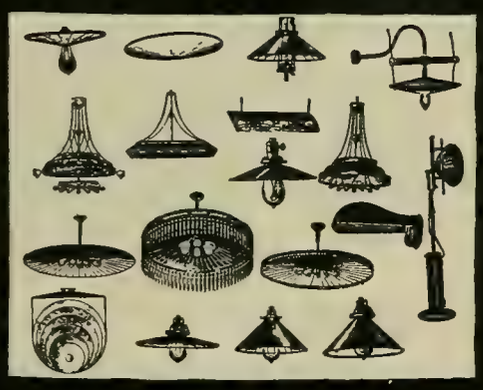

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EDISON PRIMARY BATTERIES

Formerly known as the Edison-Lalande.

FOR GAS ENGINES,
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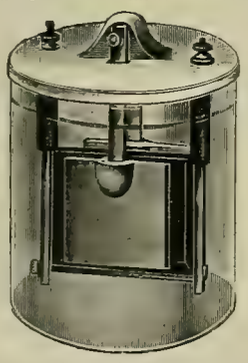
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC. . .



CONSTANT CURRENT,
NO LOCAL ACTION,
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR
PORTABLE
WORK.
Full Description in
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CROCKER-WHEELER COMPANY
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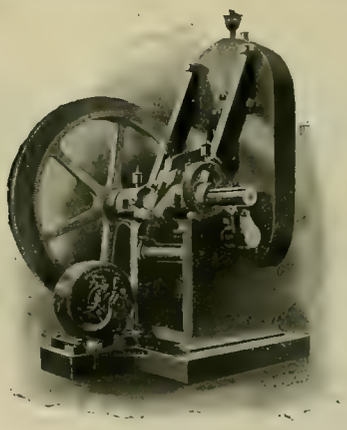

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Electric
Drive

uses a simple equipment of standard apparatus and gives Large Increases in shop output.

Grimshaw. Raven White Core. Raven Black Core.

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Grimshaw and Competition Tapes and Splicing Compounds.

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The Franklin Dynamo
50 Watts. 10 Volts, 5 Amperes.
3,000 to 4,000 revolutions. Sets of material, finished parts, complete machines. For amateur construction—very efficient. Will drive a dental engine, sewing machine or small lathe; run as a generator will furnish current for six 6 candle-power lamps. Parts $3.50, $6, $8.50. Complete $12.50. Write for circular 16.
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....OF ALL KINDS....
AMERICAN ELECTRICAL HEATER COMPANY,
Write for Catalogue. 17 and 19 Spencer Street, DETROIT, MICH.

Transformers
KUHLMAN ELECTRIC CO.
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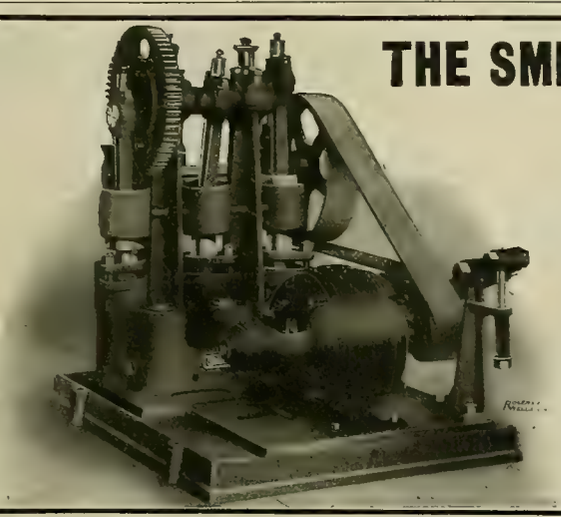

THE SMITH-VAILE ELECTRIC TRIPLEX PUMPS

afford an excellent means for pumping water for House service, Hydraulic Elevator service Factories and Mills desiring an independent water supply, also for Mine Work and : : :

WATER WORKS SUPPLY.

Can be located wherever electric current is available, and require little or no attention after once installed. We make steam and power : : : : : : : : : : : : : : :

PUMPING MACHINERY FOR ALL PURPOSES.

Jet and Surface CONDENSERS, Feed Water Heaters and Victor Turbine Water Wheels

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An item worth considering at the present price of coal. Special designs for ELECTRIC LIGHT and POWER PLANTS. See our free booklet "Green's Economizer" for detailed information.

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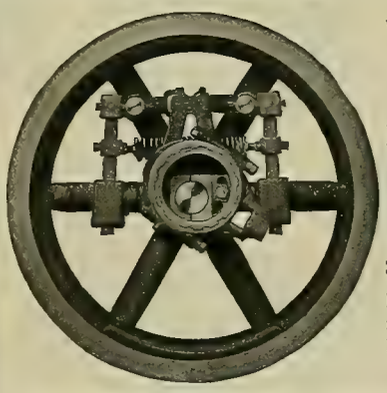
Sole manufacturers in the U. S. A.

THE NICHOLS GOVERNOR



With which are equipped the

IMPROVED NEW YORK SAFETY AUTOMATIC

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Insures the accurate regulation necessary in ELECTRIC LIGHTING WORK.

NEW YORK SAFETY STEAM POWER CO., 60 S. Canal St.,
New York. Philadelphia. San Francisco. Boston. CHICAGO, ILL.

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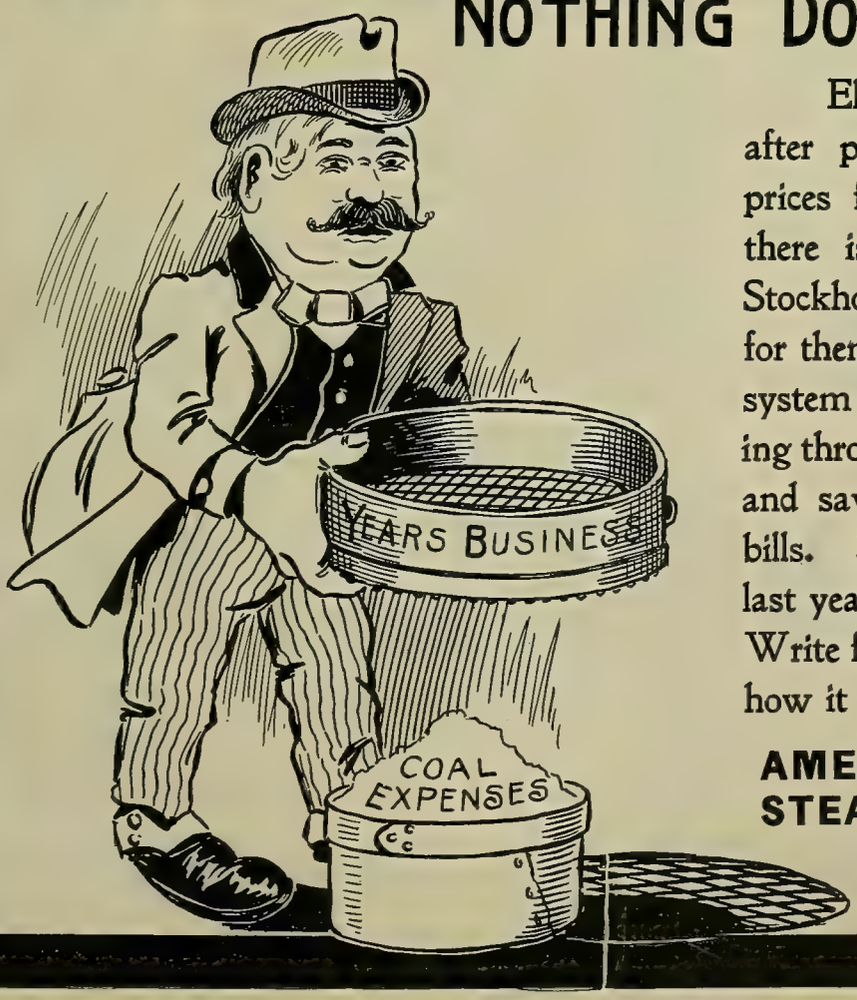

Electric Companies find after paying the present high prices for Fuel and Labor that there is nothing left for the Stockholders. Now is the time for them to decide to put in our system of Exhaust Steam Heating through Underground Mains, and save their Coal and Labor bills. 35 New Plants installed last year. We guarantee results. Write for our pamphlet showing how it is done.

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WE ARE MANUFACTURERS

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WE ARE MANUFACTURERS AGENTS

SPECIAL CIRCULARS—WRITE US

ELECTRIC APPLIANCE COMPANY,
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EDISON MINIATURE LAMPS

are made in more than 10,000 varieties,

for all classes of work in Candelabra and Decorative Lighting, Multiple and Series Burning and in all types of Battery Lamps.

Miniature Sockets and Receptacles,

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SOFT GREEN MICA

A VERY SOFT MICA FOR COMMUTATOR INSULATION.

We are the original and largest importers of this quality and have direct connection for our supply. If you have not used this quality let us send you a sample order. Prices lowest in the market. ALL OTHER QUALITIES.

EUGENE MUNSELL & COMPANY,
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VOLT - AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen.
For Sale by all Supply Houses, or
FREE, Sample Stick.

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Sole Manufacturers,
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"SAFETY" RUBBER COVERED WIRE AND CABLE
FOR EVERY ELECTRICAL SERVICE.
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THE SAFETY INSULATED WIRE & CABLE CO.,
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The individuality of
P=K SPECIALTIES
as made by the
H. T. PAISTE CO.,
Chicago, Philadelphia, New York,
extends beyond the mere design
This

250 Volt
Attachment Plug
is handsome; but it cannot be short-circuited nor broken.
To insure to yourself the best in the market you have only to
Just specify "P=K"

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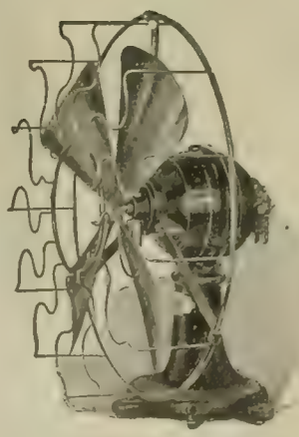
Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.



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ARE ACKNOWLEDGED TO BE THE BEST

Lundell Fans have always given the most satisfaction to dealers and users because of their superior design and construction. They are unequaled in efficiency, durability, appearance and commercial value. Orders should be placed now to insure prompt delivery, as the demand this year is very great. Write for new booklet No. 03307.

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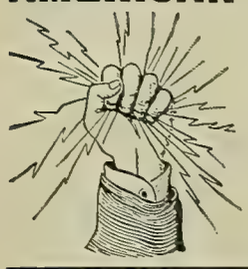
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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SEND FOR 64-PAGE CATALOGUE.
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Six Years with General Electric Company.
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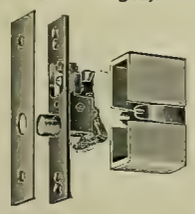
GET **ALLEN** SOLDERING STICKS (A FLUX)
FOR ALL ELECTRICAL WORK
LARGE SAMPLES FREE.
MADE BY
L. B. ALLEN CO., Inc., 1334 Columbia Ave., Chicago.

EDWARDS AND CO.
DOOR SWITCH
(The Lungen).



Porcelain Insulation.
Wire Connections in Front.
Style A—Lights when door is open; out when door is closed.
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THE ECO DOOR SWITCH OPERATES LIGHTS "EVERY OTHER TIME."
Approved by the National Board of Underwriters.
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"STAR" INCANDESCENT LAMPS

LONG LIFE,
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.
MADE BY THE MOST SKILLED WORKMEN.
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

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CHEAPEST FIRST. CHEAPEST LAST.

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WE LIKE TO BE ASKED QUESTIONS.

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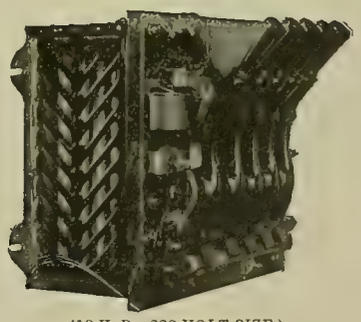
Worm's-eye View.

C & H
MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.
CHICAGO, 1232 MONADNOCK BLDG. NEW YORK, 136 LIBERTY ST. PITTSBURG, 319 FRICK BLDG.

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As chief. Am thoroughly practical and technical in, and can install, figure to the best advantage on the economical operation of, or repair any and all types of steam and electrical apparatus. Own indicator and electrical testing instruments, etc. Married, strictly sober, good character and guarantee satisfaction. Address BOX 197, care Western Electrician, 510 Marquette Building, Chicago.

POSITION WANTED.

As engineer and electrician. Nine years' practical experience in electric work. Understands repairing and installing of dynamos, motors, and construction. Will accept steady place at reasonable salary any time after April 15th. First-class references as to character and ability. Address BOX 193, care Western Electrician, 510 Marquette Building, Chicago.

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By young married man, with lighting and power company as oiler and dynamo tender or other electrical work. Am armature and field magnet winder and repairer at present, but want to learn lighting business. Three and one-half years' armature room experience. I. C. S. student. Never use tobacco or liquors. A1 references. Address BOX 92, Sylvania, Ohio.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

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By a large industrial manufacturing firm, a young or middle-aged man with technical and practical education in electrical engineering. State age, experience and salary expected, also when available. Address BOX 196, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A superintendent for a combined electric-light and water plant in a city of 3,500 inhabitants. Population increasing and business growing. Must have good references. State salary wanted. Address all applications to R. B. PRINCE, Rice Lake, Wis.

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Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

HAPGOODS.

We are constantly in need of high-class draftsmen, mechanical, electrical and civil engineers.

We also fill positions requiring men of technical and executive ability.

Write for our plan, booklet and further particulars.

HAPGOODS, 509 Monadnock Building, Chicago. Eastern Office, 256 Broadway, New York.

FOR SALE.

A complete electric-light plant in a growing town of over five thousand. Doing a good business. Seven years' city contract. Two boilers, one hundred horsepower each. One hundred and fifty horsepower engine. Alternating and direct current. Load enough for one boiler at present. Good reasons for selling. Address BOX 198, care Western Electrician, 510 Marquette Bldg., Chicago.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings), Big bargain.
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2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
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ENGINES.
1—22x33 Buckeye, style B.
1—20x20 Shidder (Auto).
2—13x21 Buckeye (Auto.).
2—16x16 Erie Ball.
1—18x36 Cummer, 4 valve.
1—16x18 Erie City slide valve.
1—20x42 Fitchburg Corliss.
1—16x42 Hamilton Corliss.
1—14x36 Allis Corliss.
1—12x34 Brown Corliss.
2—13x12 Erie Ball.
2—13x12 Armington & Sims.
1—12x12 Harrisburg.
1—11x10 Ball & Wood.
1—9x9 New York Safety.
3—7x7½ Westinghouse.

BOILERS.
6—200 H. P. Heine, 150 lbs.
3—350 H. P. Climax, 150 lbs.
1—375 H. P. National, 150 lbs.
1—267 H. P. Abendroth & Root, 150 lbs.
1—250 H. P. Sterling, 150 lbs.
2—72x18, 120 lbs.
1—72x18 R. T., 26-6 in. tubes, 150 lbs.
2—125 H. P. tubular, 120 lbs.
1—100 H. P. locomotive type, 120 lbs.
2—66x15 tubular, 100 lbs.
2—42x14 tubular, 100 lbs.

RY. GENERATORS.
1—250 K. W. Westinghouse.
2—150 K.W. Edison bi-polar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole.
4—100 K.W. Gen'l Electric.
3—100 K.W. Edison bi-polar.
2—75 K. W. Westinghouse.
2—60 K.W. Edison bi-polar.
5—D62 K. W. T. H. bi-polar.
1—35 K. W. Ft. Wayne, M. P.
1—50 K. W. Detroit, M. P.

ALTERNATORS.
2—150 K.W. St'nley 2 phase
2—120 K.W. G. E. single ph.
2—75 K.W. Stanley 2 phase.
1—60 K.W. Westinghouse, 2 phase, 60 cycle.
2—60 K.W. Stanley 2 phase.
4—60 K. W. G. E. single ph.
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3—72x16 Tubular boilers, 100 pounds.
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20x18 Ball, 250 H. P.
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180 K. W. and 120 K. W. G. E., 60 cycle, A. S. type 1,100 or 2,200 volt alternators.
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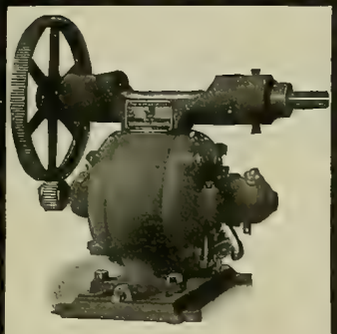

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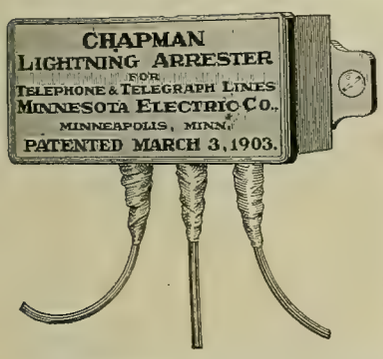

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One 187½ K. W. Westinghouse, 8-pole, 125-volt generator, with 18-30x16 Westinghouse compound engine.
One 130 K. W. General Electric, 8-pole, 125-volt generator, with 12-20x16 Erie Ball tandem compound engine.
One 60 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Buffalo Forge engine. Brand new.
One 50 K. W. Commercial, 6-pole, 125-volt generator, with 8½-13x12 Armington & Sims tandem compound engine.
One 50 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Harrisburg Ideal engine.
One 50 K. W. unit, consisting of two 25 K. W. General Electric, 4-pole, 125-volt generators, with one triple expansion vertical engine.
One 25 K. W. General Electric, 6-pole, 125-volt generator, with 9½x10 Armington & Sims engine.
Two 25 K. W. Westinghouse, 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

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One 26x48 Providence Greene, 500 H. P.
One 26x48 Harris Corliss, 500 H. P.
One 18-34x48 Cooper Corliss, cross compound, 500 H. P.
One 23x48 Harris Corliss, 400 H. P.
One 20x36 Hewes & Phillips, 200 H. P.
One 18x48 George H. Corliss, 250 H. P.
One 16x42 Providence Greene, 200 H. P.
One 20x40 Buckeye, 250 H. P.
Two 13-23x17 McIntosh, Seymour & Co. tandem, 250 H. P. each.
Two 18-30x16 Westinghouse compound, 250 H. P. each.
Three 18½x18 Armington & Sims, 250 H. P. each.
One 18½x18 New York Safety, 250 H. P.
Two 10-18x20 Payne tandem compound, 150 H. P. each.
One 13-19x15 McIntosh, Seymour & Co. tandem, 175 H. P.
One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
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Three 6x5 Westinghouse Junior, 12 H. P. each.
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Two 300 K. W. General Electric, 4-pole, speed, 400 R. P. M.
Two 225 K. W. General Electric, 6-pole, speed, 465 R. P. M.
One 200 K. W. Westinghouse, 6-pole, speed, 510 R. P. M.
Two 200 K. W. General Electric, 4-pole, speed, 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed, 535 R. P. M.
One 110 K. W. Eddy, 4-pole, speed, 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed, 650 R. P. M.
One 100 K. W. Walker, 4-pole, speed, 750 R. P. M.
Two 100 K. W. Edison, bipolar, speed, 620 R. P. M.
One 90 K. W. Thomson-Houston, 4-pole, speed, 700 R. P. M.
One 80 K. W. General Electric, 4-pole, speed, 700 R. P. M.
Two 80 K. W. Detroit, bipolar, speed, 620 R. P. M.
Five 62 K. W. Thomson-Houston, type D, speed, 900 R. P. M.
One 50 K. W. Brush, type Q, speed, 1,050 R. P. M.

ALTERNATORS.

Two 250 K. W. General Electric, 2,400 volts, 50 cycles, three-phase, speed, 600 R. P. M.
One 200 K. W. General Electric, 2,300 volts, 40 cycles, three-phase, speed, 480 R. P. M.
One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase, speed, 600 R. P. M.
One 180 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase, speed, 514 R. P. M.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase, speed, 625 R. P. M.
One 150 K. W. Stanley, 1,100-2,200 volts, 133 cycles, two-phase, speed, 800 R. P. M.
Two 120 K. W. General Electric, 1,040 volts, 125 cycles, single-phase, speed, 1,070 R. P. M.
One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase, speed, 1,070 R. P. M.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase, speed, 900 R. P. M.
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Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase, speed, 1,500 R. P. M.

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Two 200 H. P. Stanley synchronous motors, 133 cycles, two-phase, 2,400 volts, speed, 1,000 R. P. M.
One 200 H. P. Westinghouse, type C, 25 cycles, two-phase, 400 volts, speed, 480 R. P. M.
One 130 H. P. Westinghouse, type C, 60 cycles, two-phase, 200 volts, speed, 850 R. P. M.
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One 2 H. P. Wagner, 60 cycles, single-phase, 104 volts, speed, 1,800 R. P. M.
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Two M. D. 2, Thomson-Houston, 9.6 amperes, 50 lamps.
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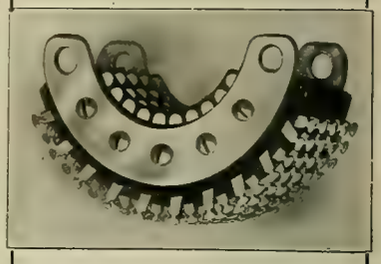

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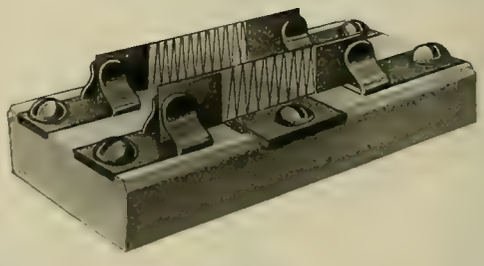

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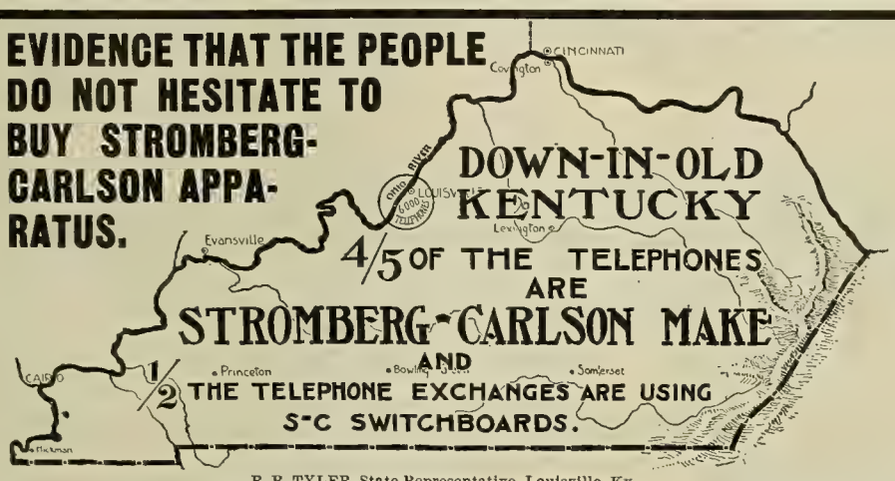

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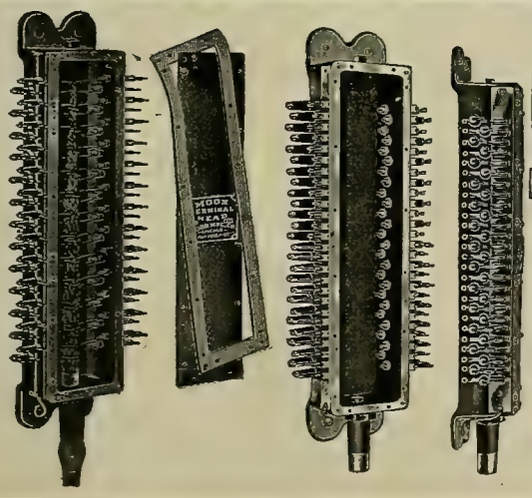
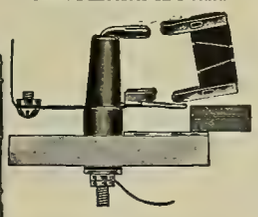


Carbon Arrester in Detail.



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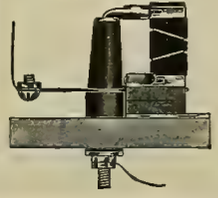

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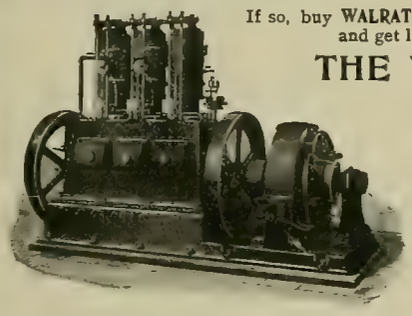

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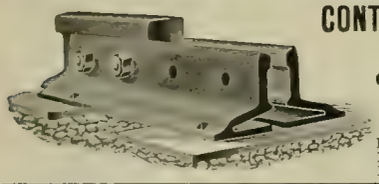

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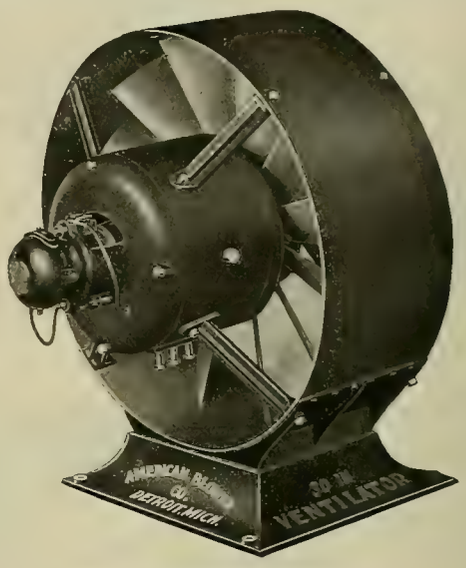

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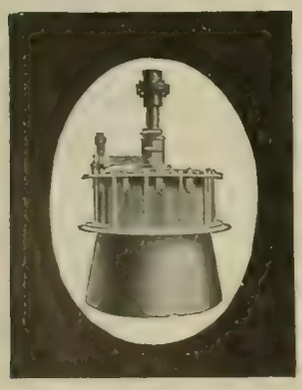

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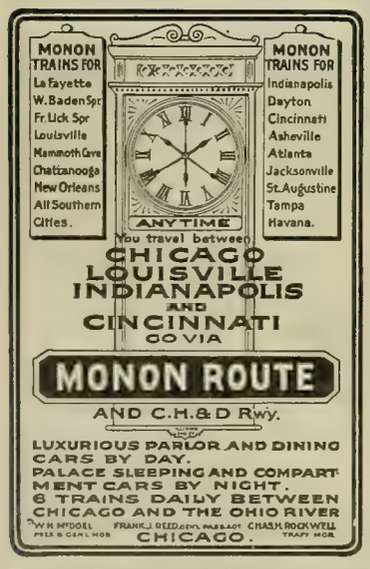

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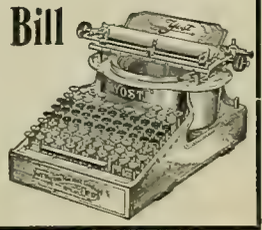

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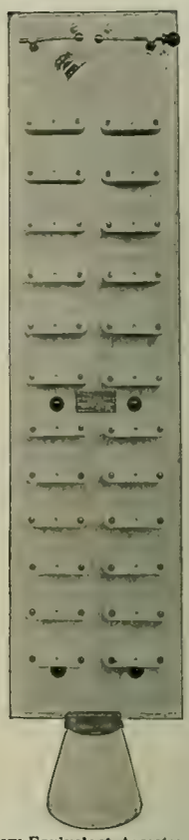

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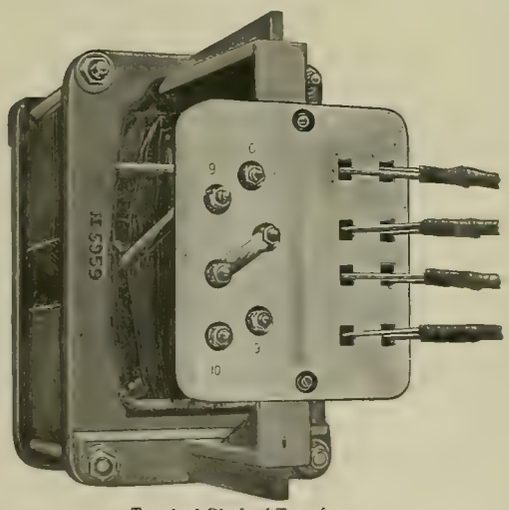

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	58, 116, 232	116, 232, 464
2100	52½, 105, 210	105, 210, 420
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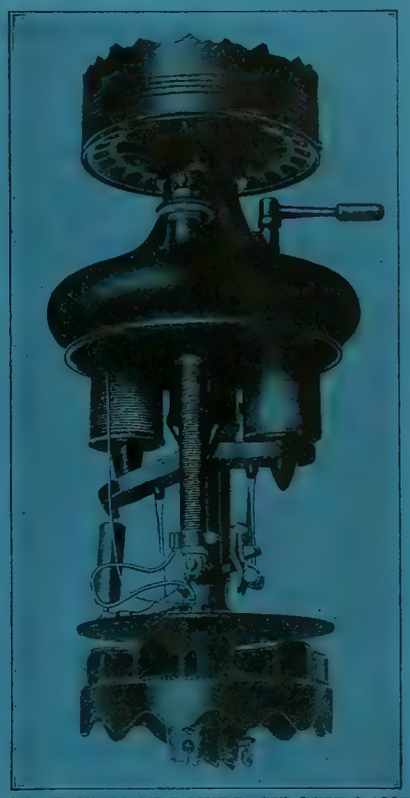

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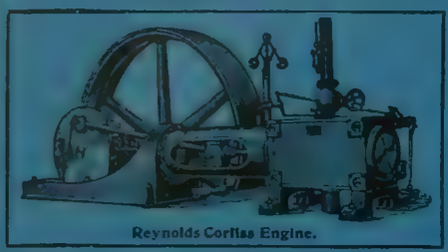
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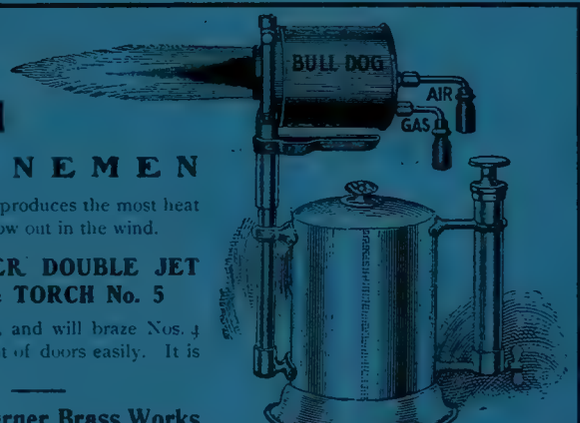

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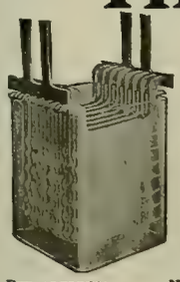

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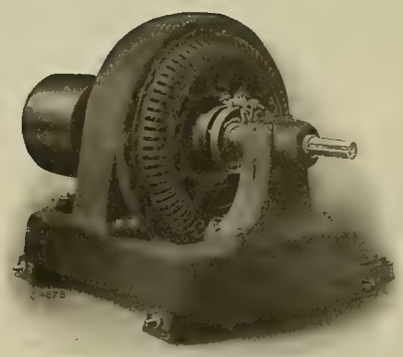

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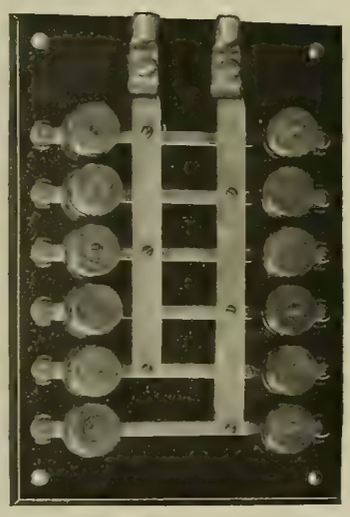

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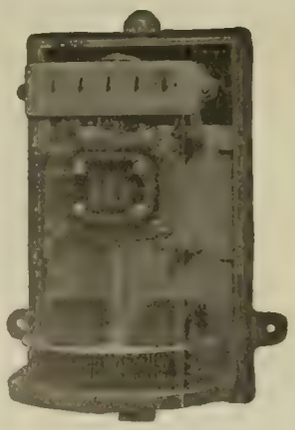

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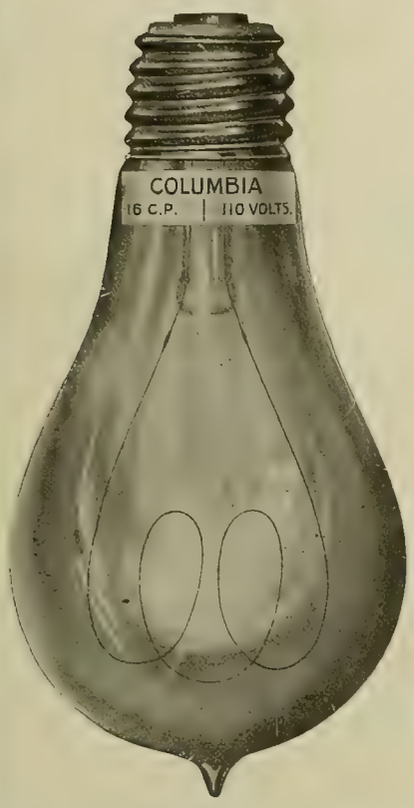

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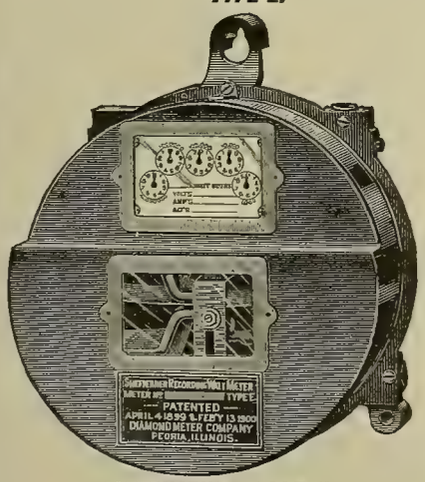

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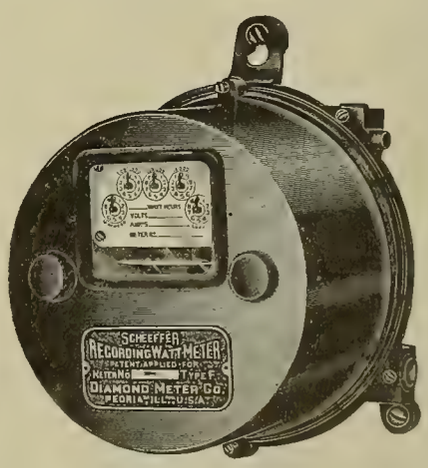

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Hobart Elec. Mfg. Co.
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Barron & Co., Jas. S.
Chase-Shawmut Company.
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Cables. (See Wires and Cables)

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Chicago Edison Co.
Consumers Carbon Co.
Dickey-Sutton Carbon Co.
Electric Appliance Co.
Reisinger, Hugo.
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New England Butt Co.
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Jeffrey Mfg. Co.

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Camp Company, H. B.
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Electric Appliance Co.
Field, C. J.
National Conduit & Cable Co.
Osburn Flexible Conduit Co.
Sprague Electric Co.
Standard Vitrified Cond. Co.
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Conduit Rods.
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Wagner Electric Mfg. Co.
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Western Electric Company.

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Warren Elec. Mfg. Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Whitehead Machinery Co.

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Green Fuel Economizer Co.

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Simplex Elec. Heating Co.
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General Electric Co.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

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Western Elec. Supply Co.
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General Electric Co.

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Parsell & Weed.

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Buffalo Forge Co.
Dustin Co., Chas. E.
Illinois Maintenance Co.
N. Y. Safety Steam Power Co.
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Sturtevant Co., B. F.
Thompson, Son & Co.
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Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
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Munsell & Co., Eugene.
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New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Chase-Shawmut Co.
General Inc. Arc Light Co.

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General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Independent Incan. Lamp Co.
Nernst Lamp Co.
Phelps Company.
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Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sterling Electrical Mfg. Co.
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Commercial Elec. Supply Co.
Nernst Lamp Co.

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Leslie & Co., A. C.

Magnet Wires.
(See Wires and Cables.)

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Buffalo Forge Co.
Sturtevant Co., B. F.

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Mica Insulator Co.
Munsell & Co., Eugene.

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General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

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Phosphor BronzeSm. Co., Ltd.

Platinum.
Baker & Company.
Gt. Western Smelt. & Ref. Co.

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Berthold & Jennings.
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Coolidge, Marshall H.
Fowler, John H.
Fowler-Jacobs Company.
Fulmer Lumber Co., D. M.
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Mueller Company, William.
O. C. Lumber Company.
Page & Hill Company.
Pendleton & Gilkey.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
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Standard Tie Company.
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Torrey Cedar Co.
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Worcester Co., C. H.

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Akron Smoking Pipe Co.

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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Internat'l Corresp. Schools.
Union College.

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Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
Matthews & Bro., W. N.
Schureman & Hayden.
Stewart Electric Co., John A.
Thompson, Son & Co.
Walsh's Sons & Co.
Whitehead Machinery Co.

Slate.
Maley, Martin.
McNamara Brothers.
Monson Burmah Slate Co.
Young, A. B.

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Paiste Co., H. T.

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Allen Co., L. B.
Western Electric Co.

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Central Electric Co.
Edwards & Company.
Electric Appliance Co.
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Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.

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Commercial Elec. Supply Co.
Electric Appliance Co.
Ewing-Merkle Electric Co.
General Electric Co.
Manhattan Elect'l Supply Co.
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Western Elect. Supply Co.

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Automatic Electric Co.
Central Electric Co.
Fahnestock Transmitter Co.
Farr Tel. & Const. Supply Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
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Stromberg-Carlson Tel. M. Co.
Swedish-American Tel. Co.
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Western Elec. Supply Co.

Tools.
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Turner Brass Works.

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Kuhlman Electric Co.
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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile

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Vulcanized Fibre.
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Empire Wire Co.
General Electric Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Western Elec. Supply Co.
Western Electric Company.

Woodwork, Electrical.
Noblett Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

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MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

SALES OFFICES

Room 85 Hartford Building, Chicago. 170 Broadway, New York.

Diam. of body, 6 in., of base flange 7½ in.

THE "I. P." (ISOLATED PLANT) TYPE DIRECT-CURRENT INSTRUMENTS

Are winners. Scales are equally divided, indications are dead beat, high range ammeters have separate shunts and the cases are of heavy polished brass.

Prices are right, the list figure for the meter illustrated for instance, being $16.50.

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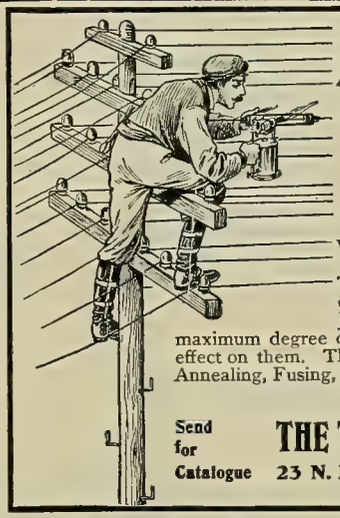

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THE TURNER DOUBLE JET GASOLINE TORCHES

will make a lineman's work much easier.

These torches are superior to all others for electricians' and lineman's work. The Double Jet construction of the burner generates the maximum degree of mechanical heat, and the wind has little effect on them. They are unequaled for Brazing, Tempering, Annealing, Fusing, Soldering, or any work requiring heat.

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ROTARY FLUSH SWITCHES.

THE HIGHEST GRADE IN EVERY PARTICULAR.

MANUFACTURED BY

THE HART MFG. CO.,

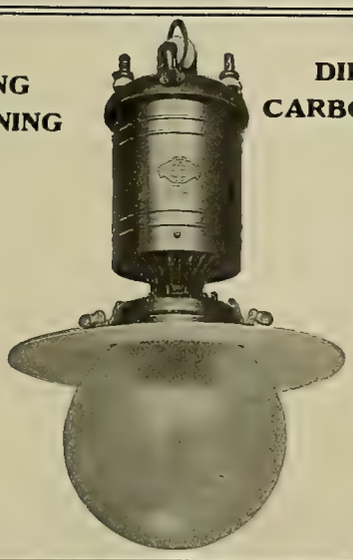
HARTFORD, CONN.

ARC LAMPS

For Series Alternating and Direct Current

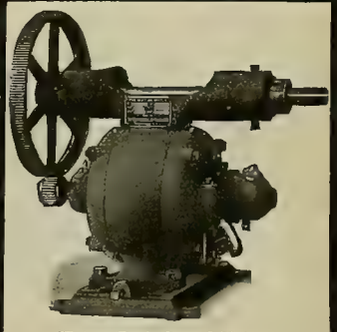
LONG BURNING

DIRECT CARBON FEED



Western Electric Company

Chicago St. Louis Denver New York Philadelphia



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Built on five frames for ⅛, ¼, ½, ¾, 1, 1¼, 1½, 2 and 3 horsepower with speed reductions of from 5 to 1.

Multi-polar type with cast dynamo steel frames and ventilate form coil wound armatures.

An efficient, durable motor built for lasting and severe use.

We build special motors and dynamos for special purposes.

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MILWAUKEE.

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The Western Electrician of May 23rd and 30th, which will cover this important event, will prove most desirable to advertisers. A large, attractive announcement will enable you to place the merits of your product before almost every buyer.

As this will be a Western convention, the Western Electrician, of course, can best serve your interests.

Send in your order and copy now.

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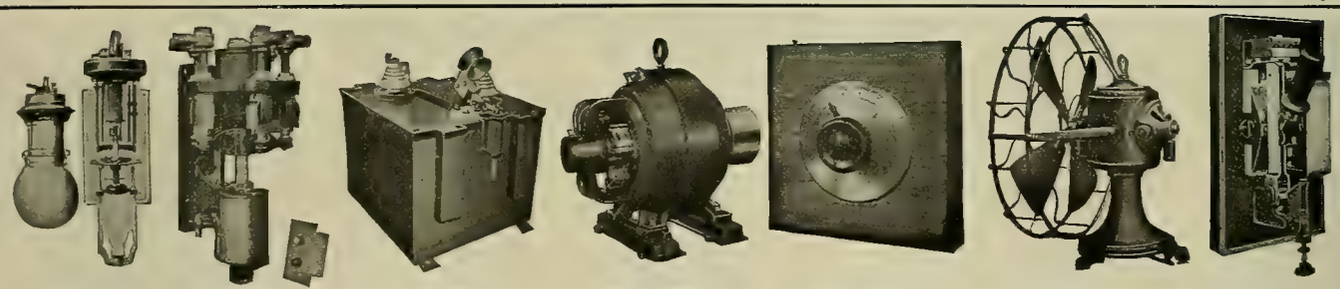

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TRADE **G. I.** MARK

STANDS FOR ELECTRICAL AND MECHANICAL PERFECTION.

Bulletins, Blueprints, Photographs, Estimates, Etc., Mailed Upon Application.

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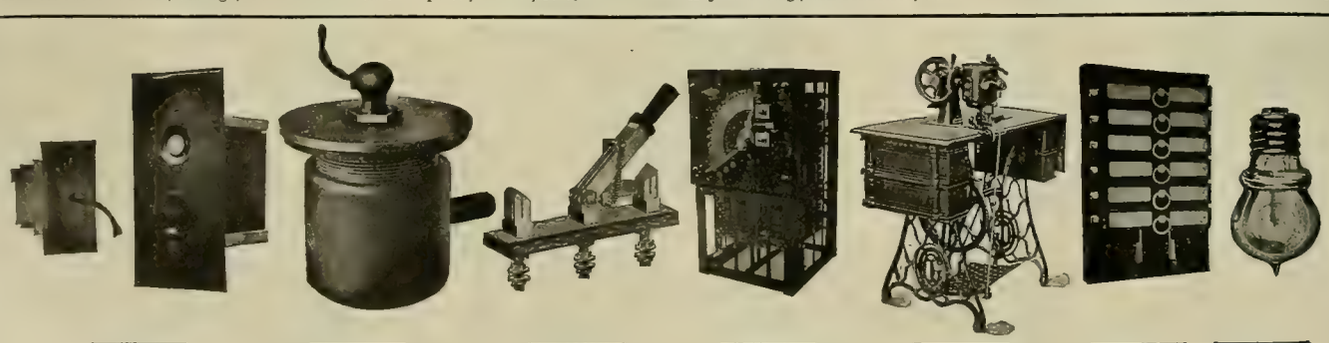
319 Hayward Bldg., San Francisco, Cal.
57 Perin Bldg., Cincinnati, Ohio.
115-117 Cannon St., London, E. C. Eng.



BULLETIN No. 54 | BULLETIN No. 94 | BULLETIN No. 50 | BULLETIN No. 240 | BULLETIN No. 65 | BULLETIN No. 51 | BULLETIN No. 190

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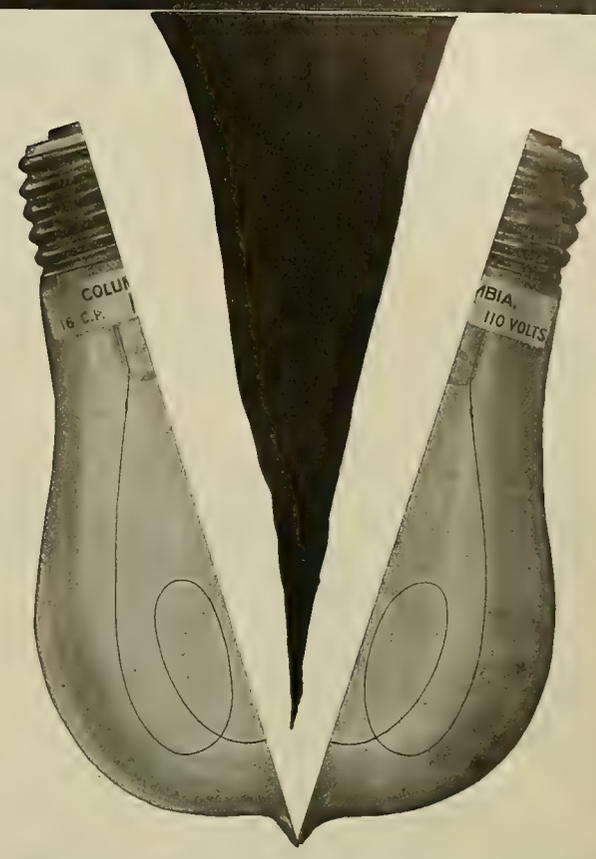
NO, NOT REALLY—!

BUT TEST IT



TEST IT

TEST IT

AN INTELLIGENT PUBLIC has tested the Columbia continuously for 14 years. Result—compelled to add continually to old factory, and finally to build large new plant to satisfy constantly increasing demand.

Quality and honest dealings pay.

Most Light. Least cost.

The Columbia Incandescent Lamp Co.

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Philadelphia, 1227 Real Estate Trust Bldg.

Chicago, Central Electric Co.
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We will extend this guarantee for three years more, or five years in all, on the condition that you give us your entire transformer trade.

There is no condition on our regular two years' guarantee; on the five years' guarantee a bill for all repairs made after the two years will be rendered, but will be cancelled upon a statement from your company that all purchases of transformers by your company since the date of the original invoice have been made from the Kuhlman Electric Co.

☞ Terms of payment... ..... days from date of invoice. We retain the ownership of the goods until the account or any note given in settlement thereof has been fully paid.

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We make shipments from factory or sales offices on the same day order is received.

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WACO, TEXAS Waco Electric Supply and Plumbing Co.

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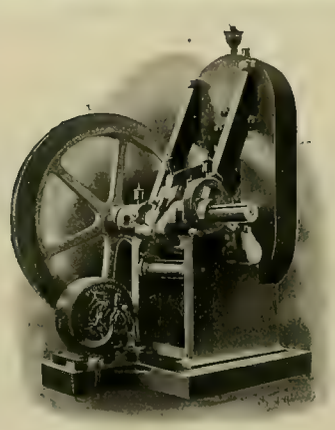
BIG STOCK ST. LOUIS!

FANS!
SUPPLIES—ALL SORTS
Ewing-Merkle Electric Co.
ST. LOUIS, MO.

CROCKER-WHEELER COMPANY
AMPERE, N.J. U.S.A.



The C-W System of Electric Drive

uses a simple equipment of standard apparatus and gives Large Increases in shop output.

Crimshaw. Raven White Core. Raven Black Core.

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

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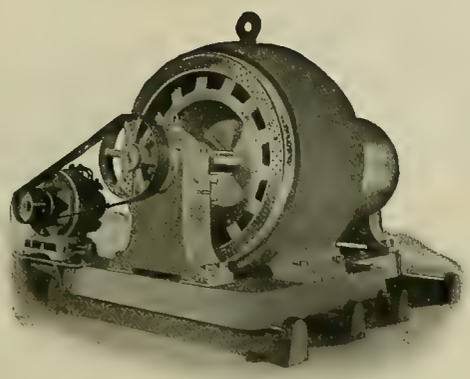
—MANUFACTURERS OF—
STEEL OUTLET AND JUNCTION BOXES, SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.
UTICA, NEW YORK.

The Warren Alternator.

OUR PRODUCT.



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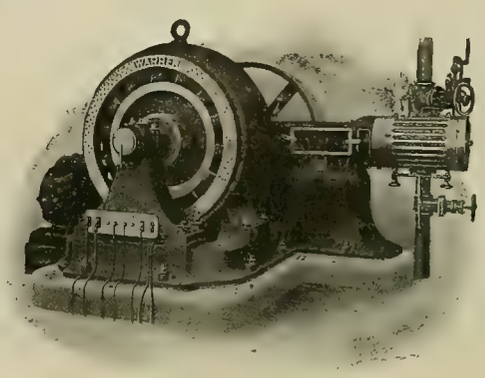
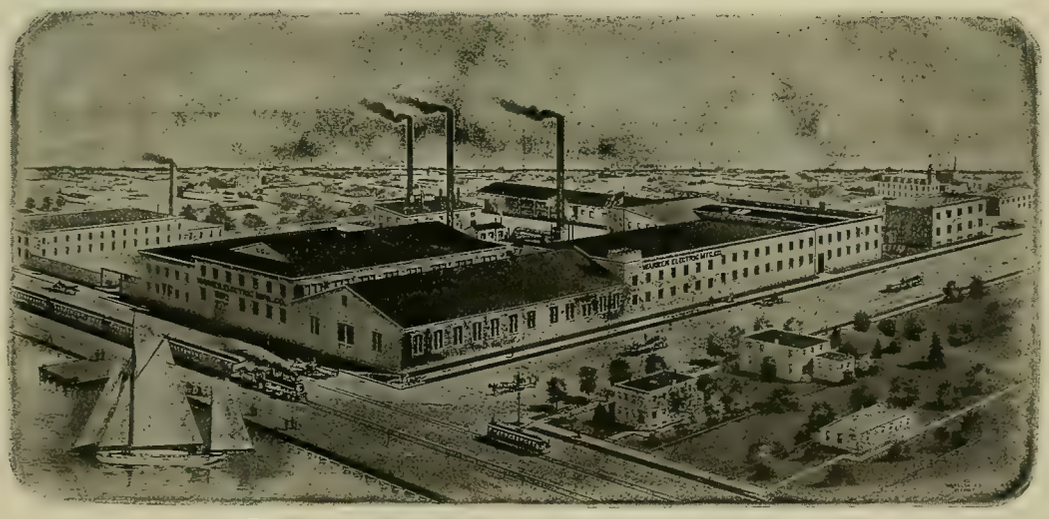


ENGINE TYPE.

OUR FACTORY.



Recent additions to our shop plant, new tools, electric crane, etc., afford us increased capacity to manufacture sizes up to

1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

BULLETINS ON APPLICATION—THEY TELL YOU ABOUT IT.

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SANDUSKY, OHIO, U. S. A.

Rumsey Electrical M'f'r's' Co., 1211 Filbert St., Philadelphia, Pa.
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Thos. Muir & Son, Detroit, Mich.
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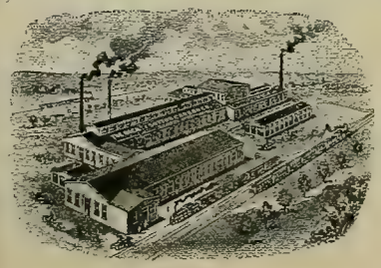
C. W. Hobson, Waco, Texas.
Kilbourne & Clark Co., 815-817 Second Ave., Seattle, Wash., Pacific Coast Agts.
A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.



CARBONS

THE DICKEY-SUTTON CARBON COMPANY,
LANCASTER, O.

WE MANUFACTURE ELECTRIC LIGHT CARBONS OF ALL KINDS, DRY BATTERIES AND BATTERY CARBONS, CARBON BRUSHES AND SPECIALTIES, ELECTROLYTIC CARBONS.

ELECTROLYSIS-PROOF

UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,

MANUFACTURERS OF

ELECTROLYSIS PROOF CONDUIT

BITUMINIZED FIBRE. (Patented.)

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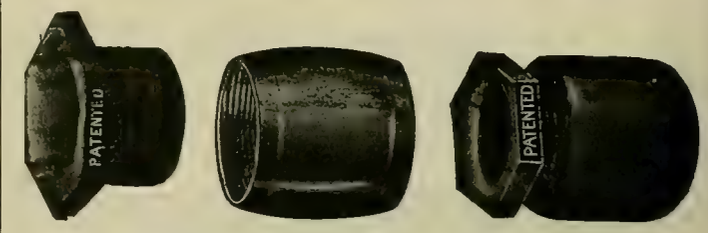
TO CONTRACTORS

USE THE

CHASE NIPPLE COMBINATION

IN YOUR JUNCTION AND OUTLET BOXES.



IT SAVES IN { COST, LABOR OF INSTALLING, ECONOMY OF SPACE IN BOX.

It Makes Rigid Connection Between Box and Conduit. No Other Combination Leaves so Much Working Space in the Box.—This is of Great Importance in Switch Boxes.

IN USE EVERYWHERE.

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(SOLE MANUFACTURERS.)

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The Simplest, Most Practical and Economical Turn-down Electric Lamp ever invented. **The ECONOMICAL**

Style 1—Pull string for bright or dim. Style 2—For variation in light turn bulb one way or the other. Write for booklet and prices. All voltages and bases.

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FIBRE-GRAPHITE COMMUTATOR BRUSH

NONGLASS

SELF-LUBRICATING

There's No Friction

with the Fibre-Graphite Commutator Brush. Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.

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5155 Wakefield St., Germantown, PHILADELPHIA.

MARTIN MALEY,
MANUFACTURER OF ALL KINDS OF
VERMONT SLATE
FOR ELECTRICAL USE.
Switchboards A Specialty.
FAIR HAVEN, VERMONT.

McNAMARA BROS.
ELECTRIC SWITCHBOARDS,
SLATE AND MARBLE.
Write for Catalogue B. Fair Haven, Vt.

STERLING EXTRA INSULATING VARNISH.
Sterling Extra Black Finishing Varnish,
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THE STERLING VARNISH CO., Pittsburg, Pa., U. S. A.
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TURN-DOWN LAMP
Teaches people to use more current by turning lamps down instead of out.
Write for detailed information.
PHELPS CO., 50 State St., Detroit, U. S. A.

N. E. A. CONVENTION,
Boston, July 6 to 10.

NICKEL PLATE.
The New York, Chicago & St. Louis R.R.
IS THE SHORT LINE
$19.00—for the round trip—**$19.00**
With membership fee of $2.00 added.

THROUGH SLEEPING CARS
STOPOVER AT NIAGARA FALLS

By depositing return portion of ticket with Joint Agent, return limit of September 1st, 1903, may be obtained.

American Club Meals in dining car, ranging from 35c. to $1.00. Midday Luncheon 50c. Also service a la carte.

For detailed information, address
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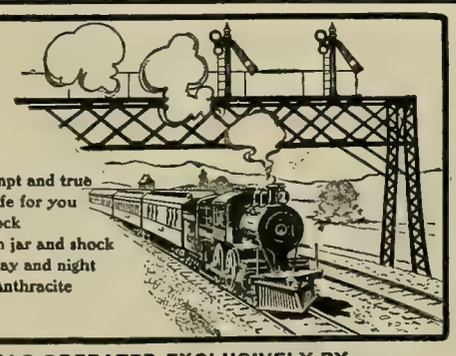
Lackawanna Railroad
THIS IS THE ROAD OF ANTHRACITE



These are the signals prompt and true
That make the journey safe for you
Over the bed of ballast rock
That keeps the trains from jar and shock
That smoothly run both day and night
On the dustless Road of Anthracite

ALL SIGNALS OPERATED EXCLUSIVELY BY
EDISON PRIMARY BATTERIES
Formerly Known as Edison-Lalande.
FULL DESCRIPTION IN BOOKLET NO. 4.
EDISON MANUFACTURING COMPANY
Factory, ORANGE, NEW JERSEY, U. S. A. New York Office, 83 CHAMBERS STREET
Chicago Office, 304 WABASH AVENUE

LITTLE JOURNEYS to lake resorts and mountain homes will be more popular this summer than ever. Many have already arranged their summer tours via the

Chicago, Milwaukee & St. Paul Railway

and many more are going to do likewise. Booklets that will help you to plan your vacation trip have just been published, and will be sent on receipt of postage, as follows:

"Colorado-California," six cents.
"In Lakeland" and "Summer Homes," six cents.
"Lakes Okoboji and Spirit Lake," four cents.

F. A. MILLER,
General Passenger Agent,
CHICAGO.

For all special lighting purposes use "Electra" Flame Light Carbons.

Ask for special list on High Grade Battery Carbons.

You should be largely represented in the May 23rd and May 30th issues of The Western Electrician — the numbers to be devoted to the coming National Electric Light convention to be held in Chicago.

EDWARDS AND CO.
New York, N.Y. U.S.A.

ELECTRO-MECHANICAL GONG

Is entirely encased in iron and is weather-proof. The mechanism is very powerful and gives 375 blows to each winding. Continuous ringing or single stroke.

VITRIFIED CLAY CONDUITS

MULTIPLE—SINGLE

LARGE FACTORIES MODERATE PRICES
PROMPT DELIVERIES

Sole Sales Agent for factories and Expert Engineers and Contractors for

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The largest and most difficult contracts undertaken.

C. J. FIELD and
FIELD CONDUIT CONTRACTING CO.
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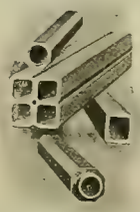

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Write for our free Illustrated Book.
"Can I Become an Electrical Engineer?"
We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Mechanical Drawing, etc. at your home, by mail. Institute indorsed by Thos. A. Edison.

Electrical Engineer Institute,
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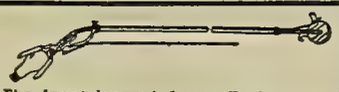

The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
Incandescent Electric Light Manipulator Co.,
116 Bedford St., Boston, Mass.

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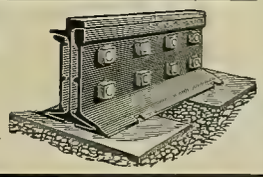
Over FIFTEEN THOUSAND (15,000) miles in use. Received the highest award in its class at Paris Exposition, 1900 and Pan-American, Buffalo, 1901.



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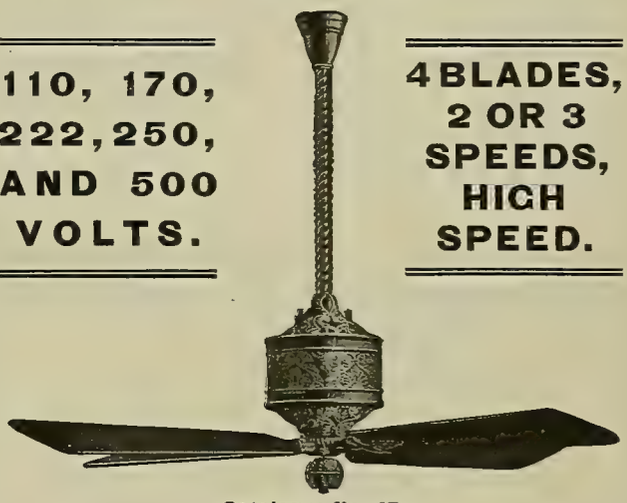
110, 170, 222, 250, AND 500 VOLTS.

4 BLADES, 2 OR 3 SPEEDS, HIGH SPEED.



Catalogue No. 45.

This illustration shows our new type Ceiling Fan, which is artistic in design and perfect in operation. We also make the Coleman guard and deflector.

SEND FOR DESCRIPTIVE CATALOGUE.

DIEHL MANUFACTURING CO.,

Elizabethport, N. J.

Branches—New York, Philadelphia, Boston.

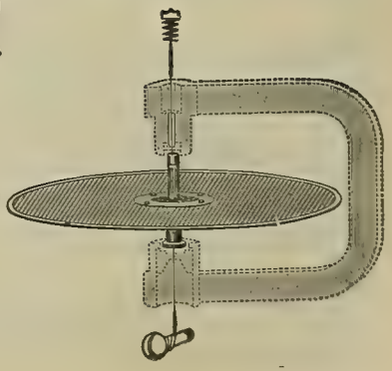
FLOTATION IN AIR

OF THE MOVING PARTS OF
STANLEY RECORDING WATTMETERS
FOR ALTERNATING CURRENT
IS ACCOMPLISHED BY

MAGNETIC SUSPENSION.

NO WEAR. NO LOST REVENUE.
NO FRICTION. ALL CURRENT USED RECORDED.

SEND FOR DESCRIPTION AND BOOK FULL OF GOOD INFORMATION
"ABOUT METERS."



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PACIFIC COAST AGENTS:
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A.-B. LAMPS DON'T FLICKER.

Adams-Bagnall Arc Lamps do not flicker because they are so simple that there is nothing to get out of order. :: :: :: :: ::

WE SEND BULLETINS.

Electric Appliance Company,

ELECTRICAL SUPPLIES,

92 and 94 West Van Buren Street, :: :: CHICAGO.

EDISON MINIATURE LAMPS

Have been for twenty years

The Standard of the World

and are to-day more largely used than all other makes combined.

Serviceable, Economical, Reliable.

Miniature and Candelabra Sockets and Receptacles.

EDISON DECORATIVE & MINIATURE LAMP DEPT.,

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MICANITE CLOTH

HIGH INSULATOR FOR ARMATURES, ETC.
NON-ABSORPTIVE, FLEXIBLE and STRONG.

MICA INSULATOR CO.

"ORIGINATORS."

CHICAGO. NEW YORK.

VOLT - AMMETERS,

POCKET SIZE.

For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.

L. M. PIGNOLET,

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"STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.

SPARKING

Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

50 Cents per Stick. $5.00 per Dozen.

SEND FOR FREE SAMPLE STICK.
For sale by all supply houses, or

It will put that high gloss on the Commutator you have so long sought after.

K. McLENNAN & CO. Sole Manufacturers, 909, 100 Washington St., Chicago.

BEARDSLEE CHANDELIER M'F'G CO. 256 AND 257 5TH CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS . . MENTION THIS PAPER.

An Attachment Plug should not be easily broken.

Our "P-K"
Can't be broken at all.
Nor should it be easily short-circuited.

Our "P-K"
Can't be short-circuited at all.
It should be simply constructed.

H. T. Com-

Paiste pany.

Our "P-K"
Is simplicity itself.
And it should be neat.

Our "P-K"
Is the handsomest made
Therefore

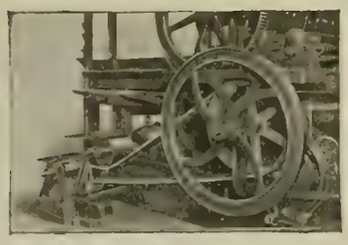
Just specify "P-K"

THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.

CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

SPRAGUE ELECTRIC COMPANY'S



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have enabled many printers to increase their business. They can increase your profits also. Write for booklet No. 03211.

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WE MAKE A SPECIALTY OF

MINIATURE SIGN LAMPS

From Two to Eight Candle Power for Multiple or series burning.

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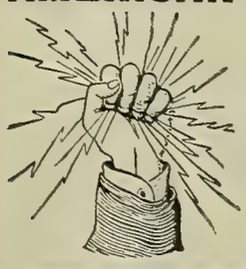
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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Electric Heating Apparatus
SEND FOR 64-PAGE CATALOGUE.
"UNIT" ENAMELED RHEOSTATS
SIMPLEX ELECTRIC HEATING CO.,
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Six Years with General Electric Company.
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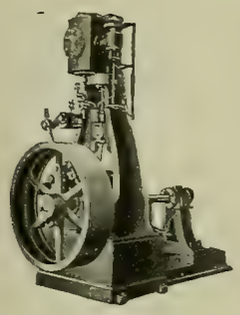
A NEW CATALOG HAS JUST GONE TO PRESS WHICH CONTAINS A FULL DESCRIPTION OF THE

STOMBAUGH GUY ANCHORS

THIS CATALOG CONTAINS MUCH VALUABLE INFORMATION ON GUYING, WHICH WILL BE OF USE TO EVERY STREET RAILWAY, ELECTRIC LIGHT AND TELEPHONE ENGINEER.

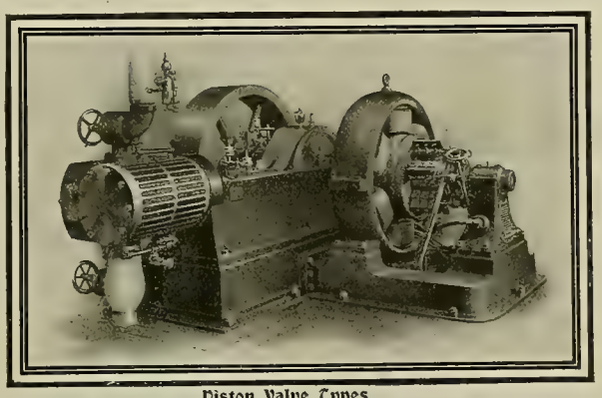
W. N. MATTHEWS & BRO.
603 CARLETON BLDG.,
ST. LOUIS.

New York Safety Automatic Engines, Vertical or Horizontal



Units Ten to 200 H. P. For Heavy Duty,

New York Safety Steam Power Co
60 So. Canal Street, Chicago, Ill.
New York, Philadelphia, San Francisco, Boston.



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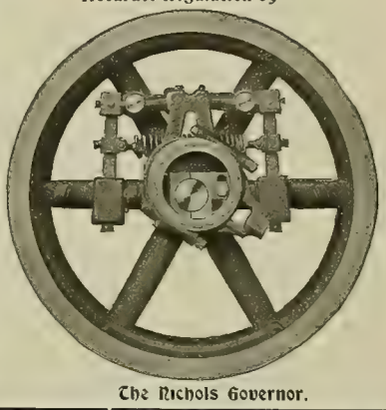
Accurate Regulation by



The Nichols Governor.

DIRECTIONS—AFTER YOU GET **ALLEN** SOLDERING STICKS (A FLUX)

Heat joint, rub LIGHTLY with Allen Soldering Stick, apply solder—That's all.

LARGE SAMPLES FREE.
MADE BY
L. B. ALLEN CO., Inc., 1334 Columbia Ave., Chicago.

It will pay you to place an attractive announcement in the Western Electrician's National Electric Light Convention Numbers — issues of May 23rd and 30th

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

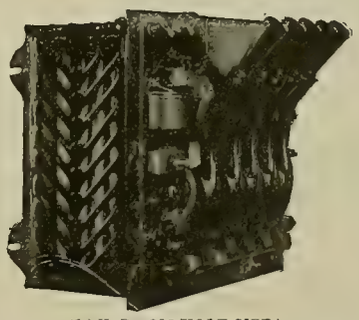
"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.
Office and Factory: PAWTUCKET, R. I.

C & H

MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.

CHICAGO, 1232 MONADNOCK BLDG. NEW YORK, 136 LIBERTY ST. PITTSBURG, 319 FRICK BLDG.

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POSITION WANTED.

By young married man, with lighting and power company as oiler and dynamo tender or other electrical work. Am armature and field magnet winder and repairer at present, but want to learn lighting business. Three and one-half years' armature room experience. I. C. S. student. Never use tobacco or liquors. All references. Address BOX 92, Sylvania, Ohio.

POSITION WANTED.

As superintendent of electric-light or water-works plant. 16 years' practical experience in this business. Results guaranteed. Am now employed as superintendent of large plant but desire a change. References. Address BOX 192, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

WANTED.

Competent man to take charge of car barn and inspect motors and cars at night. A good opening to right party. THE LIMA ELECTRIC RAILWAY & LIGHT CO., Lima, Ohio.

WANTED.

First-class, experienced, mechanical draftsmen wanted at once, some of them acquainted with electrical work; those with shop experience preferred. Apply by letter to CHIEF DRAFTSMAN, P. O. BOX 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

A superintendent for a combined electric-light and water plant in a city of 3,500 inhabitants. Population increasing and business growing. Must have good references. State salary wanted. Address all applications to R. B. PRINCE, Rice Lake, Wis.

WANTED.

Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Man as Foreman of Electric Light Plant, who understands both station and outside work, and capable of handling a crew of men. $60 per month and house rent. Also man to take charge of water works, do collecting, inspecting, tapping pipe and look after pumping station. $60 per month. Address, BOX 202, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

ELECTRICAL ENGINEERS AND ELECTRICIANS.

Want Positions. We have investigated their records and references. We recommend only competent men. We furnish technical men of all kinds. 5,000 positions filled in ten years. Let us help you. Write for booklet, "Cogs That Fit." ENGINEERING AGENCY, 15 Monadnock Block, Chicago.

GUNS $1.00 EACH.

U. S. Army guns, as curiosities, for cosey corners, dens, etc.

Walsh's Sons & Co., 261 Washington St., Newark, N.J.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings). Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2—90 K. W. General Electric type A. S. 90.
1—90 K. W. Westinghouse.
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Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

IT'S UP TO YOU.

We pay highest market prices for

SCRAP COPPER, BRASS AND PLATINUM, ALSO Incandescent Lamp Bases, Etc.

WRITE US.

We Manufacture Copper Hard Babbitt

the best on earth for electrical work, Wire Solder, Pig Lead, Ingot Copper, Spelter, etc. It will pay you to get our prices.

GREAT WESTERN SMELTING AND REFINING CO., CHICAGO.

FOR SALE.

One 300-light, 17 Kw., 120-volt, 4-pole D. C. Generator, 750 revolutions. Nearly new. Guaranteed.

STEPHENS & TYLER,
Monadnock Bldg., - Chicago.

REPAIRS

Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices.

MIDLAND ELECTRIC CO., Des Moines, Iowa.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

"All roads lead to Rome."

And all business in New York seems to tend toward

Grand Central Station.

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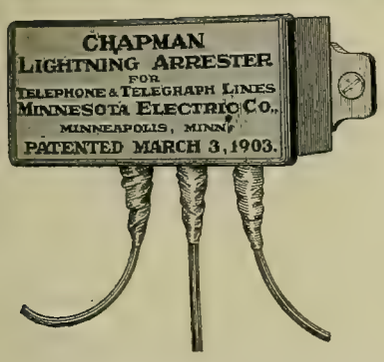

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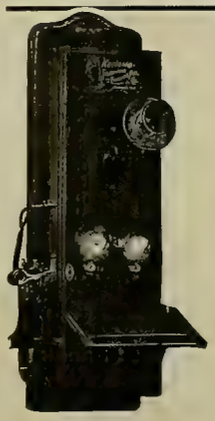

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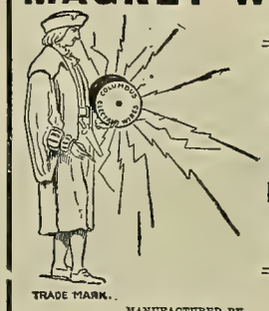

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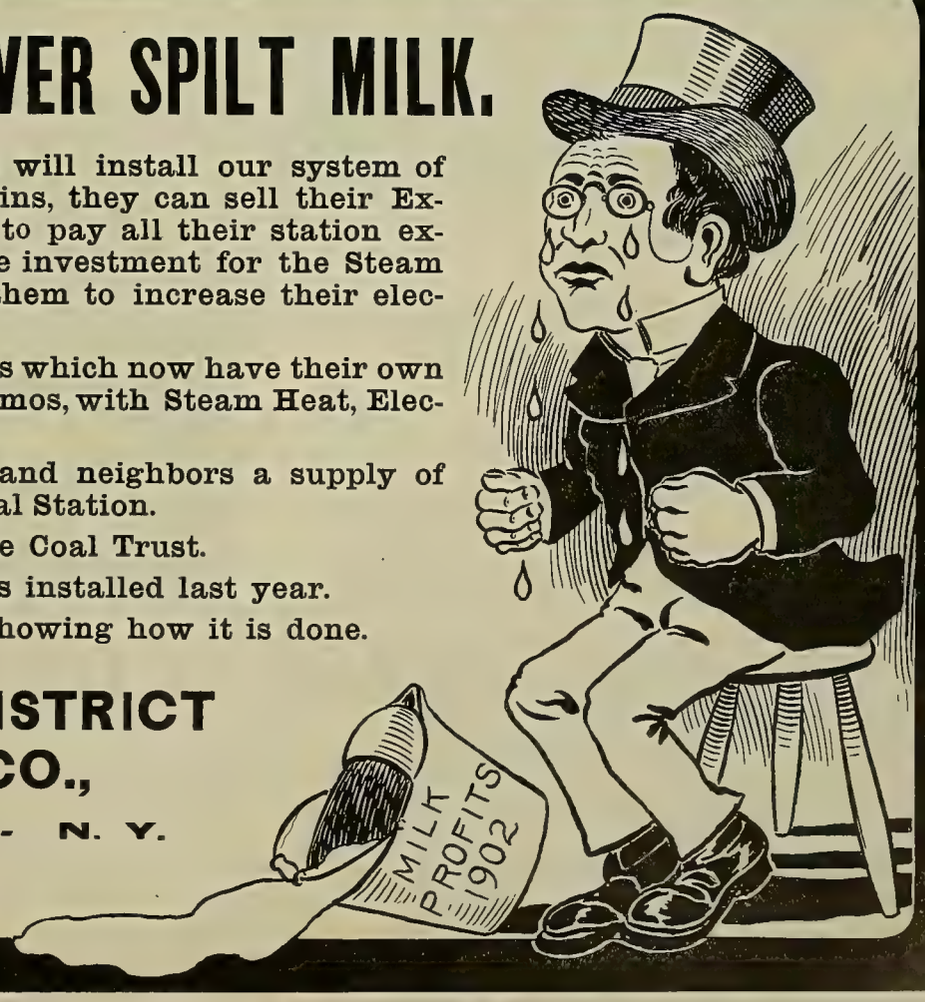

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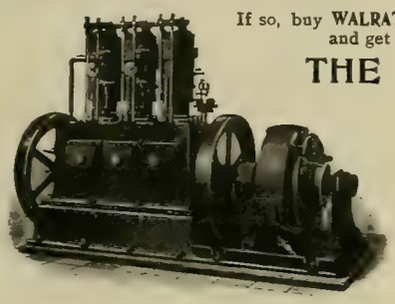

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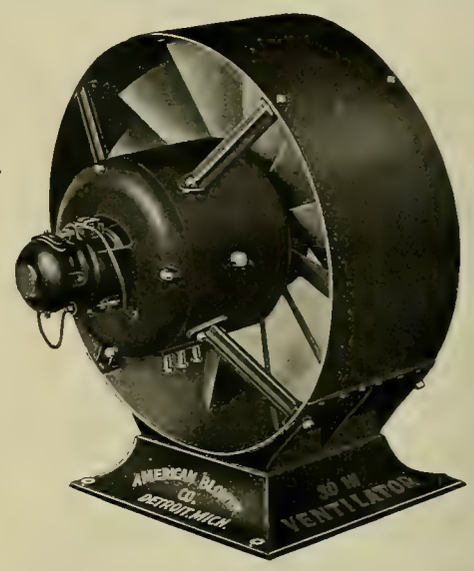

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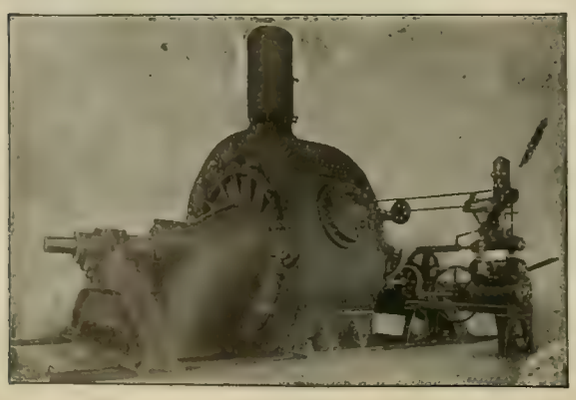

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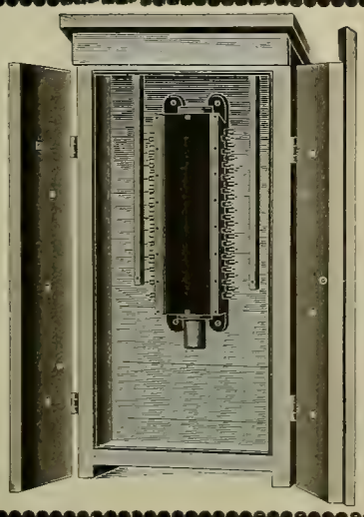

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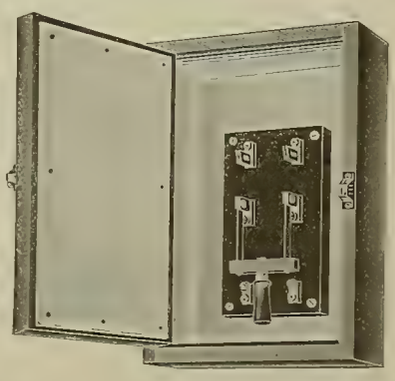

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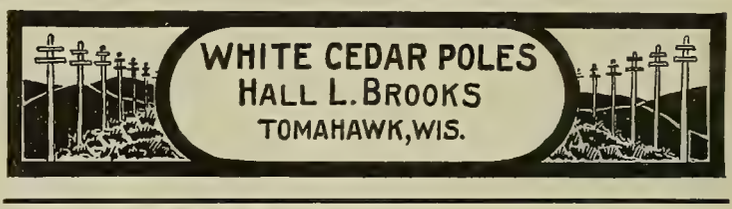

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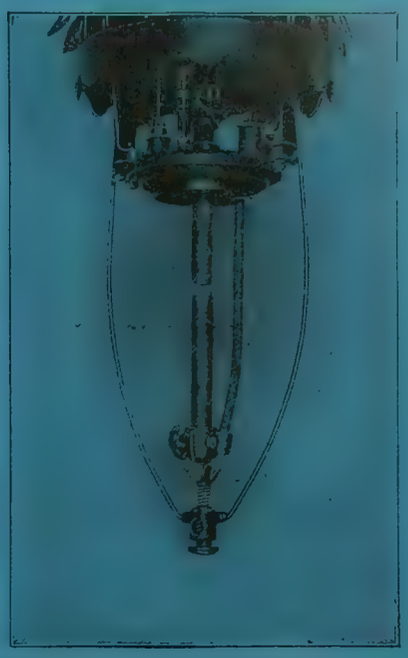

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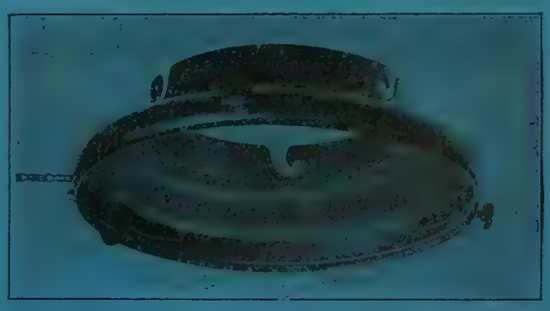

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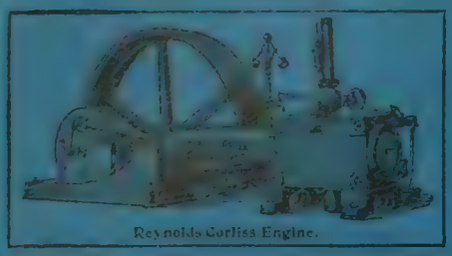
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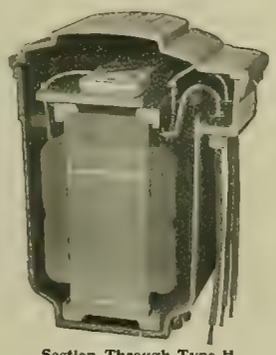

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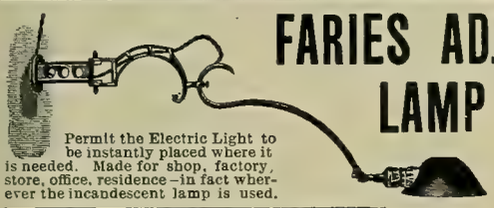

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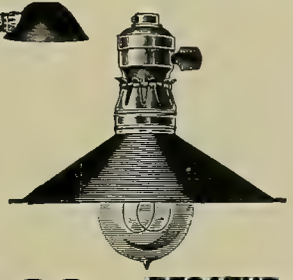

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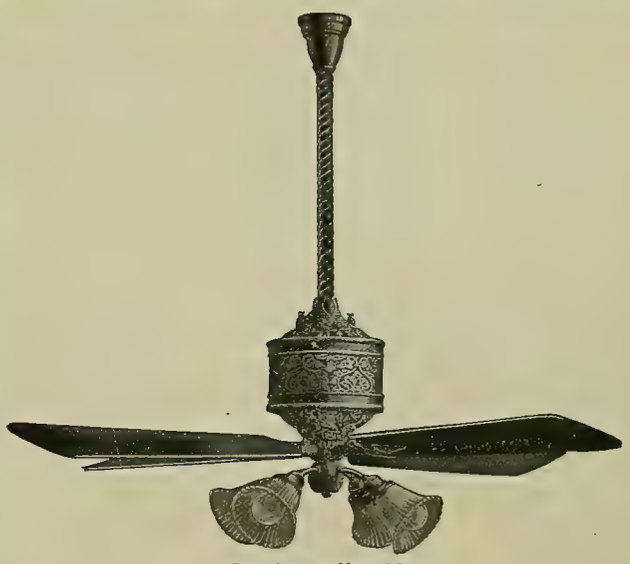

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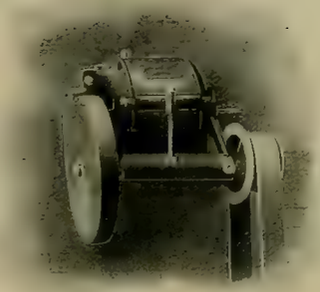

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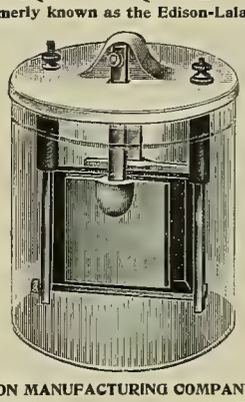

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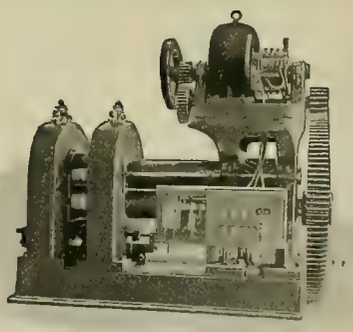

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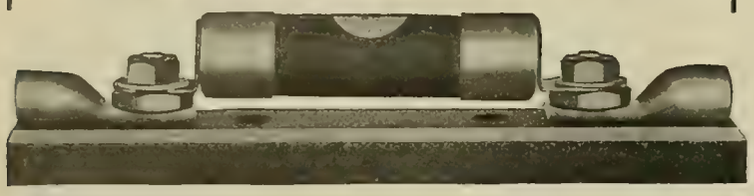

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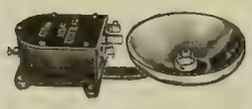

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THE convenience to factories of being able to get everything they need in the electrical line from one house—the convenience of stating the conditions and having us supply just such apparatus or supplies as are adequate to the situation—the convenience of making out a smaller check for goods delivered, than is generally given out for electrical supplies.

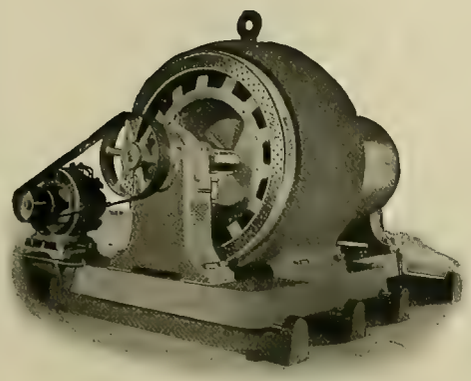
If you don't believe this—"look it up in the Green Book."

Complete factory equipment—at short notice and short prices.

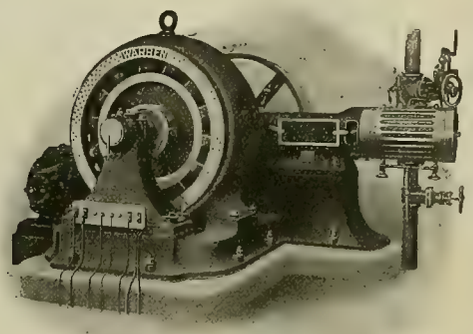
Ewing-Merkle Electric Co.,
ST. LOUIS.

The Warren Alternator.

OUR PRODUCT.



BELTED TYPE.



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OUR FACTORY.

Recent additions to our shop plant, new tools, electric crane, etc., afford us increased capacity to manufacture sizes up to

1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

BULLETINS ON APPLICATION—THEY TELL YOU ABOUT IT.

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SANDUSKY, OHIO, U. S. A.

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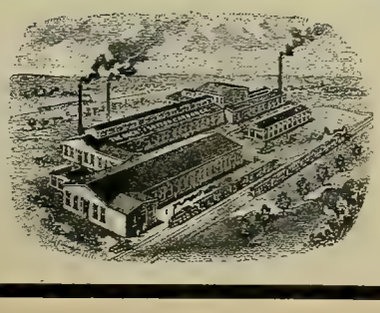
H. B. Coho & Company, 114 Liberty St., New York.
Thos. Muir & Son, Detroit, Mich.
Western Electrical Supply Co., St. Louis, Mo.
C. W. Hobson, Waco, Texas.
Kilbourne & Clark Co., 815-817 Second Ave., Seattle, Wash., Pacific Coast Agts.
A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.



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THE DICKEY-SUTTON CARBON COMPANY,
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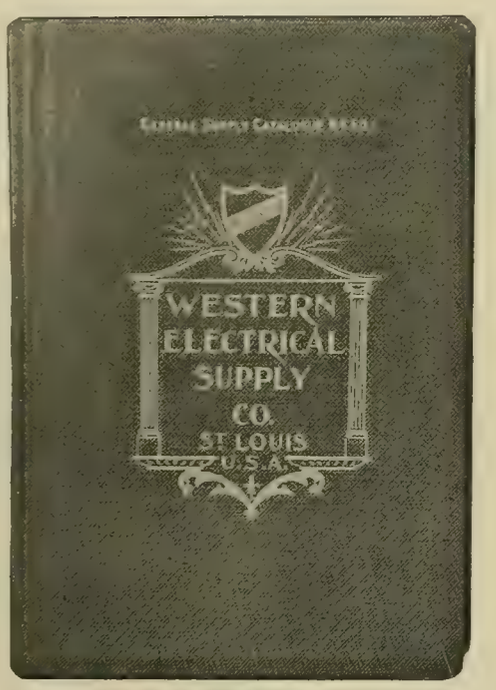
WE MANUFACTURE ELECTRIC LIGHT CARBONS OF ALL KINDS, DRY BATTERIES AND BATTERY CARBONS, CARBON BRUSHES AND SPECIALTIES, ELECTROLYTIC CARBONS.



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Illustrates the most complete and up-to-date line of supplies and construction material ever listed. :: :: ::

YOU SHOULD HAVE ONE.

We carry in St. Louis the largest and best assorted stock in the U. S.

WESTERN ELECTRICAL SUPPLY COMPANY :: St. Louis, U. S. A.

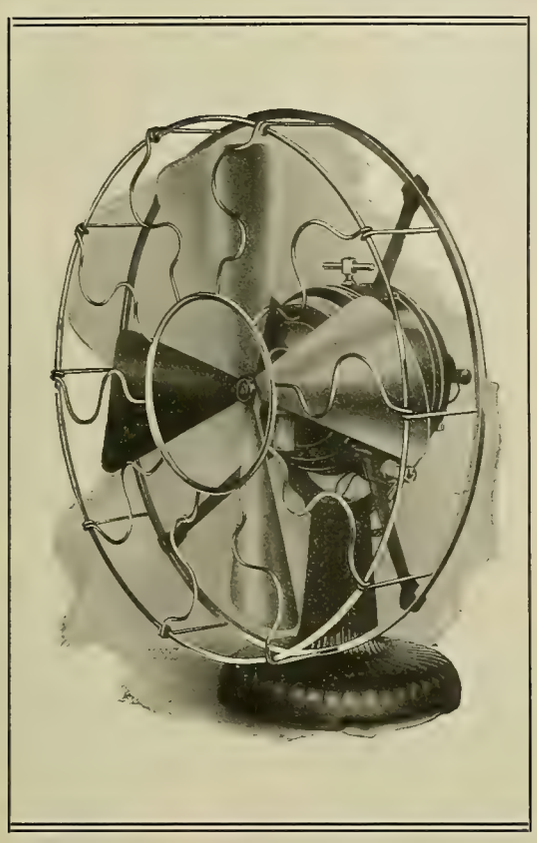
The National Electric Light Convention to be held in Chicago, May 26-28, 1903, promises to be the largest and best-attended meeting ever held.

The Western Electrician of May 23rd and 30th, which will cover this important event, will prove most desirable to advertisers. A large, attractive announcement will enable you to place the merits of your product before almost every buyer.

As this will be a Western convention, the Western Electrician, of course, can best serve your interests.

Send in your order and copy now.

Western Electrician,
510 Marquette Building,
Chicago.



Peerless Direct Current Desk and Ceiling Fans

Made in all sizes and styles and for any voltage. Our "1903" models embody all the best and latest improvements known to good fan motor practice. We issue bulletins fully describing them. :: :: ::

Western Electrical Supply Company, :: St. Louis, U. S. A.

Get Our New General Supply Catalogue No. 50 Just Published.

A. CONVENTION,
Boston, July 6 to 10.

NICKEL PLATE.
The New York, Chicago & St. Louis R.R.
IS THE SHORT LINE
$19.00—for the round trip—$19.00
With membership fee of $2.00 added.

THROUGH SLEEPING CARS
STOPOVER AT NIAGARA FALLS

By depositing return portion of ticket with Joint Agent, return limit of September 1st, 1903, may be obtained.

American Club Meals in dining car, ranging from 35c. to $1.00. Mid-day Luncheon 50c. Also service a la carte.

For detailed information, address
JOHN Y. CALAHAN, General Agent,
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REFLECTORS!

Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

American Reflector & Lighting Co.,
271-273 FRANKLIN ST., CHICAGO.

Only ⅓ of a Day
Between
CHICAGO
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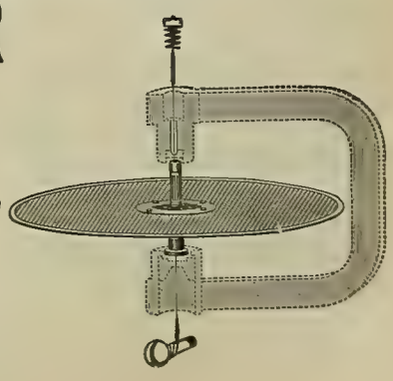
via the
MONON ROUTE
Chicago Indianapolis & Louisville Railway
and C. H. & D. Ry.
Choice of 4 SUPERB TRAINS DAILY
DAY TRAINS equipped with Parlor and Dining Cars
NIGHT TRAIN, with Palace Sleeping and Compartment Cars.
CHAS. H. ROCKWELL, Traffic Manager. FRANK J. REED, Gen. Pass. Agt.
200 Custom House Place, CHICAGO.

You should be largely represented in the May 23rd and May 30th issues of The Western Electrician – the numbers to be devoted to the coming National Electric Light convention to be held in Chicago.

FLOTATION IN AIR

OF THE MOVING PARTS OF
STANLEY RECORDING WATTMETERS
FOR ALTERNATING CURRENT
IS ACCOMPLISHED BY
MAGNETIC SUSPENSION.

NO WEAR. NO LOST REVENUE.
NO FRICTION. ALL CURRENT USED RECORDED.
SEND FOR DESCRIPTION AND BOOK FULL OF GOOD INFORMATION
"ABOUT METERS."



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GREAT BARRINGTON, MASS., U. S. A.

PACIFIC COAST AGENTS:
JOHN MARTIN & CO., San Francisco, Cal. Los Angeles, Cal. Seattle, Wash.

YOU WIN BY SURRENDERING

We are fighting for meter business. You do not use Gutmann alternating current wattmeters? Then our campaign is directed against you.
If you are not on our trade list send in your name and you will get some hot shot in the way of facts, figures and guarantees.

ELECTRIC APPLIANCE COMPANY,
ELECTRICAL SUPPLIES
92 and 94 W. Van Buren St., . . . CHICAGO.

EDISON MINIATURE LAMPS

Dry Battery Lamps

For use in portable lighting devices—electric candle sticks, pocket lanterns, carriage and bicycle lamps, clock lights for bed rooms, ruby lanterns for photography and for optical, dental and surgical instruments.

All types supplied—
Accurately rated—
Carefully selected.

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We import directly from India and handle the output of the best mines. A large stock constantly on hand enables us to make prompt shipments. ALL OTHER QUALITIES. Prices low.

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NEW YORK AND CHICAGO.

VOLT - AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET,
78-80 Cortlandt St., NEW YORK, N. Y.

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LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

USE
"SAFETY" RUBBER COVERED
WIRE AND CABLE
FOR EVERY ELECTRICAL SERVICE.
M. B. AUSTIN & CO.,
CHICAGO REPRESENTATIVE.
THE SAFETY INSULATED WIRE & CABLE CO.,
WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

Just specify "P-K"

250 Volt
Attachment Plug.

The "P-K"
is the Attachment Plug that can neither be broken nor short-circuited. It is the handy and handsome one.

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Chicago. New York. Philadelphia.
Ask for our New Catalog No. 10.

THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

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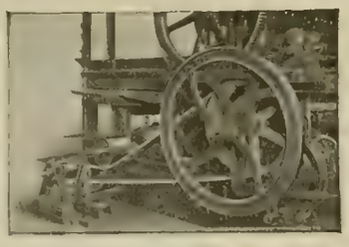

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MOTORS
have enabled many printers to increase their business. They can increase your profits also. Write for booklet No. 03211.

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WE MAKE A SPECIALTY OF
MINIATURE SIGN LAMPS
From Two to Eight Candle Power
for Multiple or series burning.
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Electric Heating Apparatus

SEND FOR 64-PAGE CATALOGUE.

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SIMPLEX ELECTRIC HEATING CO.,
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Six Years with General Electric Company.

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GET **ALLEN** SOLDERING STICKS (A FLUX)

AND
GET A QUICK JOINT.

LARGE SAMPLES FREE.

MADE BY
L. B. ALLEN CO., Inc., 1334 Columbia Ave., Chicago.

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Sales Agencies:
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KUHLMAN ELECTRIC CO.
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SENT UPON REQUEST.

It will pay you to place an attractive announcement in the Western Electrician's National Electric Light Convention Numbers—issues of May 23rd and 30th

NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

An Attractive Booklet on Guying

And STOMBAUGH GUYING

IN PARTICULAR

Is Now Ready for the Mail

IT CONTAINS MUCH INTERESTING DATA ON THE GUYING OF POLES, ETC. *WRITE FOR A COPY.*

W. N. MATTHEWS & BRO., 603 Carleton Bldg.
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EMPIRE WIRE COMPANY,
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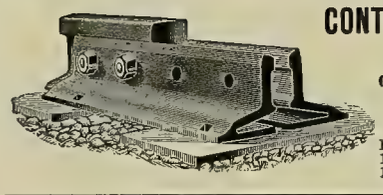

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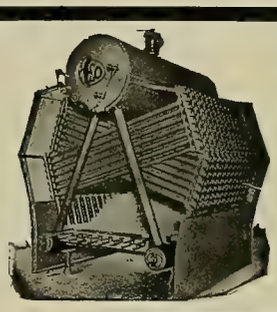
GENL. OFFICES: CENTURY BLDG, NEWARK, N. J.

OVER FIFTEEN THOUSAND (15,000) MILES IN USE.

Highest Award in its Class at Paris Exposition, 1900, and Pan-American Exposition, Buffalo, 1901.



THE WORTHINGTON
WATER-TUBE SECTIONAL
STEAM BOILER.

Built in Units From
20 TO 360 H. P.

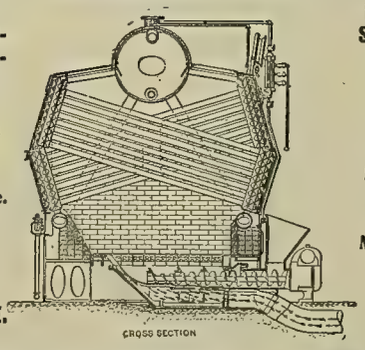
Our End-Fired Type 20 to 125.
Our Side-Fired Type 100 to 360.
Side-Fired Type set singly or in battery.

THE WORTHINGTON WATER-TUBE BOILER WITH THE AMERICAN STOKER ATTACHED.

A PERFECT CIRCULATION INSURES THE HIGHEST ECONOMY.

The Complete Area of Steam Drum is Utilized for Disengaging Surface. RESULT: DRY STEAM.

LARGE POWER IN SMALL SPACE.



IRON CASING---A SYSTEM of DOORS ---ALL PARTS ACCESSIBLE.

Casing Lined with Non-Conductor. Minimum Radiation. Short and Straight Tubes. Minimum Expansion.

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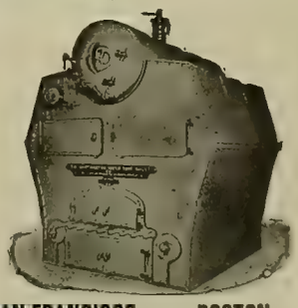
Can be placed in buildings inaccessible to other types, and, being Sectional, without demolishing your building.

A 200 H. P. Boiler can be delivered through an ordinary window or sidewalk opening.

SEND US YOUR SPECIFICATIONS.



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60 S. CANAL ST.,
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WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion: additional words 2c each.*

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

WANTED.

First-class, experienced, mechanical draftsmen wanted at once, some of them acquainted with electrical work; those with shop experience preferred. Apply by letter to CHIEF DRAFTSMAN, P. O. BOX 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

Man as Foreman of Electric Light Plant, who understands both station and outside work, and capable of handling a crew of men. $60 per month and house rent. Also man to take charge of water works, do collecting, inspecting, tapping pipe and look after pumping station. $60 per month. Address, BOX 202, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

WANTED.

Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

ELECTRICAL ENGINEERS AND ELECTRICIANS.

Want Positions. We have investigated their records and references. We recommend only competent men. We furnish technical men of all kinds. 5,000 positions filled in ten years. Let us help you. Write for booklet, "Cogs That Fit." ENGINEERING AGENCY, 15 Monadnock Block, Chicago.

HAPGOODS.

We are constantly in need of high-class draftsmen, mechanical, electrical and civil engineers.

We also fill positions requiring men of technical and executive ability.

Write for our plan, booklet and further particulars.

HAPGOODS, 509 Monadnock Building, Chicago. Eastern Office, 256 Broadway, New York.

FOR SALE.

One 62 K. W., 500 volt, Thomson-Houston compound, self-oiling generator, with extra armature. Now running daily and in good operating condition. $450.00, F. O. B. Madison, Wis. Machine can be inspected and tested under load till May 10th, when it will be displaced. MADISON GAS & ELECTRIC CO., Madison, Wis.

PLACE YOUR

"Want" and "For Sale" advertisements in the

WESTERN ELECTRICIAN,

Immediate Returns.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings), Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
6— 60 K. W. General Electric A. 60.
2— 60 K. W. Westinghouse.

Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

ELECTRICAL BOOKS.

All Kinds.

ELECTRICIAN PUBLISHING COMPANY,

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FOR SALE.

Electric Supply House having a large stock of electric supplies and fan motors. Doing good business. Write for terms. Address BOX 203, care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¾ cut-off and 275 R. P. M. Wheels, 56x12½. Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

BELTING.

All Kinds of old belting purchased. Machinery and old material of all kinds bought.

WALSH'S SONS & CO.,
261 Washington St., Newark, N. J.

PROPOSAL.

The City of Corry will receive bids until 3 P. M., June 1, 1903, for the lighting of the streets of this city with 16-1,200 nominal candlepower enclosed arc lights and 80-65 candlepower series incandescent lights or in place of the 65 candlepower; 300-25 candle power incandescent lights, and the furnishing of 50-16 candlepower incandescent lights in the City Buildings.

Bids must be in strict comformity with the specifications on file in the City Engineer's Office.

Councils reserve the right to reject any or all bids.

NEVIN R. DICKSON,
May 1, 1903. City Engineer.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,

140 S. Clinton St., Chicago.

When in search of a position advertise in the

WESTERN ELECTRICIAN.

"All roads lead to Rome."

And all business in New York seems to tend toward

Grand Central Station.

This great building, which covers the space of four city blocks, beginning at the corner of 4th Avenue and 42d Street, is the Metropolitan terminus of the

NEW YORK CENTRAL LINES

and is the center of the hotel, residence, club and theater district of the second city of the world. To reach it see that your ticket reads by the NEW YORK CENTRAL.

A copy of the 40-page illustrated catalogue of the "Four Track Series," New York Central's books of travel and education, will be sent free, post-paid, to any address on receipt of a postage stamp, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

ENGINES.
2—20x36x36 Buckeye, tandem
1—16½x28x27 Buckeye, cross.
2—13x22½x21 Buckeye, cross
2—11½x7½x16 Buckeye, cross.
1—22x33 Buckeye.
1—20x40 Buckeye.
2—13x21 Buckeye.
1—18x36 Cummer, 4 valve.
1—20x42 Fitchburg Corliss.
1—18x42 Wright Corliss.
1—16x36 Frick Corliss.
2—12x36 Green Corliss.
1—13x20½x15 A. & S.
1—13x19x15 McI. & Seymour.
1—18x20 Porter Allen.
1—18x36 Wright Corliss.
2—15x20 Russell, 4 valve.
2—16x16 Erie Ball.
2—13x12 Armington & Sims.
1—9x9 New York Safety.
3—7½x7 Westinghouse.

BOILERS.
1—375 H. P. National, 150 lbs.
1—267 H. P. Abendroth & Root, 150 lbs.
1—250 H. P., S & W., 150 lbs.
1—250 H. P. Sterling, 150 lbs.
3—300 H. P. Climax, 150 lbs.
2—125 H. P. tubular, 120 lbs.
2—100 H. P. tubular 100 lbs.
2—40 H. P. tubular, 100 lbs.

RY. GENERATORS.
1—250 K. W. Gen'l Electric.
1—200 K. W. Westinghouse.
2—150 K. W. Edison bipolar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole
4—100 K. W. Gen'l Electric.
2—75 K. W. Westinghouse.
2—60 K. W. Edison bipolar.
5—D62 K. W. T. H. bipolar.
1—35 K. W. Ft. Wayne, M. P.
1—50 K. W. Detroit.

ALTERNATORS.
All sizes in 60 & 125 cycles.

MOTORS & DYNAMOS.
All sizes and voltages.

ARC DYNAMOS.
STEAM AND ELECTRICAL MACHINERY.

THOMPSON, SON & CO.
114-118 Liberty Street, NEW YORK CITY.

REPAIRS AND SECOND-HAND MACHINERY.

STREET RAILWAY, LIGHTING AND POWER.

Write for List of Machines.

ILLINOIS ELECTRICAL MFG. CO., PEORIA, ILL.

FOR SALE.

ENGINES.
34x60 950-H. P. International Power Corliss,
28x48 750-H. P. Harris Double Eccentric Corliss
23x60 450 H. P. George H. Corliss.
20x48 300-H P. Harris Corliss.
18x42 250-H. P. Greene Corliss, Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
24x48 500-H. P. Buckeye Automatic.
15 and 23x17 300 H. P. McIntosh & Seymour Tandem Compound Railway Engine.

BOILERS.
1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

HEATERS, ETC.
500-H. P. Excelsior Heater.
300-H. P. Wheeler Heater.
300-H. P. Baragwanath Heater.
200-H. P. Kroeschell Heater.
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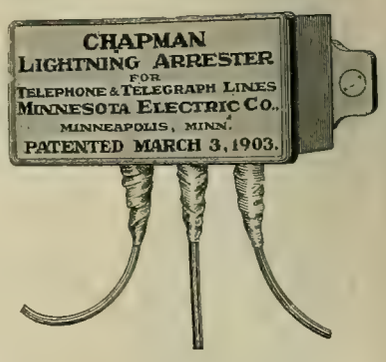

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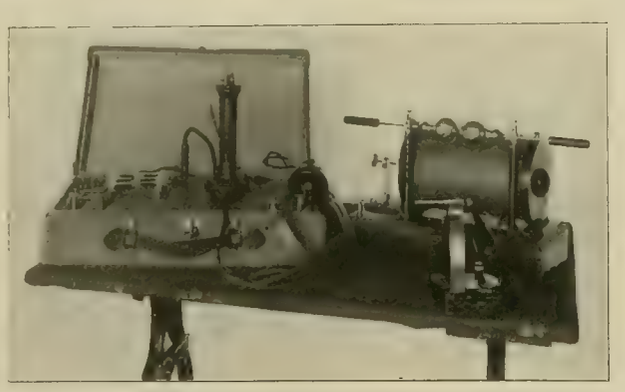

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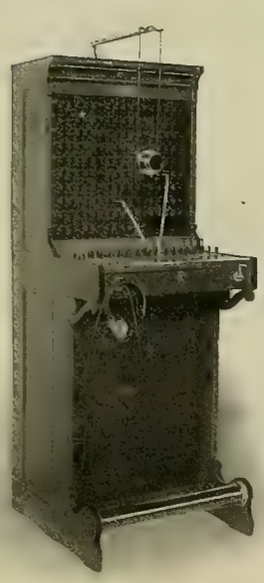

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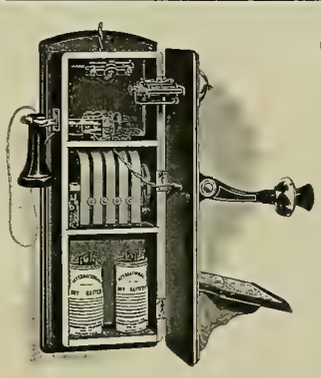

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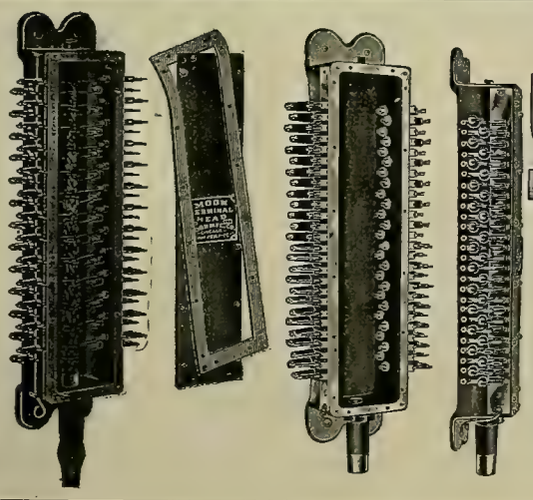

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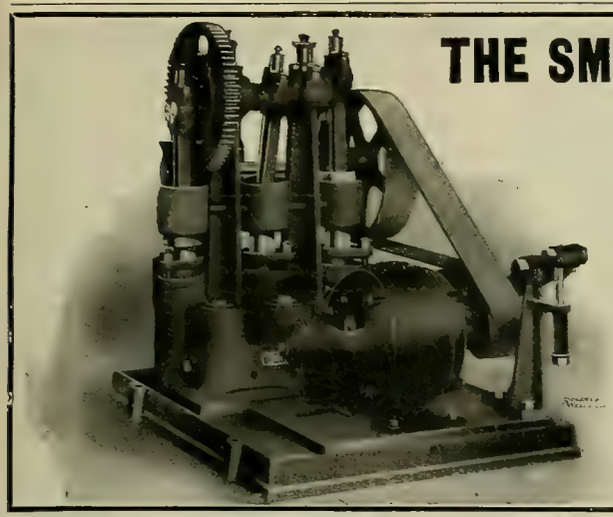

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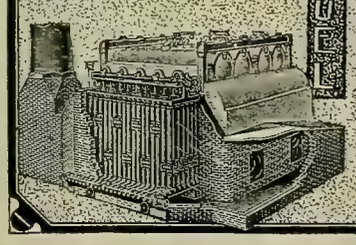

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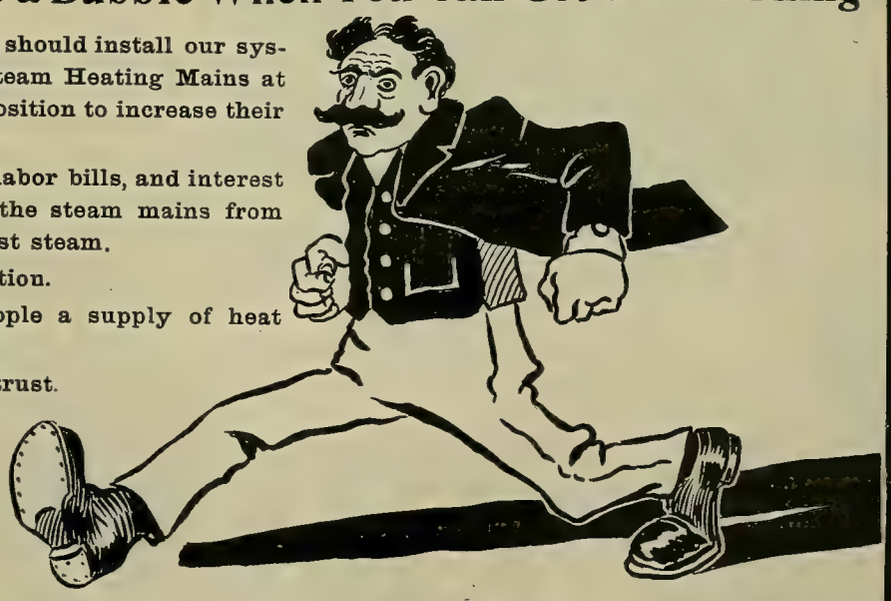

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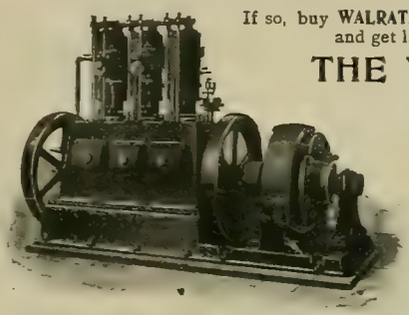

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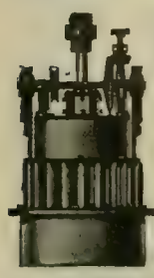

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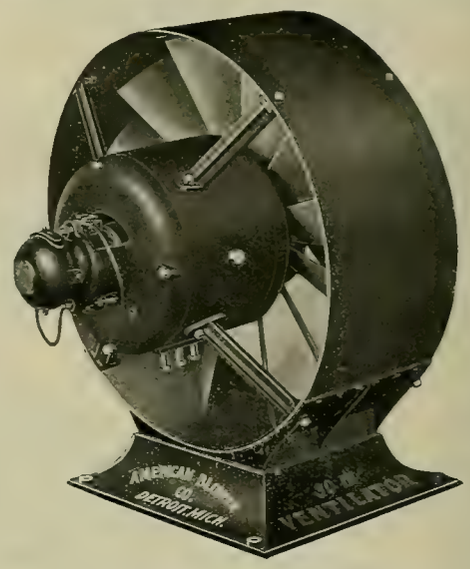

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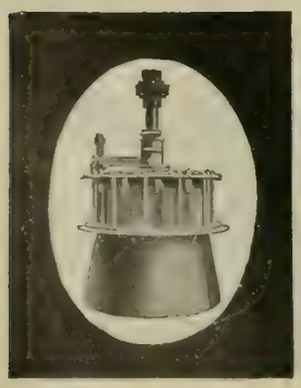

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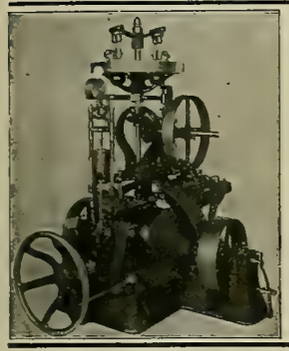

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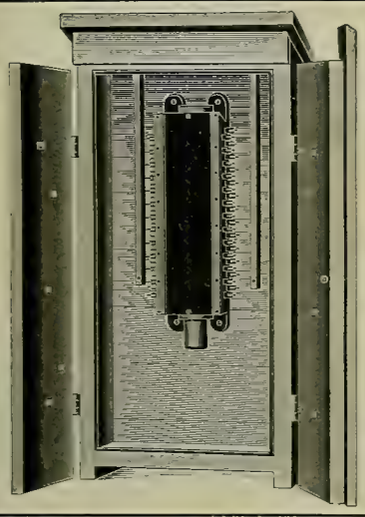

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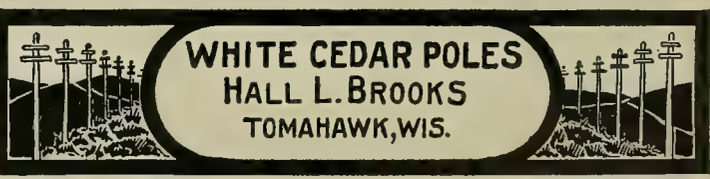

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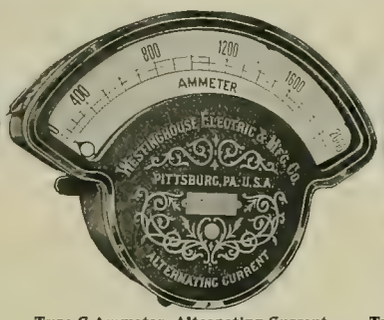

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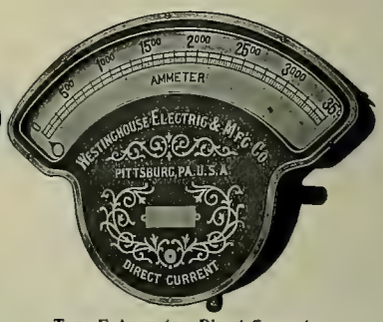

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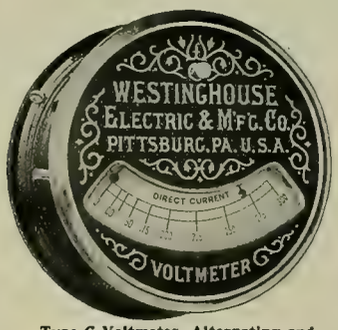

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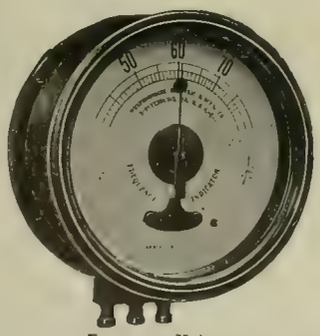

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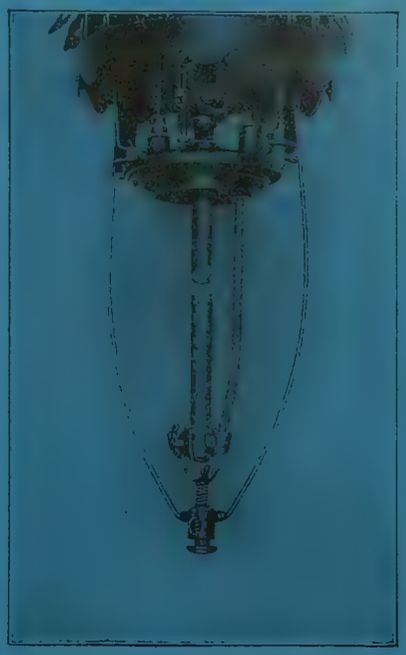

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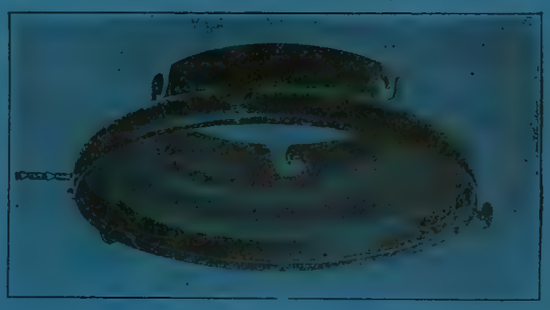

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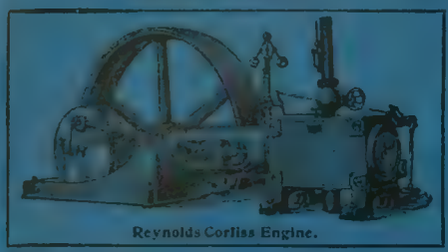
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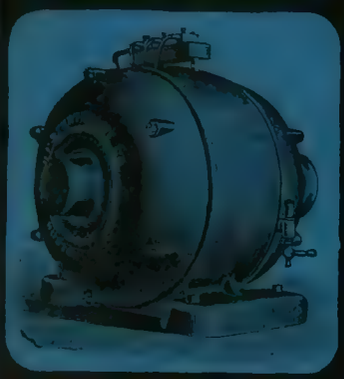

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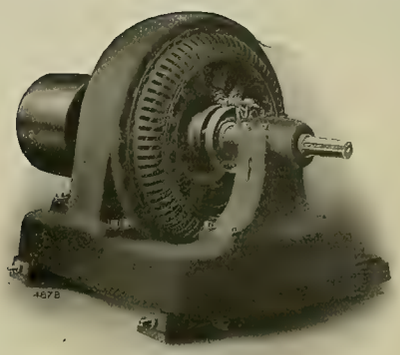

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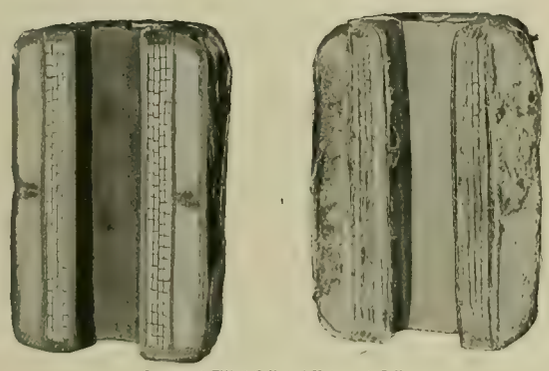

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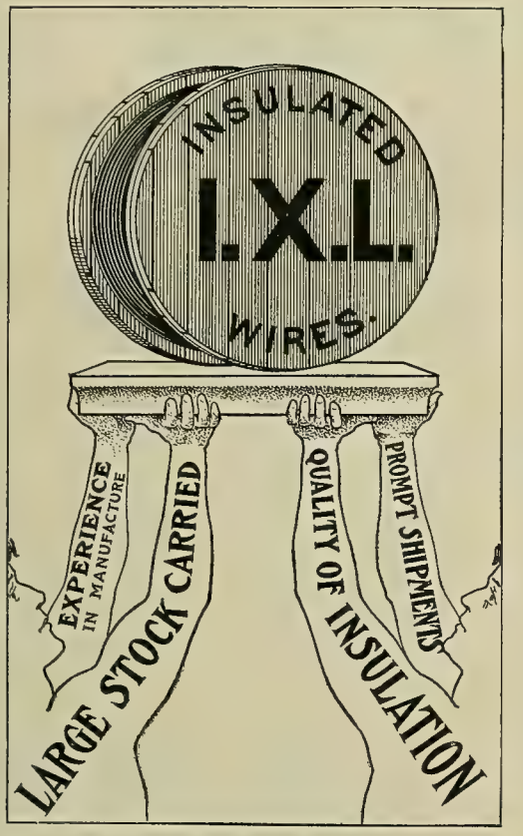

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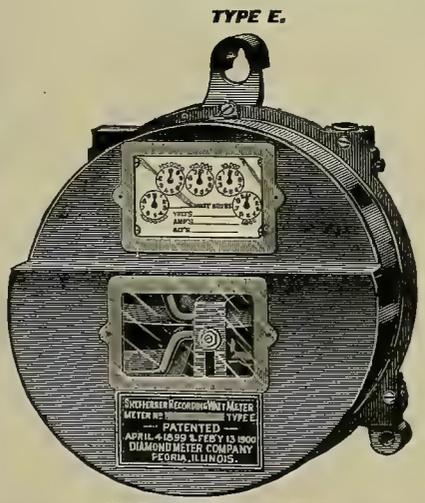

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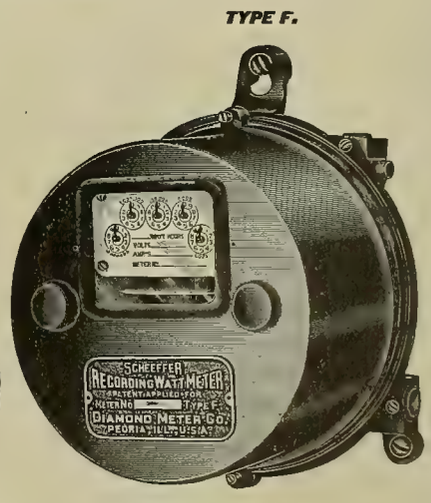

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Alphaduct Mfg. Co.
American Conduit Company.
Camp Company, H. B.
Central Electric Co.
Electric Appliance Co.
Field, C. J.
National Conduit & Cable Co.
Osburn Flexible Conduit Co.
Sprague Electric Co.
Standard Vitrified Cond. Co.
Western Elect. Supply Co.

Conduit Rods.
Barron & Co., Jas. S.

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Sprague Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Standard Pole & Tie Co.
Western Elect. Supply Co.
Western Electric Company.

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Hart Manufacturing Co.
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Western Elect. Supply Co.
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Christensen Engineering Co.
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General Inc. Arc Light Co.
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Hobart Elec. Mfg. Co.
Illinois Maintenance Co.
Mechanical Appliance Co.
Parsell & Weed.
Schureman & Hayden.
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Sprague Electric Co.
Stow Manufacturing Co.
Sturtevant Co., B. F.
Thompson, Son & Co.
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Warren Elec. Mfg. Co.
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Westinghouse El. & Mfg. Co.
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Burch Edward P.
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Stanley Instrument Co.
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Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
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Marinette Iron Wks. Mfg. Co.
Parsell & Weed.

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Dustin Co., Chas. E.
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N. Y. Safety Steam Power Co.
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Sturtevant Co., B. F.
Thompson, Son & Co.
Whitehead Machinery Co.

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Diehl Manufacturing Co.
Edison Mfg. Co.
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Sprague Electric Co.
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Western Elect. Supply Co.
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Buffalo Forge Co.
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Chicago Die & Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
McBride Mfg. Co.
Western Electric Company.
Western Elect. Supply Co.

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Faries Manufacturing Co
Phœnix Glass Co.
Western Electric Co.
Western Elect. Supply Co.

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Holmes Fibre-Graphite Co.

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Amer. District Steam Co.

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American Blower Company.
Buffalo Forge Co.
Sturtevant Co., B. F.

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Incandesent Electric Light Manipulator Co.

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Hartford Steam Boiler Inspection & Insurance Co.

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New England Butt Co.

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American Steel & Wire Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
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Kartavert Mfg. Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Junction Boxes.
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General Inc. Arc Light Co.

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General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Independent Incan. Lamp Co.
Nernst Lamp Co.
Phelps Company.
Rooney-Westbury El. Lmp. Co.
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Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sterling Electrical Mfg. Co.
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Nernst Lamp Co.

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Minnesota Electric Co.
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Leslie & Co., A. C.

Magnet Wires.
(See Wires and Cables.)

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Buffalo Forge Co.
Sturtevant Co., B. F.

Mica.
Mica Insulator Co.
Munsell & Co., Eugene.

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Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

Phosphor Bronze.
Phosphor BronzeSm. Co., Ltd.

Platinum.
Baker & Company.
Gt. Western Smelt. & Ref. Co.

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Berthold & Jennings.
Brooks, Hall L.
Carney Bros. Co.
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Coolidge, Marshall H.
Fowler, John H.
Fowler-Jacobs Company.
Fulmer Lumber Co., D. M.
Hopkins & Co., A. P.
Huebel Company, C. J.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
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Morse Cedar Co.
Mueller Company, William.
O. C. Lumber Company.
Page & Hill Company.
Pendleton & Gilkey.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Reynolds, W. T.
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Standard Tie Company.
Sterling & Son, W. C.
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Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
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Worcester Co., C. H.

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Hoffman, Geo. W.

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Akron Smoking Pipe Co.

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Stilwell-Bierce Smith-Vaile.

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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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Continuous Rail Joint Company of America.

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Westinghouse El. & Mfg. Co.

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Internat'l Corresp. Schools.
Union College.

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Ill. Maintenance Co.
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Schureman & Hayden.
Stewart Electric Co., John A.
Thompson, Son & Co.
Walsh's Sons & Co.
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Maley, Martin.
McNamara Brothers.
Monson Burmah Slate Co.
Young, A. B.

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Paiste Co., H. T.

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Western Electric Co.

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Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

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Weston Electrical Inst Co.

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Electric Storage Battery Co.
Gould Storage Battery Co.

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Commercial Elec. Supply Co.
Electric Appliance Co.
Ewing-Merkle Electric Co.
General Electric Co.
Manhattan Elect'l Supply Co.
Western Electric Co.
Western Elect. Supply Co.

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Automatic Electric Co.
Central Electric Co.
Fahnestock Transmitter Co.
Farr Tel. & Const. Supply Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co.
Swedish-American Tel. Co.
Western Electric Co.
Western Elec. Supply Co.

Tools.
Klein & Sons, Mathias.
Western Electric Co.

Torches and Brazing Apparatus.
Turner Brass Works.

Transformers.
Central Electric Company.
Christensen Engineering Co
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse El. & Mfg. Co

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Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Water Wheel Governors
Replogle Governor Works.

Wireless Tel. Apparatus.
Clark Wirel. Tel & Tel. Co., T. E.

Wires and Cables—Magnet Wires.
American Electrical Works.
Amer. Insul. Wire & Cable Co.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
Empire Wire Co.
General Electric Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
Western Elec. Supply Co.
Western Electric Company.

Woodwork, Electrical.
Noblett Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

THE H. B. CAMP CO.

MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

SALES OFFICES

Room 85 Hartford Building, Chicago. 170 Broadway, New York.

GASOLINE MOTOR CASTINGS
—FOR—
BICYCLES, AUTOMOBILES, AND LAUNCHES.
LOWELL MODEL CO.,
NORTH CHELMSFORD, MASS.

HYLO
TURN-DOWN LAMP
Teaches people to use more current by turning lamps down instead of out.
Write for detailed information.
PHELPS CO., 50 State St., Detroit, U. S. A.

MAINE SLATE FOR ELECTRICAL PURPOSES PLAIN OR ENAMELED.
THE MONSON BURMAH SLATE CO.
PORTLAND, ME.

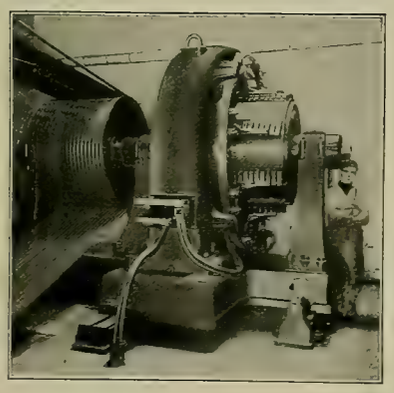
You should be largely represented in the May 23rd and May 30th issues of the Western Electrician – the numbers to be devoted to the coming National Electric Light Convention.

Enclosed Arc Lamps
FOR ALL CIRCUITS.
The Osborn-Morgan Company
CLEVELAND, OHIO.

MARTIN MALEY,
MANUFACTURER OF ALL KINDS OF
VERMONT SLATE
FOR ELECTRICAL USE.
Switchboards A Specialty.
FAIR HAVEN, VERMONT.

McNAMARA BROS.
ELECTRIC SWITCHBOARDS,
SLATE AND MARBLE.
Write for Catalogue B. Fair Haven, Vt.

GENERATORS
—FOR—
Power and Lighting



WESTERN ELECTRIC COMPANY
CHICAGO NEW YORK
SAINT LOUIS DENVER PHILADELPHIA

ELECTROLYSIS-PROOF
UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.
Construction simple, rapid and inexpensive, requires no skilled labor.
Cables drawn more easily and a longer distance than in any other.
Resistance strength when underground as great as any.
Life of Conduit everlasting. Asphalt never deteriorates.

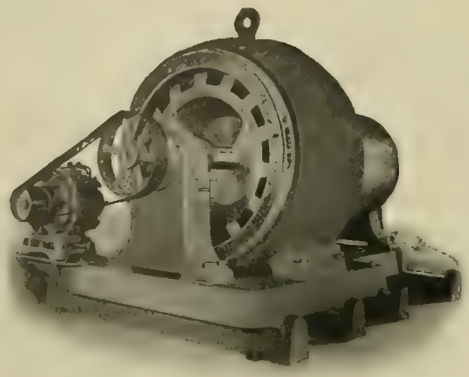
AMERICAN CONDUIT COMPANY,
MANUFACTURERS OF
ELECTROLYSIS PROOF CONDUIT
BITUMINIZED FIBRE. (Patented.)

OFFICES:
720 Arcade Building, Philadelphia, Pa.
822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

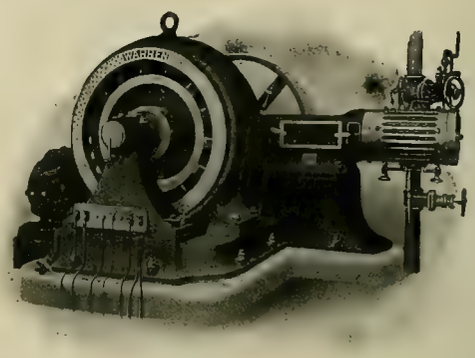
FACTORIES:
Chester, Pa.
Chicago, Ill.
Los Angeles, Cal.

The Warren Alternator.

OUR PRODUCT.

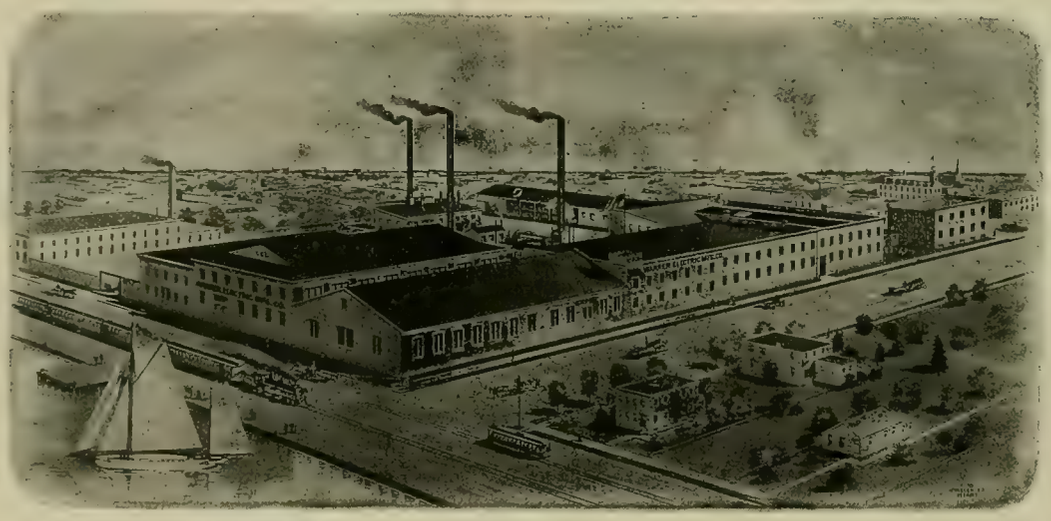


BELTED TYPE.



ENGINE TYPE.

OUR FACTORY.



Recent additions to our shop plant, new tools, electric crane, etc., afford us increased capacity to manufacture sizes up to

1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

BULLETINS ON APPLICATION—THEY TELL YOU ABOUT IT.

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SANDUSKY, OHIO, U. S. A.

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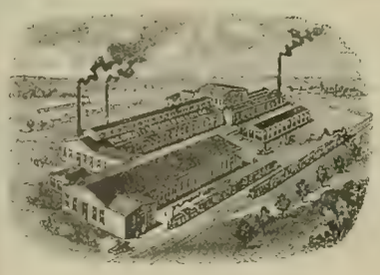
Thos. Muir & Son, Detroit, Mich.
Western Electrical Supply Co., St. Louis, Mo.
C. W. Hobson, Waco, Texas.
Kilbourne & Clark Co., 815-817 Second Ave., Seattle, Wash., Pacific Coast Agts.
A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.



CARBONS

THE DICKEY-SUTTON CARBON COMPANY,
LANCASTER, O.

WE MANUFACTURE ELECTRIC LIGHT CARBONS OF ALL KINDS, DRY BATTERIES AND BATTERY CARBONS, CARBON BRUSHES AND SPECIALTIES, ELECTROLYTIC CARBONS.

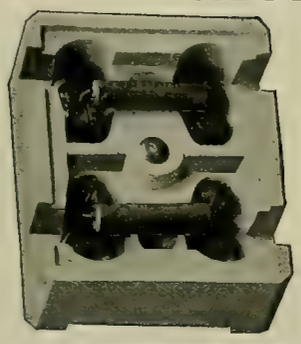
A REVOLUTION IN FUSES!

BETTER THAN THE BEST.

CHEAPER THAN THE CHEAPEST.

THE McBRIDE "ARKLESS"

ABSOLUTELY SAFE, EFFICIENT, NON-ARCING.

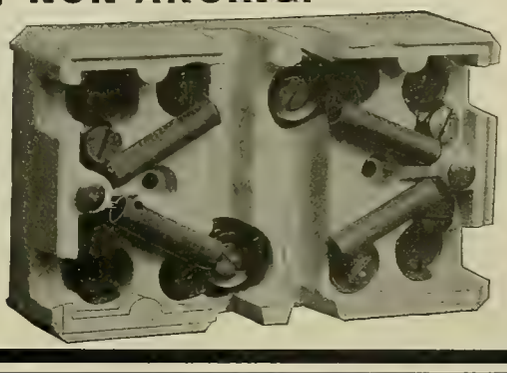


CONFORMS WITH UNDERWRITERS' REQUIREMENTS.

POPULAR AND SUCCESSFUL BECAUSE

It gives the maximum efficiency at minimum cost.
It is especially adapted to the old open-link cut outs—it makes them safe.
It is just the thing for tablet boards and fusible knife switches.
It is creating the greatest sensation in the trade.

MADE FOR 125 AND 250 VOLTS. FROM 6 TO 30 AMPERES.



McBRIDE MFG. CO.,
11 E. Woodbridge St., DETROIT, MICH.

Crimshaw.

Raven White Core.

Raven Black Core.

ALL OUR WIRES pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 33 Second St.

G. I. Co.
PARAGON

MECHANICALLY AND ELECTRICALLY PERFECT.

NO REPAIRS! NO NOISE! NO TROUBLE!

DESK BRACKET TRUNION FANS

MAXIMUM VOLUME OF AIR

MINIMUM COST OF CURRENT

BULLETIN 262.

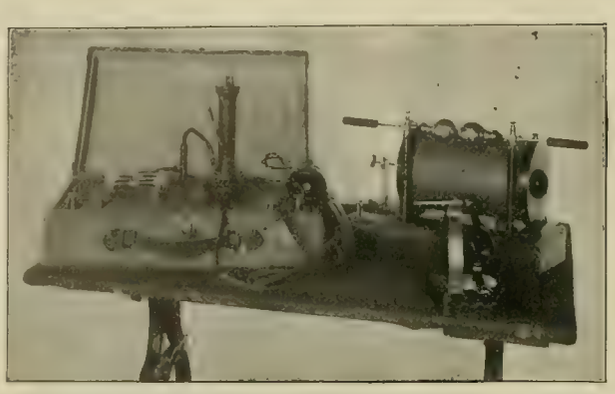
Manufactured by

General Incandescent Arc Light Co.

NEW YORK, U. S. A.

CHICAGO. CLEVELAND. CINCINNATI. ST. LOUIS. DENVER. BOSTON. SAN FRANCISCO. PHILADELPHIA.

WE MANUFACTURE
WIRELESS
TELEGRAPH APPARATUS



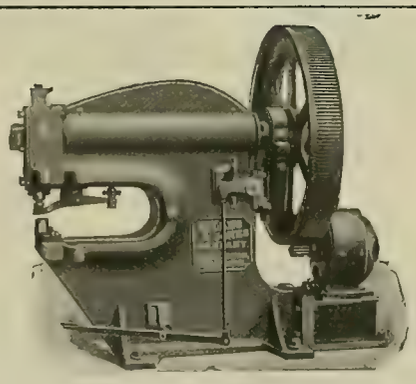
THIS SET COSTS $50.00 F. O. B. FACTORY. Comprises special Clark high-frequency sending coil, giving heavy quantity spark, Clark multiple microphonic responder, with telephonic receiver for the ear, local primary batteries, necessary retardation coils; in fact every thing to make it complete wireless telegraph station, including sender and responder, except of course the aerial overhead wire, and the coil battery, which will have to be furnished by the buyer unless he can connect with local lighting service.

LIQUID INTERRUPTER. Should buyer desire a liquid interrupter instead of usual vibrator which is attached to the Clark coil of this outfit, it will cost additional price, which will be quoted on application. With Clark liquid interrupter a quantity of liquid is included; additional supply can be obtained at reasonable cost. As a caution, it should be understood that a coil. when furnished *without* the liquid interrupter, *should not* be connected direct to the 110 or 500-volt lighting circuit, unless through a suitable resistance coil. The Clark interrupter and sending coil, however, are connected directly to the lighting circuit, say 110 volts, no additional resistance being required, like in the case where a vibrator is used. This is an important and valuable feature.

WE DO NOT BUILD WIRELESS STATIONS any more than a manufacturer of dynamos contracts to build the central stations. WE ONLY SELL YOU THE APPARATUS AT SO MUCH PER SET; but we furnish you with full information, which will enable you to set up this apparatus, and to build your overhead aerial wire, connect with the ground, etc.

Thos. E. Clark Wireless Tel. & Tel. Co.,
OFFICE, FACTORY AND LABORATORY
67-69-71 Michigan Ave., DETROIT, MICH., U. S. A.

CROCKER-WHEELER
COMPANY
AMPERE N.J. U.S.A.



The saving in labor by the

C. W. SYSTEM OF
MOTOR DRIVE

Is worth a manufacturer's closest investigation.

CHARACTERISTICS.

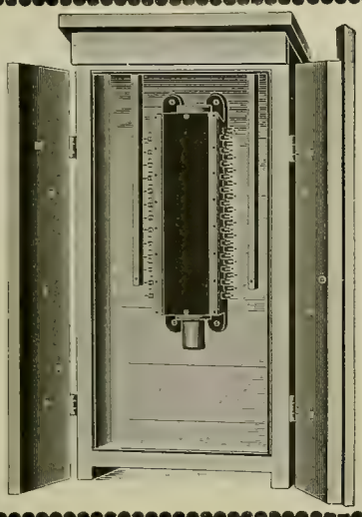
WE don't write Chinese, but we think if the above were translated, it would say something about "EVER-BEST" electrical supplies and apparatus. Anyway, we want to thoroughly impress you with the significance of our trade-mark — "EVER-BEST" not only applies to the goods we handle but to the method of handling them. Our combination of experienced men will soon show you that for anything electrical, from wire to a power plant, "EVER-BEST" should be your grounding point.

"Look it up in the Green Book."

Ewing-Merkle Electric Co.,
ST. LOUIS.

For all special lighting purposes use "Electra" Flame Light Carbons.

Ask for special list on High Grade Battery Carbons.



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OUR CABLE BOXES

are made of 1⅛-inch finished lumber, all joints tongued, grooved and white leaded, doors framed, hinges and locking device bolted and riveted.

Painted two coats of asbestos paint inside, two coats of white lead outside; can be furnished with any make of terminal head.

Lock nut cable terminals, lightning arresters or combination cable terminals and protectors.

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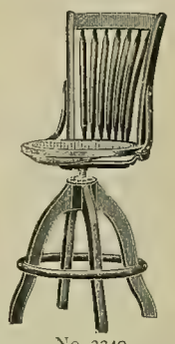
Oak and Birch, cane seat.
Oak and Birch, perforated leather seat.
These chairs finished in golden oak or mahogany.
Can furnish office chairs of all descriptions.

Order our CALPA insulator pins, substitute for locust. We make special insulator pins for high voltage transmission lines.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USED BY THE LARGEST TELEPHONE COMPANIES.

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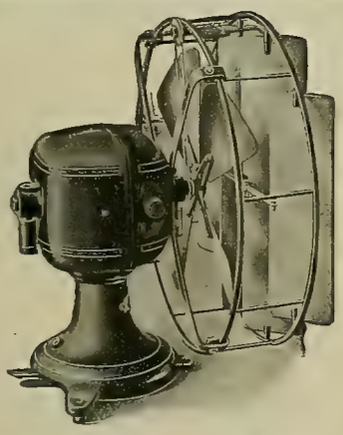
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THE DIEHL FAN CATALOGUE

FOR 1903

will describe the Coleman device for diffusing the air over nearly ½ of the circle. Can be attached to any make of Desk Bracket or Trunion Fan. Operates on any speed or angle. Positive in operation, attractive in appearance, simple in construction. Send for prices and catalogue. . . . . .

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WRITE US AT ONCE.

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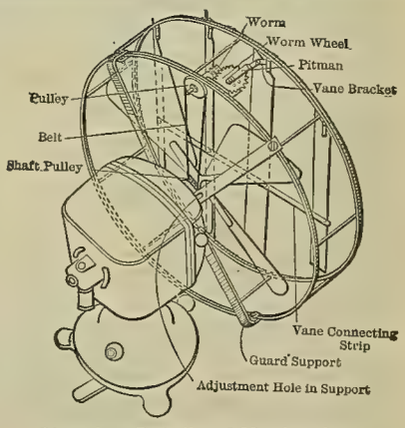

Showing Details of Mechanism. Cannot Get Out of Order.

You should be largely represented in the May 23rd and May 30th issues of The Western Electrician – the numbers to be devoted to the coming National Electric Light convention to be held in Chicago.

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STANLEY RECORDING WATTMETERS.

NO WEAR. **NO REVENUE LOST.**
NO FRICTION. **ALL CURRENT USED RECORDED.**

Send for description and book full of good information
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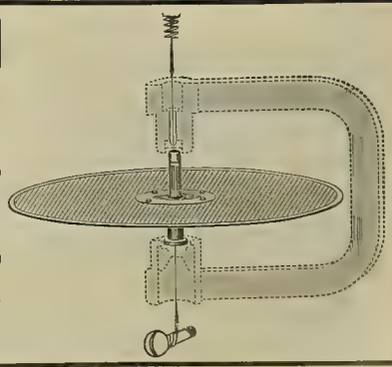

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For inside use—"O. K." two-conductor glazed braid telephone wire. Made with weatherproof compound, insulated and glazed cotton braid, with trace thread in one conductor, then twisted; carried in Chicago stock in Black, Maroon and Nut Brown colors, No. 18 B. & S. gauge copper. Costs less than many rubber wires of greatly inferior quality. Does not rot or deteriorate. :: :: :: :: :: ::

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92 and 94 W. Van Buren Street, :: :: CHICAGO.

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Have been for twenty years
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and are to-day more largely used than all other makes combined.

Serviceable, Economical, Reliable.

Miniature and Candelabra Sockets and Receptacles.

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The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

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It will put that high gloss on the commutator you have so long sought after.

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For Sale by all Supply Houses, or
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LARGE FACTORIES
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the WHITNEY Portable Wattmeters are the standard. They can be used on any frequency, are dead beat and absolutely accurate. Send for Catalogue and Discounts to

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The Simplest, Most Practical and Economical Turn-down Electric Lamp ever Invented.

The ECONOMICAL

Style 1—Pull string for bright or dim. Style 2—For variation in light turn bulb one way or the other. Write for booklet and prices. All voltages and bases.

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The Franklin Dynamo
50 Watts. 10 Volts, 5 Amperes.

3,000 to 4,000 revolutions. Sets of material, finished parts, complete machines. For amateur construction—very efficient. Will drive a dental engine, sewing machine or small lathe; run as a generator, will furnish current for six 6 candle-power lamps. Parts $3.50, $6, $8.50. Complete $12.50. Write for circular 16.

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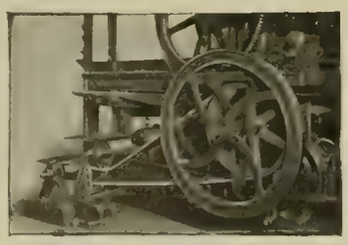

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have enabled many printers to increase their business. They can increase your profits also. Write for booklet No. 03211.

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From Two to Eight Candle Power
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WIRE AND CABLE
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IDEAL FIRE PROTECTION FOR ALL ELECTRICAL APPARATUS.
Highest Awards at National Export, Central Canadian, Pan-American and Charleston Expositions.
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It will pay you to place an attractive announcement in the Western Electrician's National Electric Light Convention Numbers—issues of May 23rd and 30th

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

OUR NEW CATALOG ON
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Send us your address and we will mail one to you. It contains much interesting matter.
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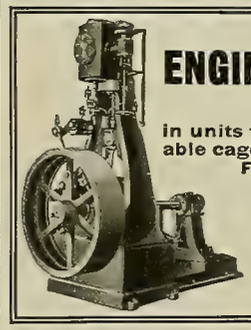

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ENGINE EXCELLENCE AUTOMATIC
Vertical or Horizontal,
in units from 6 to 200 H.P. Piston Valve, with removable cages. Controlled by the NICHOLS GOVERNOR.
For Belted or Direct Connected Service.
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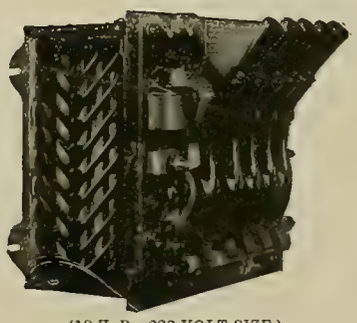
MULTIPLE SWITCH MOTOR STARTERS
WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER
Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.
THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.
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As stationary engineer or electric craneman by one who has had life long experience as traction, stationary or electrical engineer; technically educated. Western location preferred; best of recommendations. WALTER GEHLBACH, Breckenridge, Indiana.

POSITION WANTED.

Wanted by one at present employed, a position as engineer in a mill or electric-light station; understands engines, boilers, water wheels, etc. Want to change locality on account of health in family. Am married, steady, sober and industrious and have the allotted amount of common sense. Address BOX 205, care Western Electrician, 510 Marquette Bldg., Chicago.

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Superintendent and manager for electric-light and power plant. Good wages. Steady employment. Must know how to indicate engines. House wiring and caring for the business; city of seven thousand inhabitants. Want a hustler and first-class references. Address M. Y. RUSK, Prest., Brookfield Electric Light Co., Brookfield, Mo.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

WANTED.

First-class, experienced, mechanical draftsmen wanted at once, some of them acquainted with electrical work; those with shop experience preferred. Apply by letter to CHIEF DRAFTSMAN, P. O. BOX 911, Pittsburg, Pa., stating experience in full and giving references.

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Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

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All Kinds of old belting purchased. Machinery and old material of all kinds bought.
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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

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Electric Traveling Crane, 46½ inch span, 15 to 25 tons; for immediate delivery. Send description, stating make.

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EXCELLENT OPPORTUNITY.

$15,000 will secure a controlling interest in a well established and profitable electrical contracting inspection and repair business, located in New York City. Complete machinery and equipment. Owner retiring from business. Thorough investigation to principals only. Address BOX 204, care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

One 62 K. W., 500 volt, Thomson-Houston compound, self-oiling generator, with extra armature. Now running daily and in good operating condition. $450.00, F. O. B. Madison, Wis. Machine can be inspected and tested under load till May 20th, when it will be displaced. MADISON GAS & ELECTRIC CO., Madison, Wis.

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One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¼ cut-off and 275 R. P. M. Wheels, 56x12½. Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

REPAIRS

Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices.

MIDLAND ELECTRIC CO., Des Moines, Iowa.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 12 o'clock noon, May 19, 1903, and publicly opened immediately thereafter, to furnish at the navy yards, Portsmouth, N. H.; Boston, Mass.; New York; League Island, Pa.; Norfolk, Va., and Pensacola, Fla., a quantity of **electrical material**, blocks, bolts, nuts, rivets, brushes, brooms, cement, stone, canvas, dry goods, silver plated ware, crockery, glassware, filters, glass, hardware, locks, hinges, **tools**, crocus and emery cloth, drawing instruments, thermometers, musical instruments, **lamps and lamp fixtures**, leather and **belting**, lumber, timber, **railroad ties**, drills, taps, dies, brass, copper, zinc, lead, iron, steel, rails, solder, packing, hose, pipe covering, asbestos, alcohol, shellac, lye, polishing paste, pipe, pipe fittings, gauge glasses, valves, thimbles, grommets, cork jackets, stationery, bake ovens, sponges, beeswax, waste, soap, and platform cars. Blank proposals will be furnished upon application to the navy pay offices, New York; Portsmouth, N. H.; Boston, Mass.; Philadelphia, Pa.; Norfolk, Va., and Pensacola, Fla. A. S. KENNY, *Paymaster General, U. S. N.* 4-27-03

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NEW YORK CENTRAL LINES

and is the center of the hotel, residence, club and theater district of the second city of the world. To reach it see that your ticket reads by the NEW YORK CENTRAL.

A copy of the 40-page illustrated catalogue of the "Four Track Series," New York Central's books of travel and education, will be sent free, post-paid, to any address on receipt of a postage stamp, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

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2—20x36x36 Buckeye, tandem.
1—16½x28x27 Buckeye, cross.
2—13x22½x21 Buckeye, cross
2—11½x7½x16 Buckeye, cross.
1—22x33 Buckeye.
1—20x40 Buckeye.
2—13x21 Buckeye.
1—18x36 Cummer, 4 valve.
1—20x42 Fitchburg Corliss.
1—18x42 Wright Corliss.
1—16x36 Frick Corliss.
2—12x36 Green Corliss.
1—13x20½x15 A. & S.
1—13x19x15 McI. & Seymour.
1—18x20 Porter Allen.
1—18x36 Wright Corliss.
2—15x20 Russell, 4 valve.
2—16x16 Erie Ball.
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1—250 K. W. Gen'l Electric
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All sizes in 60 & 125 cycles.

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All sizes and voltages.

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114-118 Liberty Street,
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15 and 23x17 300 H. P. McIntosh & Seymour Tandem Compound Railway Engine.

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1—325-H. P. Heine Watertube Boiler.
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2—250-H. P. Babcock & Wilcox Watertube Boil.
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2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
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6—60x16 Tubular boilers, 100 pounds.
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HEATERS, ETC.
500-H. P. Excelsior Heater.
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WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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POLISHES ALL METALS. BRANCHES NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.

FOR SALE—ENGINES

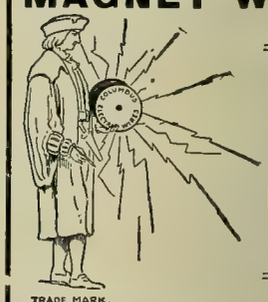
13 and 20½x15 Armington & Sims, cross compound, 250 H. P.
12 and 24x18 Williams tandem compound, 250 H. P.
20x18 Ball, 250 H. P.
12x12 Ideal, 90 H. P.
10x13 Frost automatic.
180 K. W. and 120 K. W. G. E., 60 cycle, A. S. type 1,100 or 2,200 volt alternators.
150 K. W. 60 cycle Ft. Wayne, 2,000 volt alternator.
120 K. W. and 60 K. W. G. E, 133 cycle, 1,100 volt alternators.
Direct current 110 volt generators all sizes.

Write for our complete stock list No. 51.

ILLINOIS MAINTENANCE COMPANY,
1625 Marquette Building, Chicago.

Don't fail to take advantage of the Western Electrician's National Electric Light Convention Numbers—issues of May 23rd and May 30th

MAGNET WIRE



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TRADE MARK.

MANUFACTURED BY
Columbus Insulated Wire and Brass Co.
COLUMBUS, OHIO.

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Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows, Get our Catalogue and Prices.

American Reflector & Lighting Co.,
271-273 FRANKLIN ST., CHICAGO.

CHICAGO EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.

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FIRST-CLASS EQUIPMENT THROUGHOUT.

Machine and Carpenter Work of All Kinds Correspondence Solicited.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

Just specify **"P=K"**

for an absolutely safe

All about these and our other 299 "Time Savers" in our new catalog No. 10.

H. T. PAISTE CO.,
Chicago. Philadelphia. New York.

SENT UPON REQUEST.

SENT UPON REQUEST.

EDWARDS and Co.

The R. E.-A. L. Monitor Bell.
(Patented.)

Hammer rod supported in two places and thrown straight out and in by the armature, striking gong on inside, near edge, thus giving a full, clear tone.

All springs made of Phosphor Bronze and so formed that there is least possible strain.

Contacts are platinized, adjustment is made by pressure on the standard which supports one contact. No screws or nuts being used in the adjustment, bell does not get out of order by operation.

Ordinarily the weak point is the pivot, the unreliable one the adjusting screw and nut. As these defects have been eliminated, this bell will stand hard usage and operate under adverse conditions.

The hammer entirely concealed by gong and cannot be tampered with.

It is especially adapted for use on street cars, as, in addition to the advantages mentioned, it is dust, insect and moisture proof.

NEW YORK N.Y.

DIRECT CONNECTED UNITS.

One 200 K. W. Westinghouse, 8-pole, 500-550-volt generator, with 18-30x16 Westinghouse compound engine.
One 187½ K. W. Westinghouse, 8-pole, 125-volt generator, with 18-30x16 Westinghouse compound engine.
One 130 K. W. General Electric, 8-pole, 125-volt generator, with 12-20x16 Erie Ball tandem compound engine.
One 60 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Buffalo Forge engine. Brand new.
One 50 K. W. Commercial, 6-pole, 125-volt generator, with 8½-13x12 Armington & Sims tandem compound engine.
One 50 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Harrisburg Ideal engine.
One 50 K. W. unit, consisting of two 25 K. W. General Electric, 4-pole, 125-volt generators, with one triple expansion vertical engine.
One 25 K. W. General Electric, 6-pole, 125-volt generator, with 9½x10 Armington & Sims engine.
Two 25 K. W. Westinghouse, 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

ENGINES.

One 26x48 Providence Greene, 500 H. P.
One 26x48 Harris Corliss, 500 H. P.
One 18-34x48 Cooper Corliss, cross compound, 500 H. P.
One 23x48 Harris Corliss, 400 H. P.
One 20x36 Hewes & Phillips, 200 H. P.
One 18x48 George H. Corliss, 250 H. P.
One 16x42 Providence Greene, 200 H. P.
One 20x40 Buckeye, 250 H. P.
Two 13-23x17 McIntosh, Seymour & Co. tandem, 250 H. P. each.
Two 18-30x16 Westinghouse compound, 250 H. P. each.
Three 18½x18 Armington & Sims, 250 H. P. each.
One 18½x18 New York Safety, 250 H. P.
Two 10-18x20 Payne tandem compound, 150 H. P. each.
One 13-19x15 McIntosh, Seymour & Co. tandem, 175 H. P.
One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
One 9x9 Taylor-Beck, 50 H. P.
One 7x8 Payne, 20 H. P.
Three 6x5 Westinghouse Junior, 12 H. P. each.
Two 5x4 Westinghouse Junior, 6 H. P. each.

RAILWAY GENERATORS 500-550 VOLTS.

Two 500 K. W. General Electric, 6-pole, speed, 300 R. P. M.
Two 300 K. W. General Electric, 4-pole, speed, 400 R. P. M.
Two 225 K. W. General Electric, 6-pole, speed, 465 R. P. M.
One 200 K. W. Westinghouse, 6-pole, speed, 510 R. P. M.
Two 200 K. W. General Electric, 4-pole, speed, 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed, 535 R. P. M.
One 110 K. W. Eddy, 4-pole, speed, 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed, 650 R. P. M.
One 100 K. W. Walker, 4-pole, speed, 750 R. P. M.
Two 100 K. W. Edison, bipolar, speed, 620 R. P. M.
One 90 K. W. Thomson-Houston, 4-pole, speed, 700 R. P. M.
One 80 K. W. General Electric, 4-pole, speed, 700 R. P. M.
Two 80 K. W. Detroit, bipolar, speed, 620 R. P. M.
Five 62 K. W. Thomson-Houston, type D, speed, 900 R. P. M.
One 50 K. W. Brush, type Q, speed, 1,050 R. P. M.

ALTERNATORS.

Two 250 K. W. General Electric, 2,400 volts, 50 cycles, three-phase, speed, 600 R. P. M.
One 200 K. W. General Electric, 2,300 volts, 40 cycles, three-phase, speed, 480 R. P. M.
One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase, speed, 600 R. P. M.
One 180 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase, speed, 514 R. P. M.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase, speed, 625 R. P. M.
One 150 K. W. Stanley, 1,100-2,200 volts, 133 cycles, two-phase, speed, 800 R. P. M.
Two 120 K. W. General Electric, 1,040 volts, 125 cycles, single-phase, speed, 1,070 R. P. M.
One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase, speed, 1,070 R. P. M.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase, speed, 900 R. P. M.
One 75 K. W. Stanley, 1,200-2,400 volts, 133 cycles, two-phase, speed, 1,000 R. P. M.
Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase, speed, 1,500 R. P. M.

ALTERNATING MOTORS.

Two 200 H. P. Stanley synchronous motors, 133 cycles, two-phase, 2,400 volts, speed, 1,000 R. P. M.
One 200 H. P. Westinghouse, type C, 25 cycles, two-phase, 400 volts, speed, 480 R. P. M.
One 130 H. P. Westinghouse, type C, 60 cycles, two-phase, 200 volts, speed, 850 R. P. M.
Two 30 H. P. Westinghouse, type C, 60 cycles, two-phase, 400 volts, speed, 850 R. P. M.
Two 20 H. P. Westinghouse, type C, 60 cycles, two-phase, 200 volts, speed, 840 R. P. M.
One 2 H. P. Wagner, 60 cycles, single-phase, 104 volts, speed, 1,800 R. P. M.
One ½ H. P. General Electric, 60 cycles, single-phase, 110 volts, speed, 1,800 R. P. M.

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One No. 12 Brush, 9.6 amperes, 125 lamps.
Two No. 12 Brush, 6.6 amperes, 170 lamps.
Two No. 11 Brush, 9.6 amperes, 120 lamps.
Four No. 9 Brush, 9.6 amperes, 80 lamps.
Two No. 9½ Brush, 6.6 amperes, 120 lamps.
One No. 9B Brush, 6.6 amperes, 120 lamps.
Five M. D. 12, Thomson-Houston, 6.8 amperes, 75 lamps.
Two M. D. 2, Thomson-Houston, 9.6 amperes, 50 lamps.
Six L. D. 12, Thomson-Houston, 6.8 amperes, 50 lamps.
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Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
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Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

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One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

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One 20x42 Wheelock.
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Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
One 14x17 Fisher, new.

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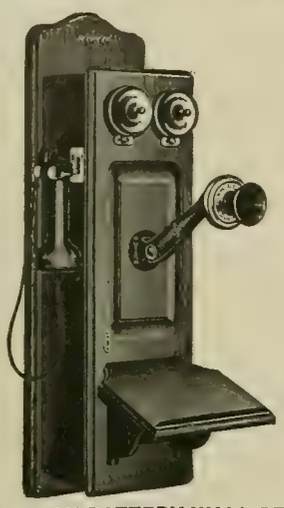

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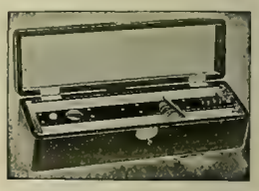

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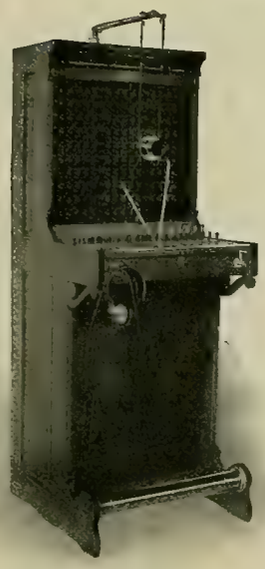

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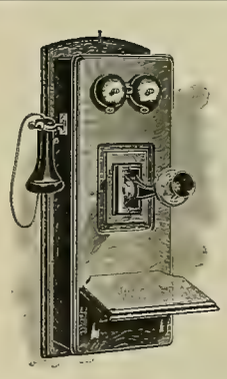

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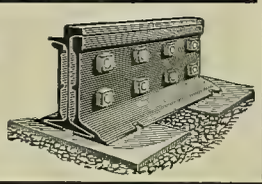

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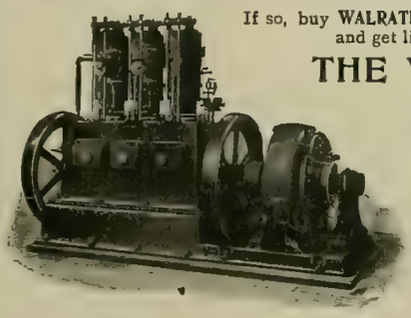

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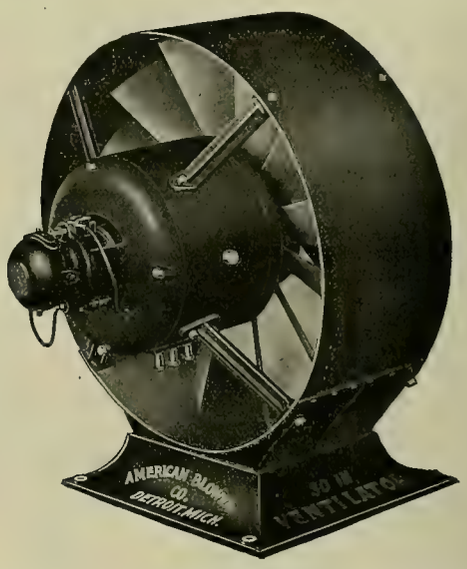

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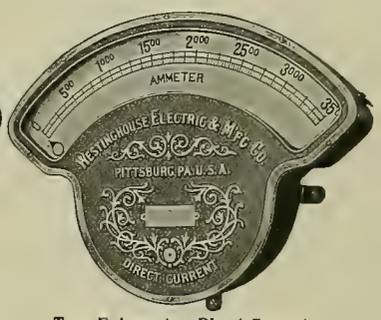

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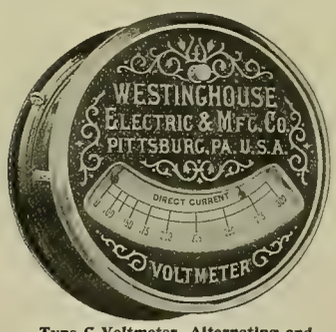

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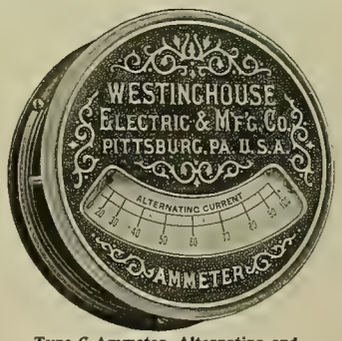

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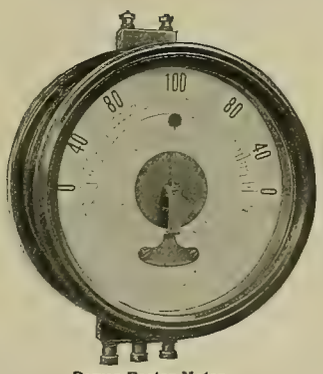

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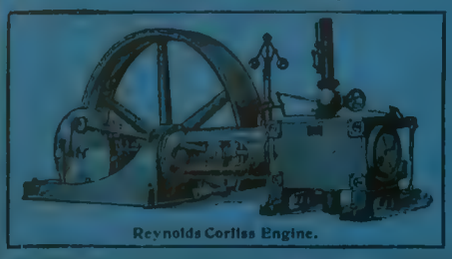
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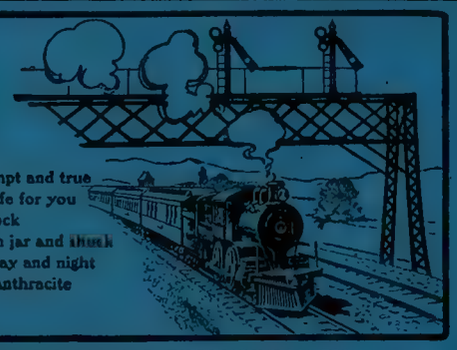

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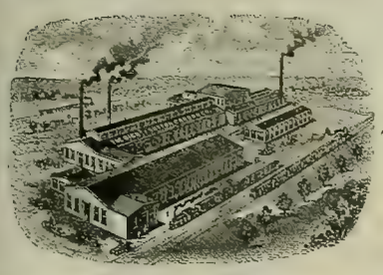

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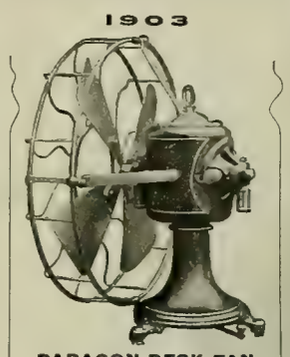

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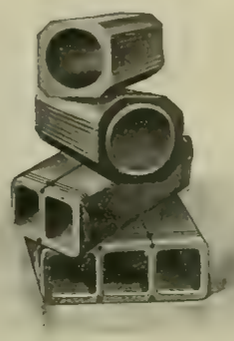
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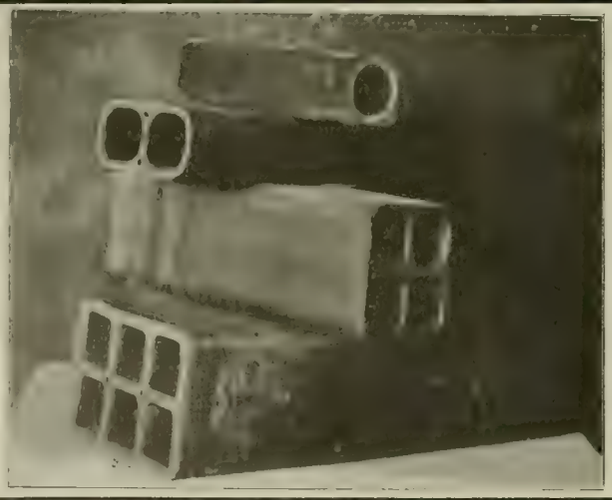

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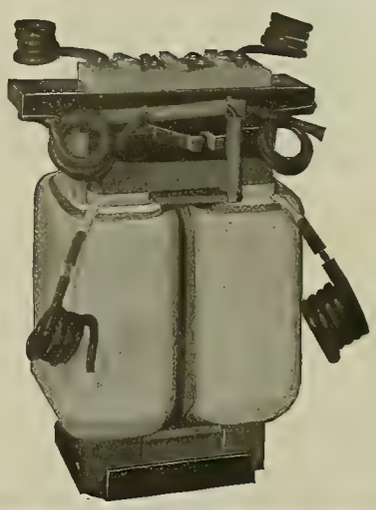

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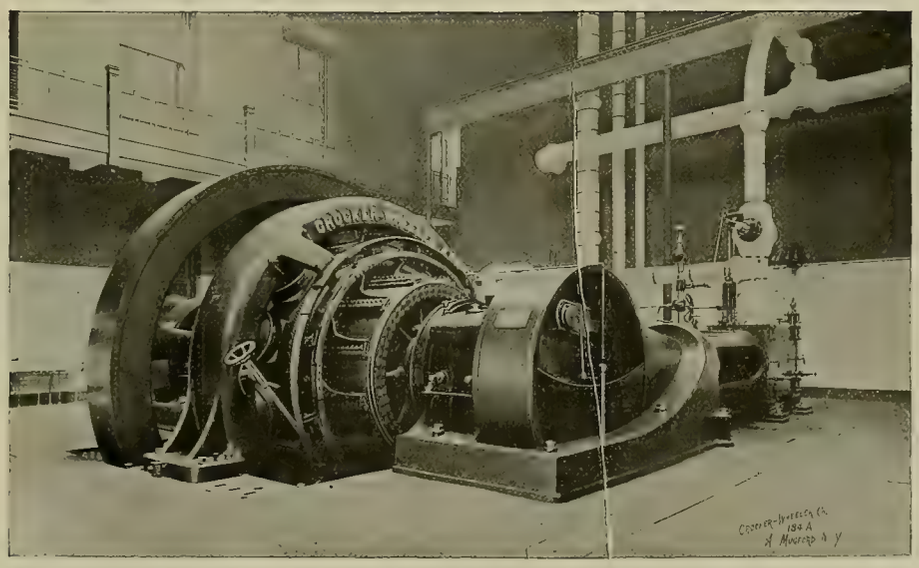

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Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Jandus Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Banner Eletric Co.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Independent Incan.Lamp Co.
Nernst Lamp Co.
Phelps Company.
Rooney-Westbury El. Lmp.Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sterling Electrical Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Lamps, Nernst.
Commercial Elec. Supply Co.
Nernst Lamp Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Minnesota Electric Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Steel.
Leslie & Co., A. C.

Magnet Wires.
(See Wires and Cables.)

Mechanical Draft.
American Blower Company.
Buffalo Forge Co.
Sturtevant Co., B. F.

Mica.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

Phosphor Bronze.
Phosphor BronzeSm.Co.,Ltd.

Platinum.
American Platinum Wks.
Baker & Company.

Poles and Ties.
Beidler & Co., Francis.
Berthold & Jennings.
Brooks, Hall L.
Carney Bros. Co.
Chicago Lumber & Coal Co.
Coolidge, Marshall H.
Fowler, John H.
Fowler-Jacobs Company.
Fulmer Lumber Co., D. M.
Hopkins & Co., A. P.
Huebel Company, C. J.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Lumber Co.
Morse Cedar Co.
Mueller Company. William.
O. C. Lumber Company.
Page & Hill Company.
Pendleton & Gilkey.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Reynolds, W. T.
Standard Pole & Tie Co.
Standard Tie Company.
Sterling & Son, W. C.
Superior Cedar & Lumber Co.
Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
Whitmore, A. E.
Worcester Co., C. H

Polish (Metal).
Hoffman, Geo. W.

Porcelain.
Akron Smoking Pipe Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Pulleys.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.

Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Midland Elec. Co.
Schureman & Hayden.
Stewart Elec. Co., John A.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Schools and Colleges.
Electrical Engineer Inst.
Internat'l Corresp. Schools.
Rose Polytechnic Institute.
Union College.

Second-Hand Mach'y.
Dustin Co., Chas. E.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
Matthews & Bro., W. N.
Schureman & Hayden.
Stewart Electric Co., John A.
Thompson, Son & Co.
Walsh's Sons & Co.
Whitehead Machinery Co.

Slate.
Maley, Martin.
McNamara Brothers.
Monson Burmah Slate Co.
Young, A B.

Sockets & Receptacles.
Benjamin Elec. Mfg. Co.
Paiste Co., H. T.

Soldering Sticks, Salts and Paste.
Allen Co., L. B.
Crescent Co.
Western Electric Co.

Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.

Stokers.
Duluth Stoker Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

Supplies, General Elec.
Central Electric Co.
Chicago Edison Co.
Commercial Elec. Supply Co.
Electric Appliance Co.
Ewing-Merkle Electric Co.
General Electric Co.
Manhattan Elect'l Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Automatic Electric Co.
Central Electric Co.
Fahnestock Transmitter Co.
Farr Tel. & Const. Supply Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
Sterling Electric Co.
Stromberg-Carlson Tel.M. Co.
Swedish-American Tel. Co.
Western Electric Co.
Western Elec. Supply Co.

Tools.
Klein & Sons, Mathias.
Western Electric Co.

Torches and Brazing Apparatus.
Turner Brass Works.

Transformers.
Central Electric Company.
Christensen Engineering Co
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
National Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbines. Water Wheels
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Watches.
Becken. A. C.

Water Wheel Governors
Replogle Governor Works.

Wireless Tel. Apparatus.
Clark Wirel. Tel& Tel. Co., T. E.

Wires and Cables—Magnet Wires.
American Electrical Works.
Amer. Insul. Wire & Cable Co.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
Empire Wire Co.
General Electric Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
Western Elec. Supply Co.
Western Electric Company.

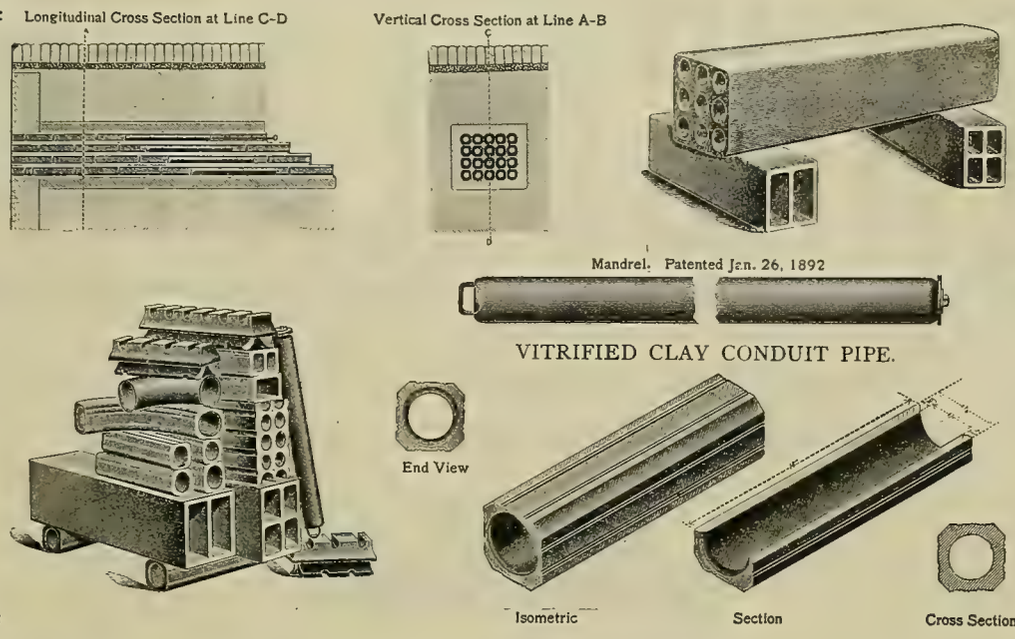
Woodwork, Electrical.
Noblett Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

The H. B. CAMP CO.

Manufacturers of

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

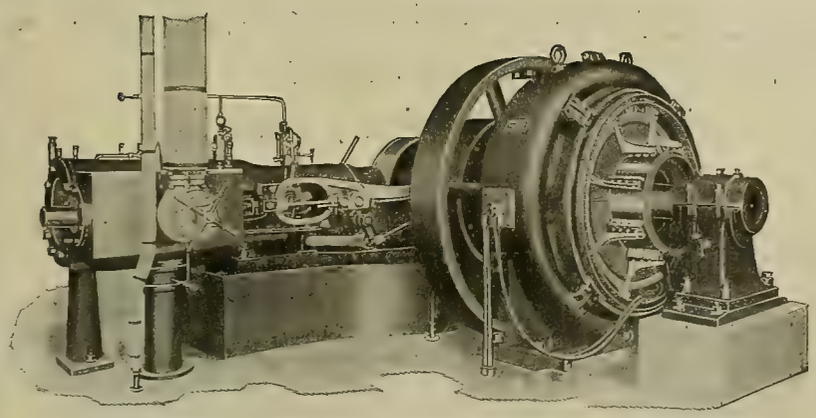


Installers of Complete Underground Conduit Systems.

Sales Offices

Room 85 Hartford Building, Chicago. 170 Broadway, New York

Triumph Generators and Motors Are the Standard of Excellence.



200 K. W. Triumph Generator, Direct-Connected to Buckeye Engine.

Our machines are constructed to give their maximum output without undue strain on any part. The design is simple, and embodies all the latest improvements. All parts are readily accessible and easily adjusted.

We employ the highest engineering talent, and use only the best workmanship and materials, which is a substantial guarantee that our machines are both efficient and durable.

It will pay you to investigate. Ask for Bulletin "W E."

TRIUMPH ELECTRIC CO.,

Main Office and Works: CINCINNATI, OHIO, U. S. A.

NEW YORK: 39 Cortlandt Street. Branches in all Large Cities. LONDON: 97 Victoria Street.

SEE THE NERNST LAMPS

in St. Louis at the next Convention in 1904

(We are not in possession of advance information, but acting the role of prophet.)

The Nernst Lamp

GIVES MORE LIGHT FOR LESS MONEY

Is cheapest to burn, and therefore cheapest to buy, and will pay for itself in a short time

A FEW ADVANTAGES OVER OTHER KINDS

1—Requires only about one-half as much current as the incandescent.

2—Gives a natural white light, like the sun's rays, bringing out the true color of fabrics, etc.

3—75 per cent. of the light is thrown downward without any shadows.

4—Does not flicker, hum nor make any noise, being an absolutely steady light.

5—The power factor is 100 per cent.

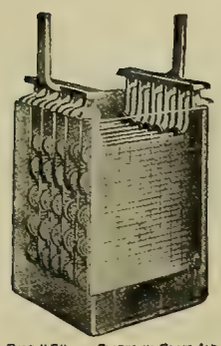
WRITE FOR INFORMATION AND PRICES

Commercial Electrical Supply Co.,

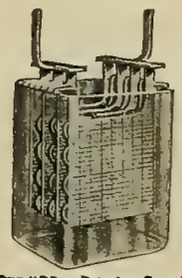
1000 Market Street, ST. LOUIS, MO.

Agents for

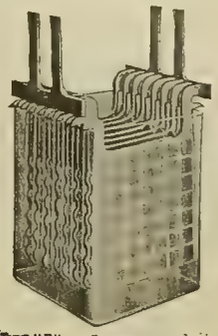
Missouri, Texas, Iowa, Louisiana, Southern Illinois, Mississippi, Nebraska, Tennessee, Kansas, Alabama, Arkansas, Kentucky, and the Territories



TYPE "E"—11 PLATES IN GLASS JAR.



TYPE "D"—7 PLATES IN GLASS JAR.



TYPE "F"—15 PLATES, IN GLASS JAR.

THE "Chloride Accumulator"

INSTALLATIONS MADE AND CONTRACTED FOR.

TYPE "B"
3 PLATES, IN GLASS JAR.

TYPE "C"
3 PLATES, IN GLASS JAR.

FOR

Central Lighting and Power Stations

86 INSTALLATIONS AGGREGATING 116,500 K. W. HOURS.

FOR

Railway Service

272 INSTALLATIONS AGGREGATING 158,100 K. W. HOURS.

TYPE 501—PORTABLE BATTERY

FOR

Isolated Lighting and Power

501 INSTALLATION AGGREGATING 25,200 K. W. HOURS.

Total Capacity of "Chloride Accumulators" in Central Station, Railway and Isolated Plant Service 305,111 K. W. Hours.

TYPE 504—PORTABLE BATTERY.

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA, - PA.

TYPE "G"—19 PLATES, IN LEAD-LINED TANK.

SALES OFFICES:

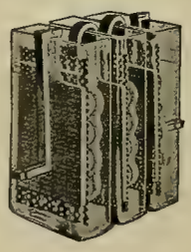
PHILADELPHIA:
Allegheny Ave. and 19th St.

NEW YORK:
100 Broadway.

BOSTON:
60 State St.

BALTIMORE:
Continental Trust Bldg.

ST. LOUIS:
Wainwright Bldg.



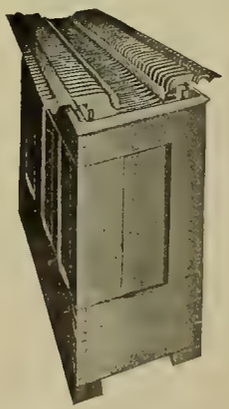
B. T.—COUPLER IN GLASS JARS.

CHICAGO:
Marquette Bldg.

CLEVELAND:
Citizens Bldg.

SAN FRANCISCO:
Nevada Block.

HAVANA, CUBA:
34 Empedrado St.



TYPE "H"—87 PLATES, IN LEAD-LINED TANK.

WELCOME

MEMBERS OF THE
NATIONAL ELECTRIC
LIGHT ASSOCIATION
1903

CHICAGO EDISON COMPANY

STATIONS AND SUB-STATIONS

HARRISON ST.	WASHINGTON ST.
N. CLARK ST.	ADAMS ST.
RANDOLPH ST.	SEDGWICK ST.
W. DIVISION ST.	ILLINOIS ST.
KINZIE ST.	LYDIA ST.
DEARBORN ST.	STATE ST.
TWENTY-FIRST ST.	W. FOURTEENTH ST.

TWENTY-SEVENTH ST.

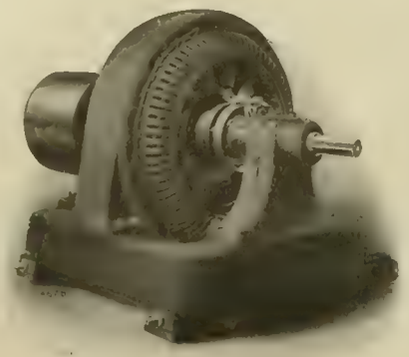
WELCOME

MEMBERS OF THE
NATIONAL ELECTRIC
LIGHT ASSOCIATION
1903

COMMONWEALTH ELECTRIC-COMPANY

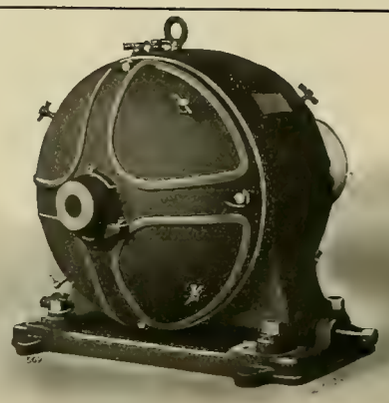
STATIONS AND SUB-STATIONS

FISK ST. FIFTY-SIXTH ST.
LAKE VIEW. HYDE PARK.
W. MADISON ST. EDGEWATER.
SOUTH CHICAGO.



250 K. W. 3-Phase Alternator.

"Ceco"



30 H. P. Motor, Enclosed.

Electrical Machinery

Armature for 200 K. W. Direct-Current Generator. Engine Type.

FOR

Lighting
Power and
Railway Service

Modern Design
Accurate Construction
Unequaled Performance

Direct-Current Motors and Generators built in capacities up to 1,000 K. W.
Alternating Current Generators built in capacities up to 1,500 K. W.

Before installing Electrical Apparatus investigate

"Ceco"

National Electric Co.,

Successor to

Christensen Engineering Co.

Chicago: Old Colony Bldg.
Pittsburg: Gellatly & Co.

Milwaukee

San Francisco, Seattle } Kilbourne & Clark Co.

Milwaukee, Wis., May 16, 1903

Announcement

The constantly increasing demand for Christensen Air Brakes and "Ceco" Electrical Machinery has made a change of our organization necessary. To accomplish this result, the owners of the stock of this company have organized the National Electric Company, and the assets, good-will, etc., of this company have this day been transferred to the National Electric Company. The purposes, ownership, management and control of the new company are identical with those of the old.

We desire and solicit a continuance under our new name of the satisfactory relations which have heretofore existed between us and the trade.

Yours very truly,

CHRISTENSEN ENGINEERING COMPANY.

THE

General Electric Company's

Thomson High Torque Induction Meter

Has torque of 80 millimeter grammes at full load. Compare this with the torque of other meters. Losses in field at full load less than one watt. Losses in potential circuit less than two watts.

Total losses at full load in field and potential circuits about 2½ watts.

Torque of 32 millimeter grammes per watt loss at full load; weigh the importance of this fact.

GENERAL OFFICES: Schenectady, N. Y.

Chicago Office, Monadnock Block.

Sales Offices in all Large Cities.

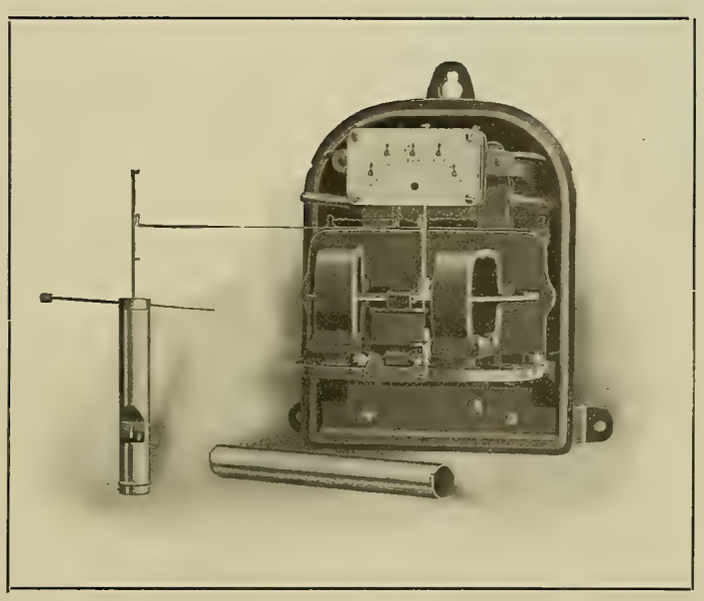
THE

General Electric Company's

Portable Torque Balance

The value of a meter is determined by its ability to maintain accuracy in use.

Permanent accuracy depends upon torque.



The General Electric Company's Portable Torque Balance will accurately measure the absolute torque of any motor meter.

Measure the torque of the meters you are using and propose to use.

This device will prove invaluable to all Central Stations.

GENERAL OFFICES: Schenectady, N. Y.

Chicago Office, Monadnock Block.

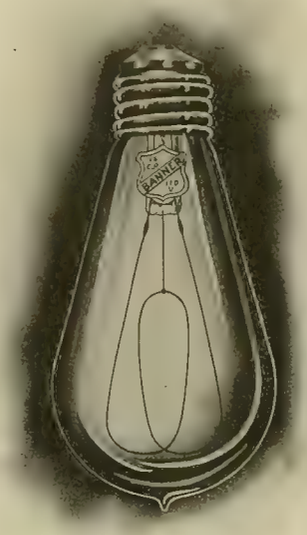
Sales Offices in all Large Cities.

BANNER LOGIC.

Banner Lamps—"Not thrown together" but carefully assembled by workmen who know the pride of doing good work and will do no other kind.

There is said to be a "Lamp Trust" selling "cheap" lamps. Undoubtedly the people who want that kind of lamps have to be catered to by someone. Why not a Trust? Certainly!

If we cannot make Banner Lamps as well as we know how, we'll quit making them.



It is easier to find a four-leaf clover at midnight than to come across a "Banner" that won't deliver the goods.

Is'nt it funny? A "low grade" lamp outside the Trust is a "high grade" one the moment it joins hands with the Magic Circle.

Put your "Trust" in "Banners" and you get the lamp that's trustworthy.

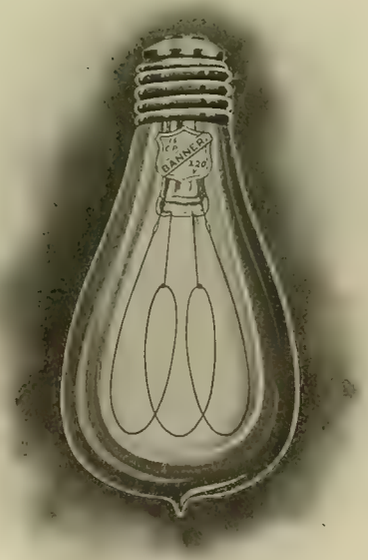
"Banner" Betterness is no more an accident than the St. Louis Exposition will be. Here are some of the "Wise Whys":

Management:
Awake and Enthusiastic.
Employes:
Skilful and ditto.
Material:
Bought right. Kept right. Handled right.
Machinery:
Plant Equipment '03 and next year '04.
You bet!

Banner Lamps—Not made but envied by the "Trust."

"Banners" live long, work well, shine bright and die hard.

When you want "Banner Brilliancy" from a "Banner" that is just exactly the time you can get it.



When you sell Banner Lamps you do not need to offer up a prayer that they'll stay sold.

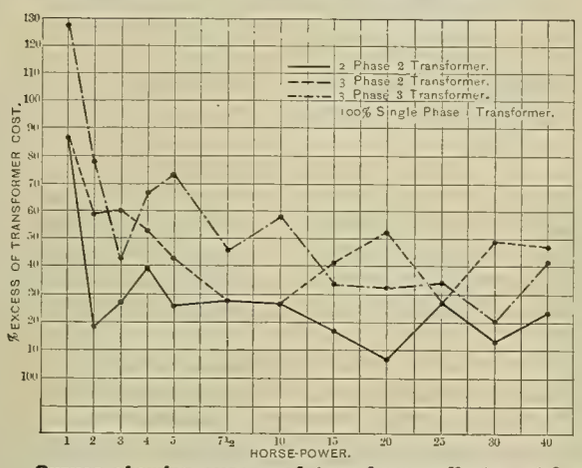
All that human brains, human skill, human enthusiasm and earth's proudest product can contribute towards making a perfect Electric Lamp, will be found in the first of any 100 "Banners" you come across—and also the other 99.

THE BANNER ELECTRIC CO.,

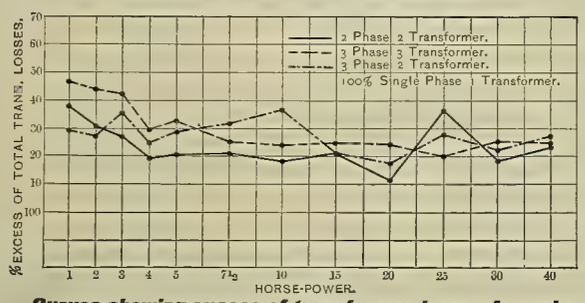
Manufacturers of **BANNER**
- LAMPS.
- AUTOMATIC TIME SWITCHES.
- ENTRANCE SWITCHES AND PLUG CUT-OUTS.
- MAIN LINE FUSE BLOCKS.
- TERMINAL LUGS, ETC., ETC.

YOUNGSTOWN, OHIO.

Why Multiphase Plants Use Single Phase Motors



Curves showing excess of transformer first cost for polyphase motors as compared with Single Phase.



Curves showing excess of transformer losses for polyphase motors as compared with Single Phase.

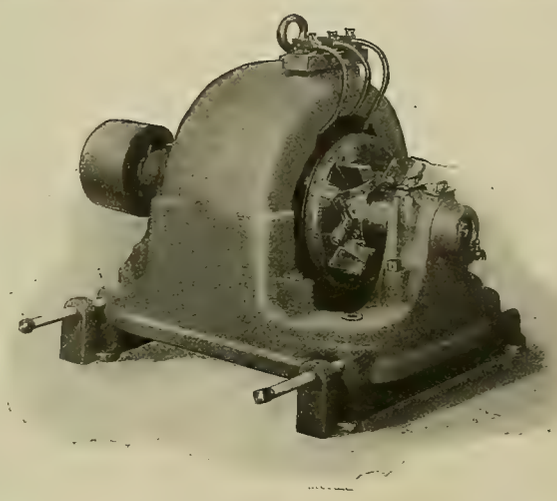
1—Because first cost of transformers is 25 to 50 per cent. less than for polyphase motors.

2—Because transformer losses are 25 to 50 per cent. less than for polyphase motors.

3—Because line construction costs 50 per cent. less than for polyphase motors.

4—Because Wagner Single Phase Motors do everything polyphase motors will do, and effect all the above economies.

And for many other reasons of less importance.



Will Single Phase Motors Operate Satisfactorily on Small Generators?

This question is effectually answered by the following data.

MUNICIPAL ELECTRIC LIGHT PLANT
HENDERSON, KENTUCKY

Generators...1—75 K. W., 60 cycles.
1—150 K. W., 60 cycles.
Wagner Motors...1—10 H. P., operating buggy factory.
1—7½ H. P., operating passenger elevator.
2—4 H. P., operating meat grinders.
Wagner Motors...1—4 H. P., operating printing office.
2—3 H. P., operating printing office.
1—2 H. P., operating bottling works.
1—1 H. P., operating job printing office.
1—½ H. P., operating six ceiling fans.
TOTAL CAPACITY WAGNER MOTORS, 100 H. P.

WHITEHALL ELECTRIC COMPANY
WHITEHALL, ILLINOIS

Generators. .1—75 K. W. 60 cycles.
Wagner Motors...1—25 H. P., operating city pumping plant.
1—25 H. P., " clay crusher in jug factory.
1—10 H. P., operating pottery factory.
Wagner Motors...10 motors, miscellaneous sizes, operating printing offices, elevators, pumping water for stock farm, grinding feed, etc.
TOTAL CAPACITY IN WAGNER MOTORS, 100 H. P.

LAUREL IMPROVEMENT COMPANY
LAUREL, MISS.

Generators...2—90 K. W., 60 cycles.
Wagner Motors...1—30 H. P., operating wagon factory.
1—30 H. P., operating railway machine shop.
1—30 H. P., operating cross-arm factory.
1—15 H. P., operating knitting mill.
Wagner Motors...1—10 H. P., 2— 4 H. P., 1— 3 H. P., 2— 2 H. P., operating miscellaneous plants
TOTAL CAPACITY IN WAGNER MOTORS, 100 H. P.

CRESCO LIGHT, HEAT AND POWER CO.
CRESCO, IOWA.

Generators...1—75 K. W. 60 cycles.
Wagner Motors...1—15 H. P., operating wood-working shop.
1—10 H. P., operating grain elevator.
1—10 H. P., installed on farm, operating feed cutters, deep well pump, cream sep't'rs, etc.
Wagner Motors...1—7½ H. P., operating machine shop.
3—1 H. P., operating printing presses and ice cream freezers.
TOTAL CAPACITY IN WAGNER MOTORS, 45 H. P.

Wagner Electric Manufacturing Company
ST. LOUIS, U. S. A.

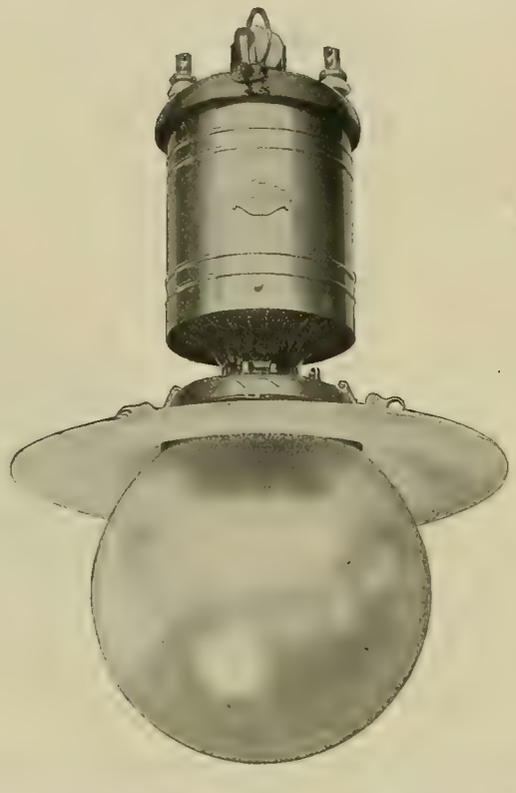
WE ARE BUILDERS OF THE ONLY SUCCESSFUL SINGLE PHASE MOTOR

THE WESTERN ELECTRIC COMPANY'S

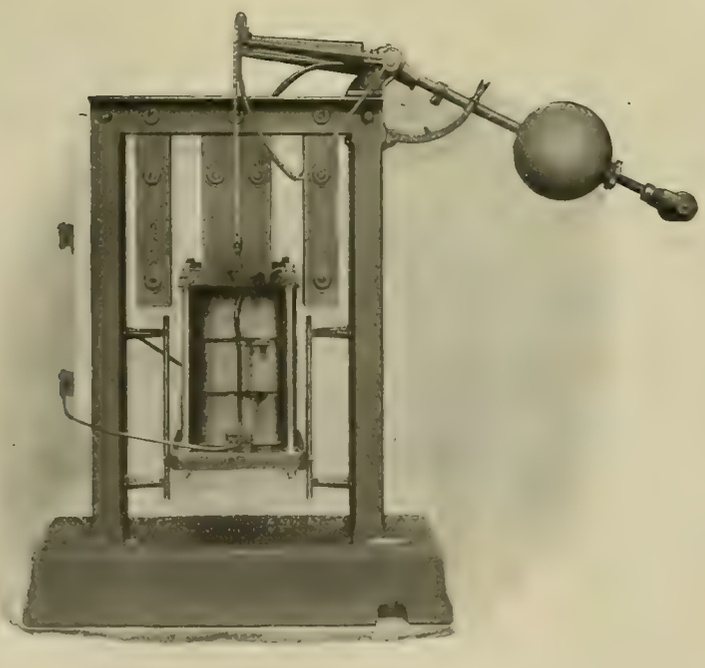
SERIES ALTERNATING
Arc Lighting Equipment

LONG LIFE

HIGH EFFICIENCY



Numerous Competitive Tests, Proof of its Superiority



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"CARBON FIGURES"

416 Towns in the United States of 10,000 population or over.

529 Central Lighting Stations in these towns.

43 Have no enclosed lamps.

486 Have enclosed lamps.

440 Using Columbia Carbons.

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THIS TELLS THE STORY.

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CLEVELAND, O.

IRON ARMORED
CONDUIT

FLEXIBLE METALLIC
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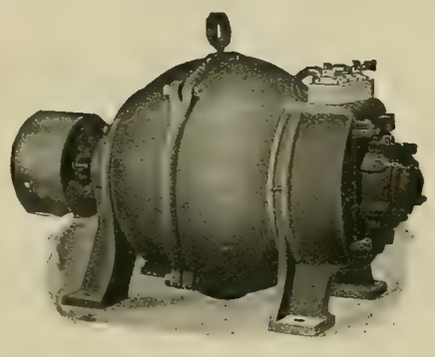
DIRECT-CURRENT ELECTRIC

MOTORS



THE SPRAGUE ELECTRIC COMPANY

for many years has been closely identified with the principal achievements in the design and construction of direct-current electric motors, and is recognized as an authority upon the installation of power plants. Long experience in this class of work has resulted in the accumulation of a vast amount of valuable data, thus enabling the Sprague Company to produce the very best possible results to the customer. The Sprague Electric Company's motors are unequaled for efficiency and durability. Write for bulletins Nos. 03206 and 03207.

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ELECTRIC COMPANY

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FLEXIBLE STEEL
ARMORED CONDUCTORS

STEEL ARMORED
FLEXIBLE CORD

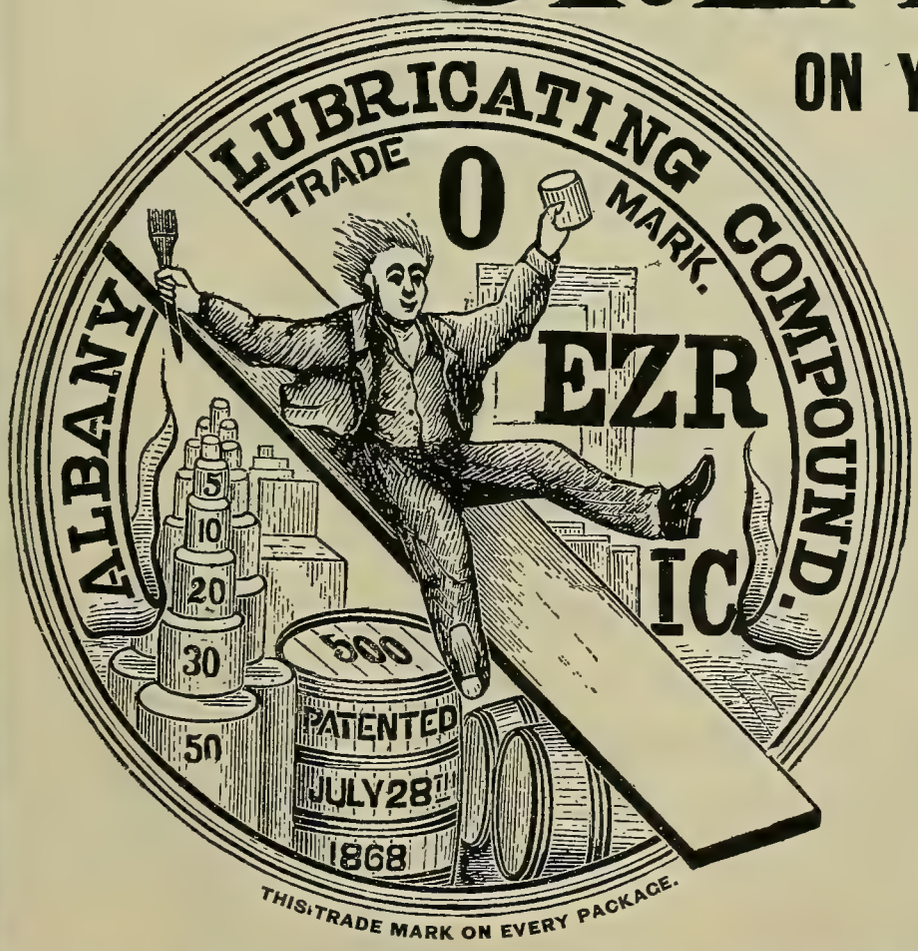
TO SAVE 1/2 OF YOUR OIL BILL

USE ALBANY GREASE

ON YOUR DYNAMOS

AND

Electrical Machinery of All Kinds.



Cost of using Oil.

Cost of using ALBANY GREASE.

SPECIAL OFFER

to Superintendents of Electric Lighting and Power Plants:

To prove it will pay you to use ALBANY GREASE we will send a sample can of ALBANY GREASE and an Albany Grease Cup free of charge for testing.

Remember, there is only ONE **ALBANY GREASE** And we are the Only Makers.

ADAM COOK'S SONS

Branch: HOWARD B. WINNE, 31 SO. CANAL ST., CHICAGO, ILL. 313 WEST ST., NEW YORK, U. S. A.

Mfrs. Adv. Bureau N. Y.

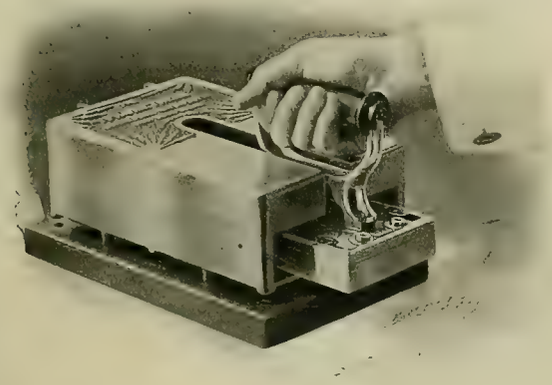
Like the Rest of Our Goods Our Lamps Are

CENTRAL STATION MANAGERS

Can Increase their Output and Dividends

By acquainting their customers with the

WIRELESS ELECTRIC HEATING AND COOKING APPARATUS



MANUFACTURED BY

THE PROMETHEUS ELECTRIC CO.

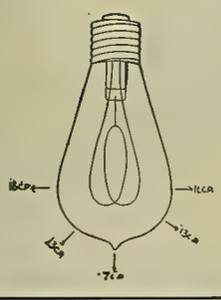
39 Cortlandt St., New York.

COOKING APPARATUS OF EVERY DESCRIPTION, LAUNDRY IRONS, STOVES, STERILIZERS, CAR HEATERS, CURLING IRONS AND RHEOSTATS. SEND FOR ILLUSTRATED CATALOGUE.

ADVICE TO THE LOVELORN

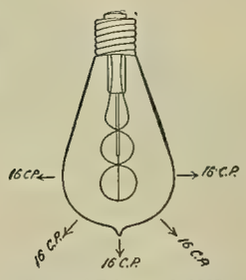
By the Editor

"MIDNIGHT SUN."



THE OTHER KIND.

Side	16	Candle Power.
Angle	13	" "
Tip	7	" "
Average	12	" "



Patented February 1, 1902.

THE STERLING SPECIAL.

Side	16	Candle Power.
Angle	16	" "
Tip	16	" "
Average	16	" "

DEAR SIR:

I am a young lady of 37 and in love with a gentleman of about the same age. I have met him several times, always at my home and in the evening, but the lights are so poor I can't get a good look at him. How can I arrange to see what he looks like?

U. D. F.

U. D. F.:

Get a few Sterling Special Lamps. They give 128% more candlepower for the same current.

NEXT.

DEAR MR. EDITOR:

I am a young orphan girl, aged 29, living with my parents and have been keeping company with a young man who says he loves me. We quarreled last night because I said the Sterling Special gave more light for the same money or the same light for less money. What shall I do, write him or let him go?

P. D. Q.

Let him go P. D. Q., he is a chump. The Sterling Special gives 128% more light for the same money or gives the same light and saves 56.25%.

Never write when you are not wrong.

Any further Information gladly given. Write, telegraph or call.

STERLING ELECTRICAL MFG. CO.

WARREN, OHIO.

New York, 26 Cortlandt St. Chicago, 57 Washington St. Toronto, Ont., Canada, J. A. Kammerer & Co. San Francisco, 22 California St.

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"BRIGHTEST AND BEST"

Manfr's. Adv. Bureau N.Y.

For all special lighting purposes use "Electra" Flame Light Carbons.

Ask for special list on High Grade Battery Carbons.

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SPECIAL NOTICE

A specially arranged dark room has been set aside where day and night demonstrations will be given of our scientific prism glass globes and optical illuminating appliances.

Holophane Glass Company,
New York.

These, our little "SHOW WINDOWS," coming out even as they do every week, can't give you an adequate idea of ALL the goods we manufacture—

BUT OUR CATALOGUE CAN.

SEND FOR IT.

EDWARDS & CO., New York.

WESTERN ELECTRIC CO., New York.

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WHEREVER YOU STICK THE LAMP IT LIGHTS

ELBLIGHT SYSTEM

PATENTED

Weatherproof
Waterproof
Acidproof
Gasproof
Foolproof

Quick
Effective
Safe
Economical
Practical

SEND FOR CATALOG

THE ONLY SYSTEM OF DECORATIVE LIGHTING APPROVED BY NATIONAL BOARD OF FIRE UNDERWRITERS

Main Aisle,
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Installed by
Mine Signal & Electric Co.

Denver, Colo.,
ELBLIGHT DECORATION

ELBLIGHT COMPANY OF AMERICA

114 W. 32d Street, New York.

LINK-BELT

OVERLAPPING
PIVOTED BUCKET CARRIER
(PATENTED)

A single machine will automatically deliver coal from track hopper to bunkers and ashes from under boilers to ash pockets.

It occupies little space, insures cleanliness and saves money. It can be adapted to a wide range of special conditions.

THE LINK-BELT TELESCOPIC ASHES ELEVATOR delivers ashes from basement to wagon on street and drops below level of sidewalk when not in use.

THE TRANSMISSION OF POWER BY MANILA ROPE

LINK-BELT MACHINERY CO.
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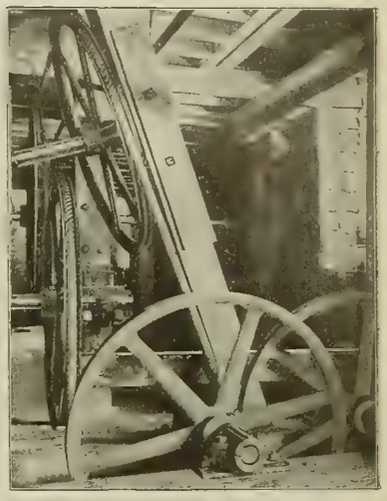

"DIAMOND H"

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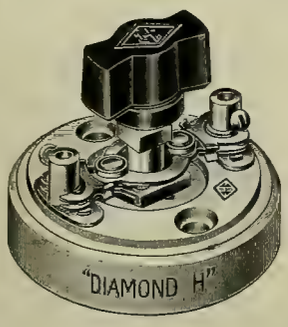
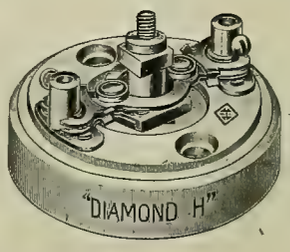
STRICTLY MODERN
—AND—
UNEXCELLED HEAVY BASES

"Open" or "Closed" for Cleat or Concealed Work.



Covers Lined Throughout with Fibre.
Dial Indicating.

Sheet Mica Insulation. Dial, Removable, to Facilitate Connecting Up.



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THE HART MFG. CO.,
302 Asylum Street, - - HARTFORD, CONN.

"DIAMOND H"

ELECTRICITY FOR ENGINEERS. 424 PAGES. ILLUSTRATED. PRICE $2.50.
ELECTRICIAN PUBLISHING CO.,
510 Marquette Building, - - CHICAGO.

MAGNETIC SUSPENSION
STANLEY RECORDING WATTMETERS.

NO WEAR. NO REVENUE LOST.
NO FRICTION. ALL CURRENT USED RECORDED.

Send for description and book full of good information
"ABOUT METERS."

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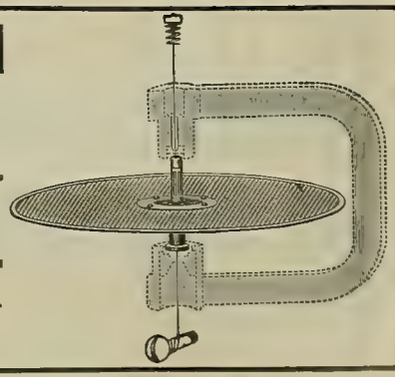
THE HENDRIE & BOLTHOFF M'F'G & SUPPLY CO., Denver, Col.
FOR MEXICO—VICTOR M. BRASCHI & BRO., Mexico City.



THE NEW TELEPHONE WIRE.

For inside use—"O. K." two-conductor glazed braid telephone wire. Made with weatherproof compound, insulated and glazed cotton braid, with trace thread in one conductor, then twisted; carried in Chicago stock in Black, Maroon and Nut Brown colors, No. 18 B. & S. gauge copper. Costs less than many rubber wires of greatly inferior quality. Does not rot or deteriorate. :: :: :: :: :: ::

ELECTRIC APPLIANCE COMPANY,
TELEPHONE MANUFACTURERS. ELECTRICAL SUPPLIES.
92 and 94 W. Van Buren Street, :: :: CHICAGO.

EDISON MINIATURE LAMPS

Over 400,000 Annually Shipped to Users.

All types—every variety.
Prompt shipment—in any quantity.

Miniature and Candelabra Sockets and Receptacles.

EDISON DECORATIVE & MINIATURE LAMP DEPT.,
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Not a rubber friction tape, but a tape coated with linseed oil left slightly tacky. Ninety times the electrical restivity of friction tape. Send for samples and prices.

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ORIGINATORS
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VOLT - AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET,
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Enclosed Arc Lamps
FOR ALL CIRCUITS.
The Osborn-Morgan Company
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BEARDSLEE CHANDELIER M'F'G CO. 256 AND 257 SOUTH CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS — MENTION THIS PAPER.

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Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

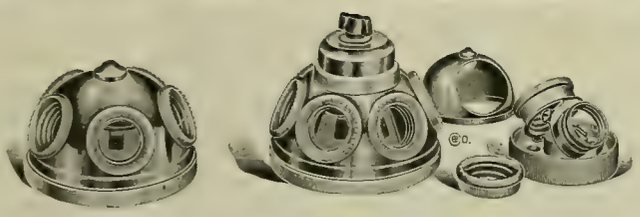
The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK.
For sale by all supply houses, or

It will put that high gloss on the Commutator you have so long sought after.

K. McLENNAN & CO. Sole Manufacturers, 909, 100 Washington St., Chicago.



DON'T MISS IT.

Our exhibit of **Wireless Clusters** and Electrical Specialties on sixth floor of Auditorium Hotel, Chicago, May 26th, 27th and 28th. You have heard of them and you ought to see them.

BENJAMIN ELECTRIC MFG. CO.,
Factory, 141 S. Clinton Street, CHICAGO, ILL.
Eastern Office, 27 Thames Street, NEW YORK CITY, U. S. A.

WE MAKE A SPECIALTY OF

MINIATURE SIGN LAMPS

From Two to Eight Candle Power
for Multiple or series burning.

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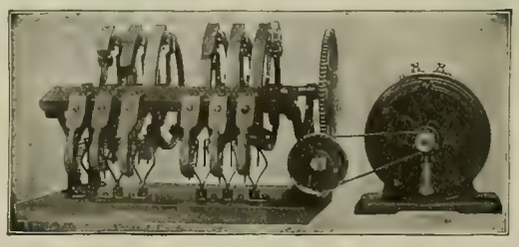
The Rooney-Westbury Electric Lamp Co.
154 E. 23rd Street, " New York City.

IMPROVED REYNOLDS SIGN FLASHER.

SEE IT IN OPERATION AT THE CONVENTION

SIXTH FLOOR, AUDITORIUM HOTEL.

CENTRAL STATION MANAGERS AND OTHERS
CAN GREATLY INCREASE THEIR PROFITS BY ADVOCATING THE USE OF THE
IMPROVED REYNOLDS FLASHER.
FLASHED ELECTRIC SIGNS



Attract the millions who are out-doors at night; therefore, flashed signs are most valuable to the merchant.
Our Flasher is the **SIMPLEST** in the world, and users pronounce it the **only reliable.**
It saves half the current. Investigate it **NOW.**

REYNOLDS ELECTRIC FLASHER MFG. CO., Inc., 221 Fifth Ave., Chicago.

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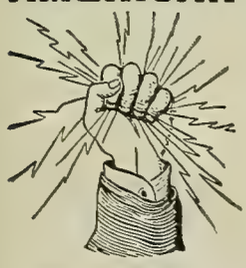
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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INCANDESCENT AND FLEXIBLE CORDS,
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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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Electric Heating Apparatus
SEND FOR 64-PAGE CATALOGUE.
"UNIT" ENAMELED RHEOSTATS
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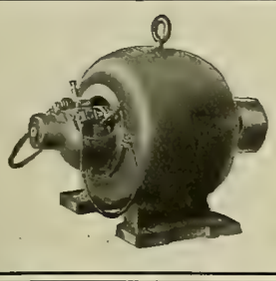
THE RODLESS
STOMBAUGH GUY ANCHOR

Has been greatly improved by casting a wrought-iron eye into the helix. This makes the eye unbreakable. The installation of this anchor is the same as the rod anchors of the same size, and will hold strains as heavy as they will. They are just the thing for those who have strand to use up.

W. N. MATTHEWS & BRO.
Distributors,
603 CARLETON BLDG., ST. LOUIS.
Send for new descriptive catalog



MICHAELS & HILLY,

MANUFACTURERS OF
HIGH-GRADE MULTIPOLAR TYPE SLOW SPEED
DYNAMOS and MOTORS

Also a secondary transformer for bells, burglar alarms, annunciators, electric gas lighting systems, door openers, doctors, dentists and surgeons. Can be used for all open circuit battery use. :: Write for booklet and prices.

60 TO 62 W. VAN BUREN ST., CHICAGO.

GET **ALLEN** SOLDERING STICKS (A FLUX)
AND
GET A PERFECT JOINT.
LARGE SAMPLES FREE.
MADE BY
L. B. ALLEN CO., Inc., 1334 Columbia Ave., Chicago.

INSULATING COMPOUND **DIELECTROL** DIELECTRIC MNFG. CO. SAINT LOUIS

ALPHADUCT FLEXIBLE CONDUIT

CONSTRUCTION.

1—Inner lining of heavy fireproofed canvas. 2—Coating of weatherproofing. 3—Fireproofed cord. 4—Filling and weatherproofing compound. 5—Outer jacket fireproofed. 6—Outer coating protecting against weather and abrasion.

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CHICAGO OFFICE: 303 Fisher Building, Wm. M. Porter Western Sales Manager.

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

H-P RUSTLESS
Cable Hangers

Are made of zinc and of one piece. Besides being rustless they are durable and strong. No assembling or loss of parts, very simple and easily applied; go on the same way every time; will not jump off suspension wire nor allow cable to slip. The grip tightens with each strain on the hanger.

Packed in small convenient boxes of 500 each.

Fig. 1.

Fig. 2.

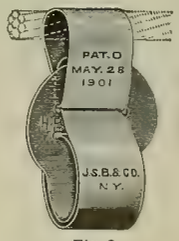

Fig. 3.

DIRECTIONS.

The circular enlargement is held in the left hand against the cable while the free end is wound once around passing through the lower slot, see Fig. 1. Around again, through the upper slot and over suspension wire, see Fig. 2. Bend free end and hook into upper slot, see Fig. 3.

ASK FOR SHEET No. 119.

JAMES S. BARRON & CO.
200-206 West Broadway, Cor. Franklin Street. New York.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

WANTED.

Outside and inside men. State experience and reference. SANBORN-MARSH ELECTRIC CO., Indianapolis.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

WANTED.

First-class, experienced, mechanical draftsmen wanted at once, some of them acquainted with electrical work; those with shop experience preferred. Apply by letter to CHIEF DRAFTSMAN, P. O. BOX 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Competent man to take care of motors, electric cranes and wiring in large manufacturing plant. Give references, experience, and wages expected. THE FALK COMPANY, Milwaukee, Wis.

FOR SALE.

One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¾ cut-off and 275 R. P. M. Wheels, 56x12½. Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

BELTING.

All Kinds of old belting purchased. Machinery and old material of all kinds bought.
WALSH'S SONS & CO.,
261 Washington St., Newark, N. J.

Western Electrician
WANT ADS
Bring Results.

Special Announcement

WE HAVE JUST BOUGHT the immense manufacturing property corner of Sixteenth and Lincoln Streets, Chicago, situated on the C. B. & Q. R. R. tracks, occupying the entire block and improved with modern steel construction, truss roof buildings, electric power transmission, electric traveling cranes, railroad tracks running right into the building, etc., freight depots for all railroads within one quarter of a mile—ideally located for quick handling and quick shipments, either in car lots or less. At this new location we shall handle, overhaul and repair the larger size dynamos and motors exclusively, having outgrown the capacity of our present works. **To save the expense of moving these large machines to the new warehouse we are naming special low prices for immediate orders.** Come to the National Electric Convention and inspect these machines, or write at once if you can't come and are interested in any machines. General offices and sales department as heretofore at 54-62 S. Clinton Street, Chicago.

GREGORY ELECTRIC COMPANY,

54-62 S. Clinton Street, - CHICAGO.

110 to 125 Volt Incandescent Dynamos.

Light.
1 180 Triumph, M. P.
1 210 C. & C., M. P.
1 225 Akron, M. P., comp.
1 300 Phoenix, M. P., 15 K. W.
1 300 Ahlm-Edwards, M. P., comp., 17½ K. W.
1 350 Edison, 20 K. W., comp., s-o.
2 350 C. & C., M. P., 20 K. W.
1 350 Card, M. P., s-o.
1 400 Westinghouse, M. P., comp., 22½ K. W.
1 400 Crocker-Wheeler, M. P., comp., 22½ K. W.
2 450 Commercial, 25 K. W., M. P., comp.
1 450 Edison, 25 K. W., self-oiler.
1 450 C. & C., M. P., 25 K. W., slow speed.
1 540 C. & C., M. P., 30 K. W., slow speed.
1 540 Fisher, M. P., comp.
2 600 Card, M. P., comp.
1 600 Card, M. P., self-oilers.
1 750 Card, comp., M. P.
2 700 Commercial, M. P., comp.
2 800 Edison, 45 K. W., self-oilers.
2 800 Edison, 45 K. W., comp.
2 1,000 Gen. Elec., 55 K. W., comp., M. P.
1 1,500 Card, M. P., comp.
2 1,500 Gen. Elec., M. P., 6-pole, direct-connected to Ames tandem, comp., 11x17x12 automatic engine.
3 1,800 Edison, 100 K. W., self-oilers, comp.

220 to 250 Volt Generators.

K. W.
1 9 New England, M. P.
1 12 Edison, self-oiler.
1 12 New England, 8-pole.
2 15 Edison, self-oilers.

220 to 250 Volt Generators—Continued.

K.W.
1 20 Northern, multipolar.
1 22½ Northern, M. P., comp.
1 20 Edison, self-oiler, comp.
1 20 Edison, self-oiler.
1 20 Wagner, M. P.
1 25 Crescent, multipolar.
1 25 Commercial, self-oiler, comp.
1 35 Northern, M. P., comp.
1 37½ Keystone, M. P., comp.
1 40 Commercial, M. P., direct connected to 10x12 Chandler-Taylor automatic engine.
1 45 Am. Eng. Co., M. P.
2 45 Edison, comp., self-oilers.
1 55 Fuller, multipolar.
1 62 T.-H., D 62, comp., oil cups.
1 62 T.-H., D 62, comp., self-oiler.
1 70 Western Electric, self-oiler.
1 75 Card, M. P., comp.
3 75 Siemens & Halske, Churchward type, multipolar, brand new, for direct connection.
1 80 C. & C., comp., self-oiler.
1 100 Edison, comp., self-oiler.
1 125 Siemens & Halske, M. P., either for belted or direct connection to engine, can be wound for 200, 250 or 300 R. P. M.
2 125 National, M. P., comp., new armatures.

500 to 550 Volt Generators.

K. W.
1 20 Card, M. P., comp.
1 25 Bullock, multipolar.
1 30 Card, M. P., self-oiler.
1 30 Edison, self-oiler.
1 30 Gen. Elec., M. P., form H.
1 33 Wood, M. P.
1 35 C. & C., self-oiler.
1 40 Northern, M. P.
2 45 Edison, comp., new armatures, self-oilers.

500 to 550 Volt Generators—Continued.

K.W.
1 50 T.-H., D 50, oil cups.
1 60 Westinghouse, oil cups, bor.
1 50 Northern, M. P., self-oiler, comp.
2 60 Edison, comp., self-oilers.
1 62 T.-H., D 62, self-oiler, comp.
1 62 T.-H., D 62; oil cups.
1 65 Crocker-Wheeler, M. P.
1 75 Akron, M. P.
1 75 Bullock, M. P.
2 75 Gen. Elec., M. P. 4, comp.
3 100 Edison, comp.
2 100 Gen. Electric, M. P. 4, comp.
3 Gen. Elec., slate-panel switchboards for above.
1 100 Westinghouse, M. P., comp., 6-pole.
3 150 Westinghouse, M. P. 6, comp.
1 200 Gen. Elec., M. P. 4, comp., s.-o.

125-133 Cycles Alternating Generators.

1,100 Volts.
3 1,300 T.-H., A 70, comp., self-oiler, with exciter.
1 1,500 Westinghouse, 75 K. W., with exciter, self-oiler.
3 1,500 Wood, 75 K. W., comp., toothed armt., with exciter.
3 1,500 Same as above, 2,200 volts.
1 1,800 Westinghouse, 90 K. W., comp., toothed armt., with exciter.
1 1,800 Gen. Elec., 90 K. W., type A. S. 90, comp., slotted armt., with exciter.
3 2,400 Westinghouse, 120 K. W., comp., self-oiler, toothed armt., with exciter.
1 2,400 Same as above, 2,200 volts.
3 2,400 Gen. Elec., 120 K. W., toothed armt., composite, with exciter, fine.
3 2,400 Same as above, 2,200 volts.
2 2,400 Gen. Elec., 120 K. W., type A. S., comp., slotted armt., with exciter.
1 3,000 Gen. Elec., 150 K. W., monocyclic, toothed armt., comp., with exciter.
2 4,000 Stanley, inductor type, 200 K. W., 1,100 or 2,200 volts, 2 phase, with exciter.
1 8,000 Westinghouse, 400 K. W., slotted armt., 3 bearings, distributed windings, with exciter, extra fine.

Alternating Generators.

60 Cycles, 1,100 Volts, 7,200 Alternations.
Light.
1 300 Gen. Elec., 15 K. W., comp., toothed armt., with exciter.
1 500 Westinghouse, 25 K. W., comp., toothed armt., with exciter.
1 1,500 Warren-Medberry, 75 K. W., 2-phase inductor type, with exciter.
1 1,500 Same as above, 2,200 volts.
2 1,500 Westinghouse, 75 K. W., toothed armt., comp., with exciter.
1 1,500 Stanley, inductor, 75 K. W., 2-phase, 1,100 or 2,200 volts, with exciter.
1 1,500 Wood, 75 K. W., comp., slotted armature, with exciter.
1 2,400 Westinghouse, 120 K. W., toothed armt., comp., self-oiler, 2,200 volts, with exciter.
1 3,000 Westinghouse, 150 K. W., comp., toothed armt., 12 poles, with exciter.
1 3,000 Gen. Elec., 150 K. W., 3-phase, with exciter and switchboard (May).

Rotary Transformers.

Booster Sets and Motor Generators.
H. P.
1 5 Crocker-Wheeler, 220 volts d. c. to 55 volts a. c.
1 60 K. W., Siemens & Halske, brand new, Churchward type, M. P., rotary transformer, 60 cycle, 2-phase, 175 v. alt. to 250 v. direct.

Electrical Machinery Bought, Sold and Exchanged. **REPAIRS** Switchboards Built to meet Specifications.
ILLINOIS ELECTRICAL MFG. CO.,
Lowest Prices. **PEORIA, ILL.** Write Us.

ENGINES.

2—20x36x36 Buckeye, tandem.
1—16½x28x27 Buckeye, cross.
2—13x22½x21 Buckeye, cross
2—11¼x7½x16 Buckeye, cross.
1—22x33 Buckeye.
1—20x40 Buckeye.
2—13x21 Buckeye.
1—18x36 Cummer, 4 valve.
1—20x42 Fitchburg Corliss.
1—18x42 Wright Corliss.
1—16x36 Frick Corliss.
2—12x36 Green Corliss.
1—13x20½x15 A. & S.
1—13x19x15 McI. & Seymour.
1—18x20 Porter Allen.
1—18x36 Wright Corliss.
2—15x20 Russell, 4 valve.
2—16x16 Erie Ball.
2—13x12 Armington & Sims.
1—9x9 New York Safety.
3—7½x7 Westinghouse.

BOILERS.

1—375 H. P. National, 150 lbs.
1—267 H. P. Abendroth & Root, 150 lbs.
1—250 H. P., S. & W., 150 lbs.
1—250 H. P. Sterling, 150 lbs.
3—300 H. P. Climax, 150 lbs.
2—125 H. P. tubular, 120 lbs.
2—100 H. P. tubular 100 lbs.
2—40 H. P. tubular, 100 lbs.

RY. GENERATORS.

1—250 K. W. Gen'l Electric
1—200 K. W. Westinghouse.
2—150 K. W. Edison bipolar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole.
4—100 K. W. Gen'l Electric.
2—75 K. W. Westinghouse.
2—60 K.W. Edison bipolar.
5—D62 K.W. T. H. bipolar.
1—35 K.W. Ft. Wayne, M. P.
1—50 K. W. Detroit.

ALTERNATORS.

All sizes in 60 & 125 cycles.

MOTORS & DYNAMOS.

All sizes and voltages.

ARC DYNAMOS.

STEAM AND ELECTRICAL MACHINERY.

THOMPSON, SON & CO.
114-118 Liberty Street,
NEW YORK CITY.

FOR SALE.

ENGINES.

34x60 950-H. P. International Power Corliss,
28x48 750-H. P. Harris Double Eccentric Corliss
23x60 450 H. P. George H. Corliss.
20x48 300-H P. Harris Corliss.
18x42 250-H. P. Greene Corliss, Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
24x48 500-H. P. Buckeye Automatic.
15 and 23x17 300 H. P. McIntosh & Seymour Tandem Compound Railway Engine.

BOILERS.

1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

HEATERS, ETC.

500-H. P. Excelsior Heater.
300-H. P. Wheeler Heater.
300-H. P. Baragwanath Heater.
200-H. P. Kroeschell Heater.
150-H. P. Berryman Heater.

WHITEHEAD MACHINERY CO., Davenport, Iowa.

FOR IMMEDIATE DELIVERY.

600 H. P. 21 and 36x30 Williams tandem compound engine.
250 H. P. 12 and 24x18 Williams tandem compound engine.
250 H. P. 13 and 20½x15 Armington & Sims cross compound.
300 H. P. 20x18 Erie Ball automatic.
75 H. P. 10x13 Frost automatic.

DYNAMOS.

180 K. W. and 120 K. W., G. E., 60 cy. A. S. type 1,100 or 2,200 V. alternators.
120 K. W. and 60 K. W., G. E., 133 cy. 1,100 and 2,200 V. alternators.
150 K.W. Wood and 50 K. W., Siemens-Halske 60 K. W., Siemens-Halske 2,000 V. alternators.
200 H. P. Edison 200 V. motor.
Direct current 110 V. generators, all sizes.

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1625 MARQUETTE BUILDING, - - - - - CHICAGO.

CHICAGO EDISON COMPANY REPAIR SHOPS

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Dynamos and Motors.

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SCHUREMAN & HAYDEN,

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NOTICE.

COMPTROLLER'S OFFICE.

CITY OF NEW ORLEANS.

NEW ORLEANS, May 18th, 1903.

Pursuant to Ordinance No. 1717 N. C. S. Sealed proposals will be received at this office until the hour of 2:30 p. m., Monday, June 8th, 1903, for the construction of an electric lighting and power system for the City of New Orleans in accordance with plans and specifications on file in the office of the City Engineer. Deposit $10,000 with the City Treasurer, and his receipt enclosed with bid. Bond $100,000. Hon. W. J. Hardee, City Engineer, will furnish bidders with a blank form of proposal; no proposal will be considered unless submitted on such form. The City reserves the right to reject any and all bids.

V. TUJAGUE,
Comptroller.

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All Kinds.
ELECTRICIAN PUBLISHING COMPANY,
Suite 510 Marquette Bldg., CHICAGO

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MULTIPLE, SINGLE

LARGE FACTORIES
MODERATE PRICES
PROMPT DELIVERIES

Sole Sales Agent for Factories. Expert Engineers. Contracts for Conduits or Complete Subway Systems. The largest and most difficult contracts undertaken.

C. J. FIELD,
Tel. 5928 Broad,
Field Conduit Contracting Co.
29 Broadway, New York

APPARATUS

For Central Station and Power House Equipment

A three hundred kilowatt alternating unit, consisting of one 300 K. W. Stanley, two-phase, 60-cycle, 2,400-volt alternator, directly connected to a 16-32x24 McIntosh, Seymour & Co. vertical cross-compound engine.

ALTERNATORS.

One 250 K. W. General Electric, 2,400 volts, 50 cycles, three-phase.
One 200 K. W. General Electric, 2,300 volts, 40 cycles, three-phase.
One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 180 K. W. Westinghouse 2,200 volts, 60 cycles two-phase.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase.
One 150 K. W. Stanley, 1,100-2,200 volts, 133 cycles, two-phase.
Two 120 K. W. General Electric, 1,040 volts, 125 cycles, single-phase.
One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 75 K. W. Stanley, 1,200-2,400 volts, 133 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
One 45 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase.

RAILWAY GENERATORS 500-550 VOLTS.

Two 500 K. W. General Electric, 6-pole, speed, 300 R. P. M.
Two 300 K. W. General Electric, 4-pole, speed, 400 R. P. M.
Two 225 K. W. General Electric, 6-pole, speed, 465 R. P. M.
One 200 K. W. Westinghouse, 6-pole, speed, 510 R. P. M.
Two 200 K. W. General Electric, 4-pole, speed, 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed, 535 R. P. M.
One 110 K. W. Eddy, 4-pole speed, 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed, 650 R. P. M.
One 100 K. W. Walker, 4-pole, speed, 750 R. P. M.
Two 100 K. W. Edison, bi-polar, speed, 620 R. P. M.
One 90 K. W. Thomson-Houston, 4-pole, speed, 700 R. P. M.
One 80 K. W. General Electric, 4-pole, speed, 700 R. P. M.
Two 80 K. W. Detroit, bi-polar, speed, 620 R. P. M.
Five 62 K. W. Thomson-Houston, type D, speed, 900 R. P. M.
One 50 K. W. Brush, type Q, speed, 1,050 R. P. M.

DIRECT CONNECTED UNITS.

One 200 K. W. Westinghouse, 8-pole, 500-550-volt generator, with 18-30x16 Westinghouse compound engine.
One 130 K. W. General Electric, 8-pole, 125-volt generator, with 12-20x16 Erie Ball tandem compound engine.
One 60 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Buffalo Forge engine. Brand new.
One 50 K. W. Commercial, 6-pole, 125-volt generator, with 8½-13x12 Armington & Sims tandem compound engine.
One 50 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Harrisburg Ideal engine.
One 50 K. W. unit, consisting of two 25 K. W. General Electric, 4-pole, 125-volt generators, with one triple expansion vertical engine.
One 30 K. W. Eddy, 4-pole, 125-volt generator, with 10x12 Watertown engine.
One 25 K. W. General Electric, 6-pole, 125-volt generator, with 9½x10 Armington & Sims engine.
Two 25 K. W. Westinghouse 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

ENGINES.

One 26x48 Harris Corliss, 500 H. P.
One 18-34x48 Cooper Corliss, cross compound, 500 H. P.
One 23x48 Harris Corliss, 400 H. P.
One 20x36 Hewes & Phillips, 200 H. P.
One 18x48 George H. Corliss, 250 H. P
One 16x42 Providence Greene, 200 H. P.
Two 18-30x16 Westinghouse compound, 250 H. P. each.
Three 18½x18 Armington & Sims, 250 H. P. each.
One 18½x18 New York Safety, 250 H. P.
Two 10-18x20 Payne tandem compound, 150 H. P. each.
One 13-19x15 McIntosh, Seymour & Co. tandem, 175 H. P.
Two 14x13 Armington & Sims, 150 H. P.
One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
One 12x10 Westinghouse Junior, 75 H. P.
One 8x10 B. F. Sturtevant, 40 H. P.
One 7x8 Payne, 20 H. P.
Three 6x5 Westinghouse Junior, 12 H. P. each,
Two 5x4 Westinghouse Junior, 6 H. P. each.

Direct current generators and motors, 110, 220 and 500 volts.
Alternating-current motors, 60 and 125 cycles.
Brush and Thomson-Houston arc generators—all sizes.
Babcock & Wilcox and water tube boilers.
Transformers, arc lamps, street railway motor equipments.

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Armature Fields Rewound

FOR SALE.

GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
Six Edison, No. 60, 175 K. W.
Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

ALTERNATING GENERATORS.

One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

STREET CAR EQUIPMENT.

One hundred and eighty 25 H. P. motors, new and complete with pinions, gear and gear cases.
One hundred and eighty "K" Controllers.
Twenty-five K-2 Controllers.

ENGINES.

Six 36 and 60x60, Cooper cross-compound non-condensing, new, never shipped from factory.
One 30x54 St. Louis Corliss.
Two 24x60 Lane & Bodley, designed for rolling mill work.
One 28x60 Pennsylvania Iron Works Co.
One 20x48 Wheelock.
One 20x48 Double Wheelock.
One 20x42 Wheelock,
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
One 14x17 Fisher, new.

BOILERS.

Four 66x18 with 66 4-inch tubes. A complete battery at a great bargain.
Three 66 x 14, with 66 4-inch tubes.
Two 72 in. x 18 ft., with 66 4-inch tubes.
Five 60x16 ft. high pressure boilers
Two Sterling Water Tube Boilers, 250 H.P. each.
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One 60 ft. Ferris Wheel, electrically driven.

AT A BARGAIN — A complete Edison 3-wire plant of 300 K. W. capacity.

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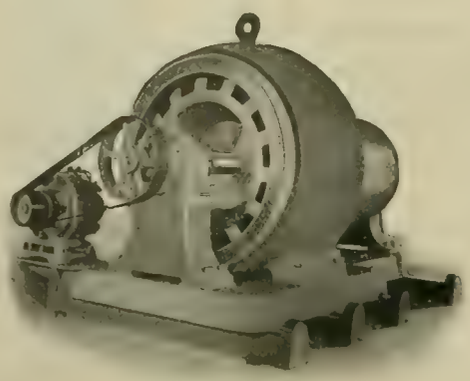
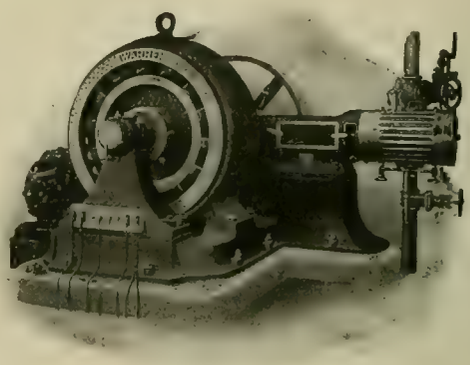
CINCINNATI, OHIO.

The Warren Alternator.

OUR PRODUCT.



BELTED TYPE.



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1000 KILOWATT Machines of the Engine Type and
1500 KILOWATT Machines of the Water Wheel Type.

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ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

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Self-Flashing SIGN LAMPS

fit any Edison socket. They have concealed within the ordinary Edison base a wonderful mechanism which flashes the lamp up and down from 1 to 16 candlepower at irregular intervals. Each lamp is an independent unit, and runs on its own timecard. The effect is startling. "Each lamp has a skedoodle of its own," as Pat Murphy says.

The mechanism is waterproof, foolproof, non-get-atable and non-adjustable, and guaranteed for a year.

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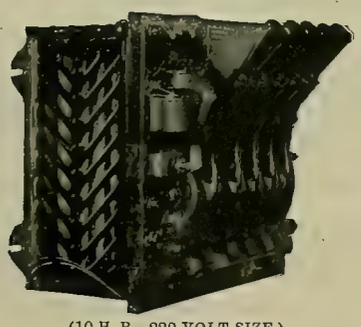
C & H
MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE



(10 H. P. 220-VOLT SIZE.)

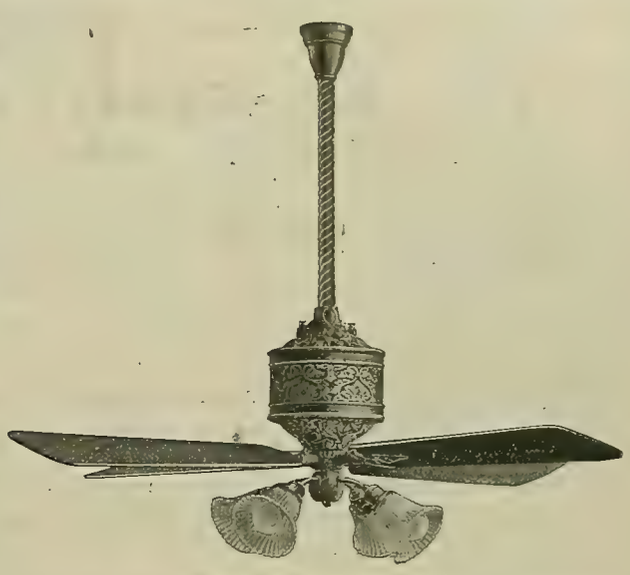
THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.

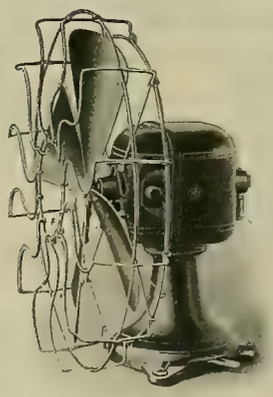
CHICAGO, 1232 MONADNOCK BLDG. NEW YORK, 136 LIBERTY ST. PITTSBURG, 319 FRICK BLDG.

Diehl Fan Motors



New High-Speed Ceiling Fan.

Artistic Design, Noiseless in Operation, Perfect Oiling System. Efficient, Durable. Special Nyssa Blades, 2 or 3 Speeds. We make 12 other styles, all prices, all good. Our 15 years' experience assures you that we make the



Best.

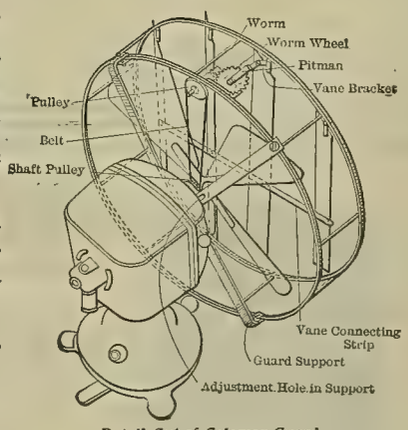
Our New Desk and Bracket Fans are the best sellers because they never give trouble.

If you want to sell the most attractive and best fan, send for catalogue and prices.

The COLEMAN Guard and Deflector is the talk of the trade. It is a great money maker to every one who handles it.

Can be installed on Desk, Bracket or Trunnion of any make.

Send for further information.



Detail Cut of Coleman Guard.

Diehl Manufacturing Co.,
Elizabethport, N. J.

BRANCHES:
New York, Boston, Philadelphia.

A REVOLUTION IN FUSES!

BETTER THAN THE BEST.

ARKLESS FUSE
McBRIDE MFG. CO.

CHEAPER THAN THE CHEAPEST.

THE McBRIDE "ARKLESS"

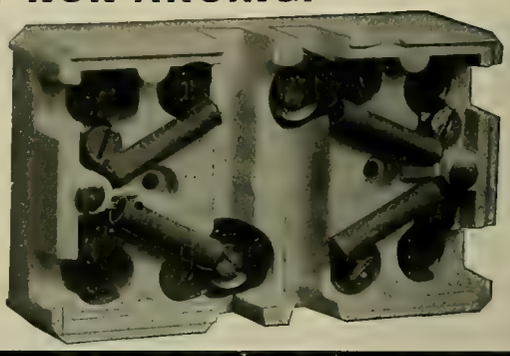
ABSOLUTELY SAFE, EFFICIENT, NON-ARCING.

CONFORMS WITH UNDERWRITERS' REQUIREMENTS.

POPULAR AND SUCCESSFUL BECAUSE

It gives the maximum efficiency at minimum cost.
It is especially adapted to the old open-link cut-outs—it makes them safe.
It is just the thing for tablet boards and fusible knife switches.
It is creating the greatest sensation in the trade.

MADE FOR 125 AND 250 VOLTS. FROM 6 TO 30 AMPERES.



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NEW ENGLAND BUTT COMPANY

MANUFACTURERS OF

Machinery for Insulating Electrical Wires

Braiding, Taping, Winding, Twinning, Cabling, Stranding, Polishing and Measuring Machines. Cable Covering Braiders

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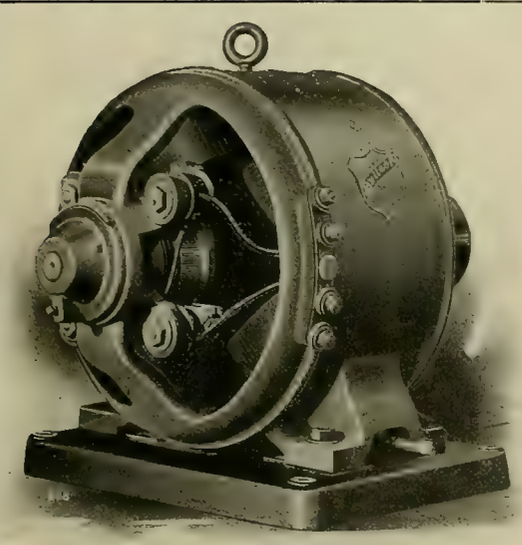

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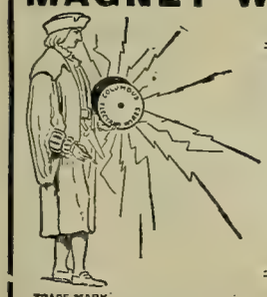

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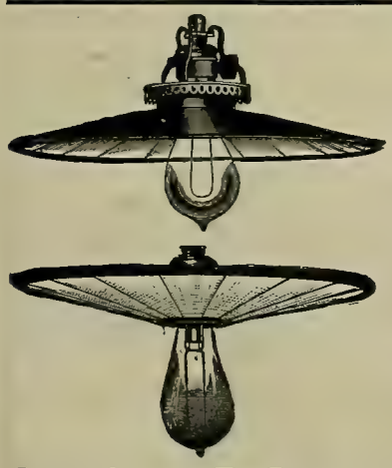

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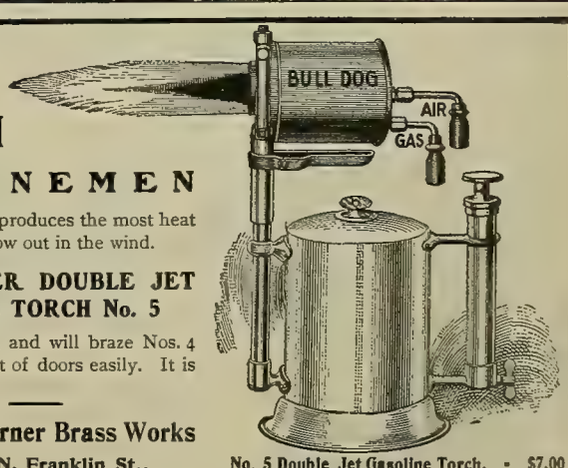

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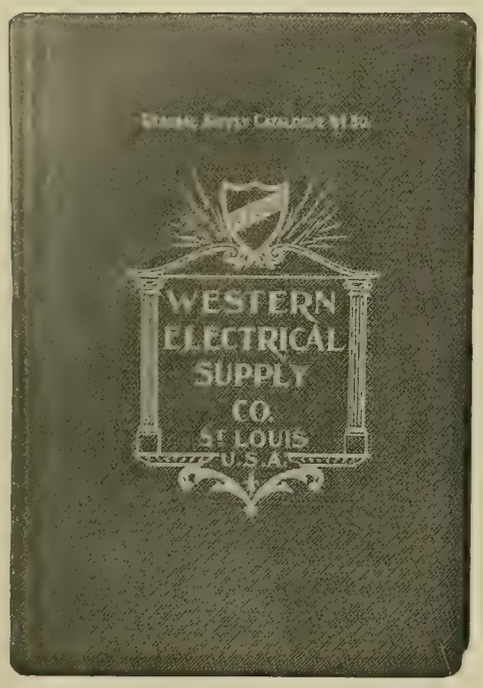

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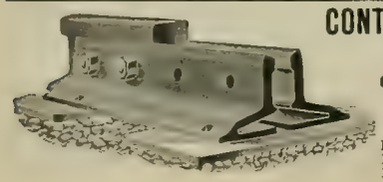

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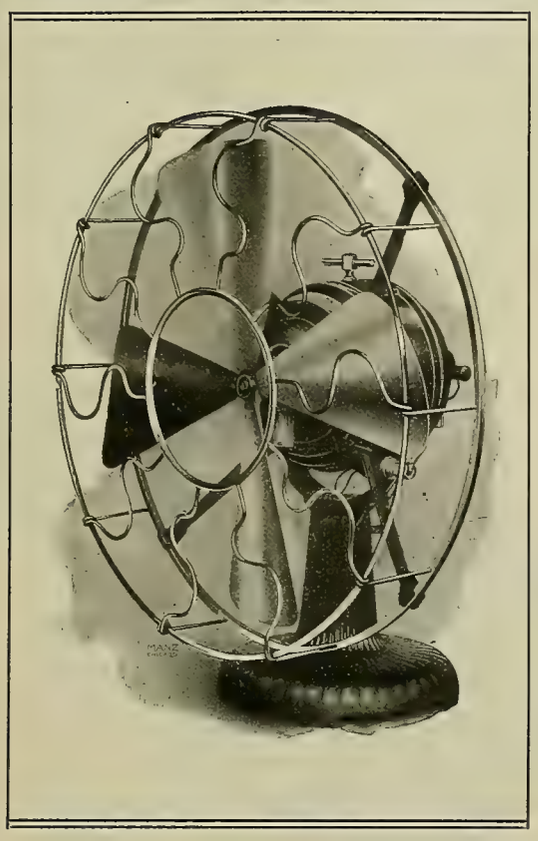

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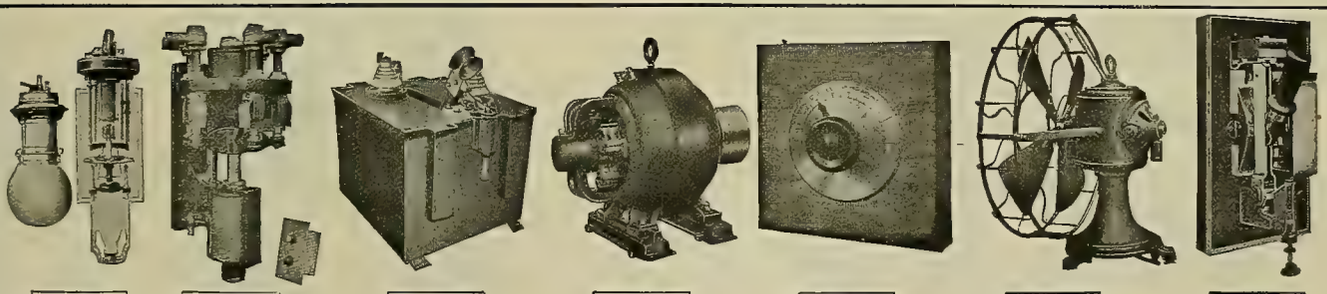

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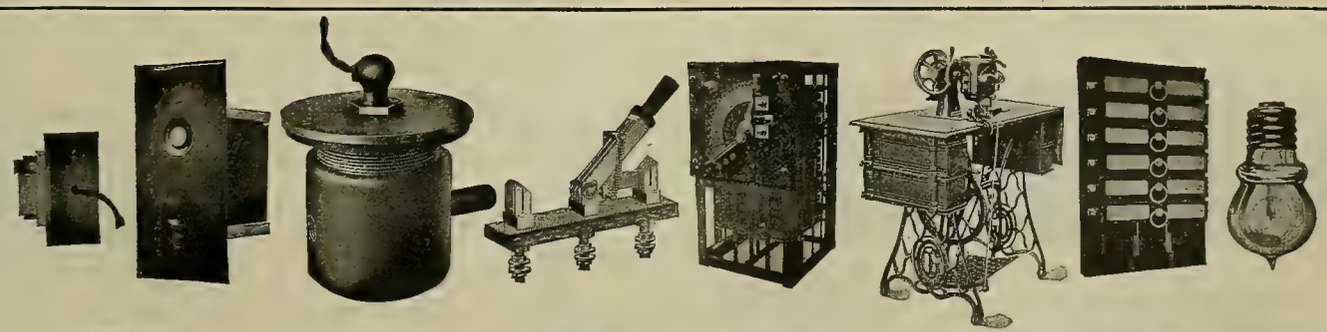

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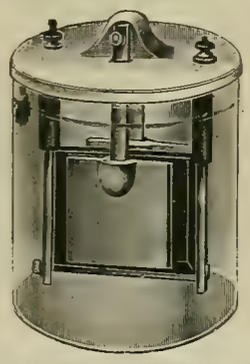

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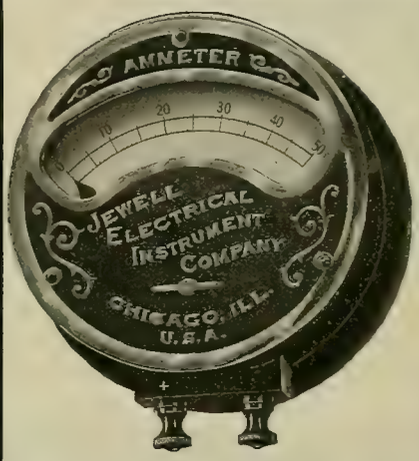

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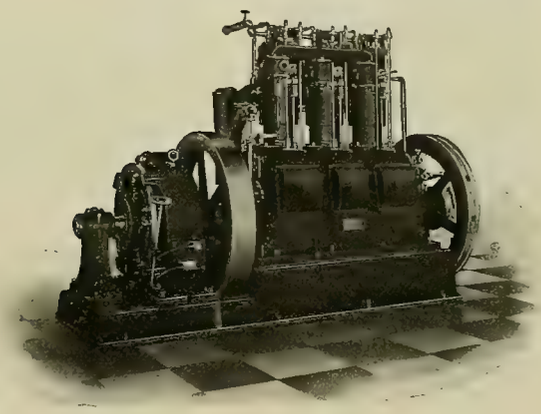

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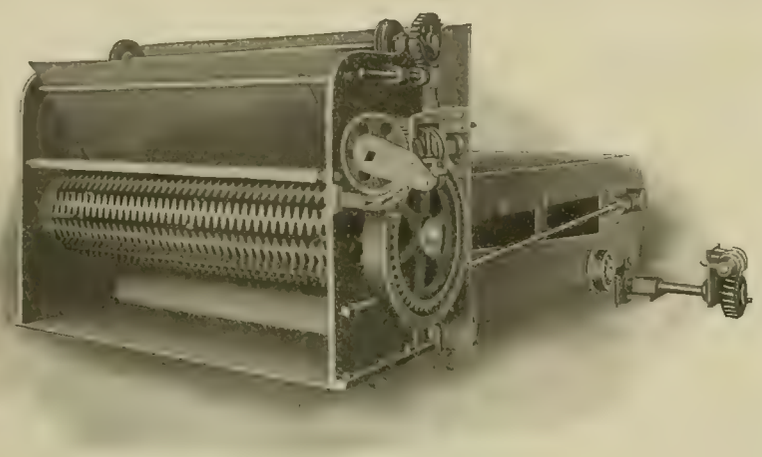

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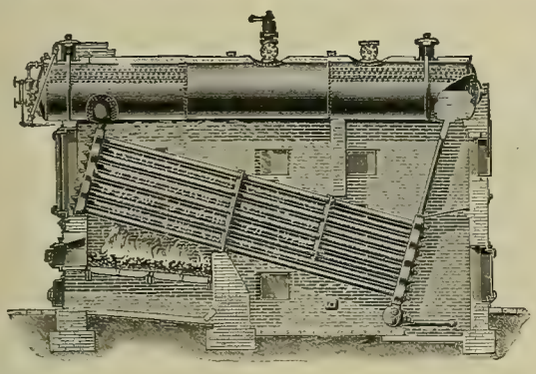

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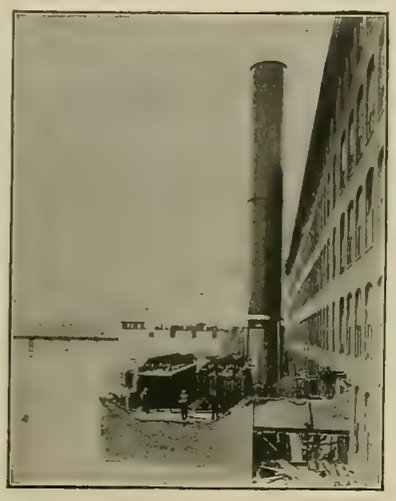

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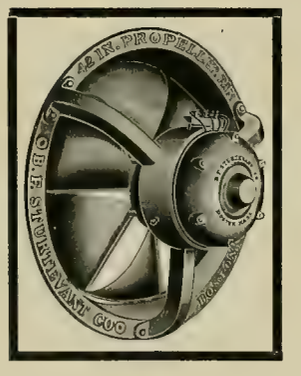

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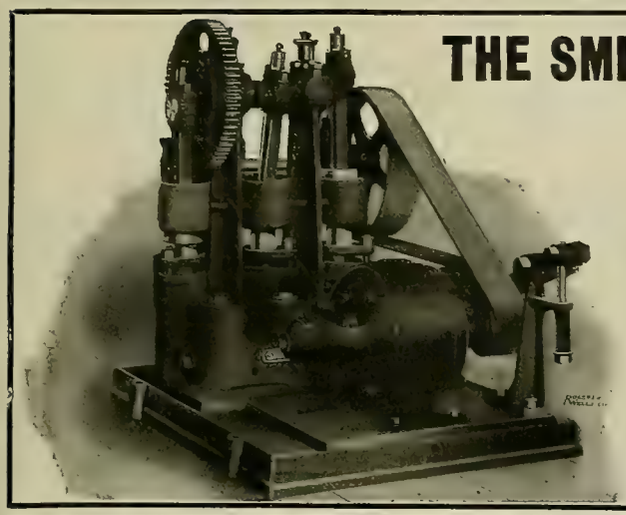

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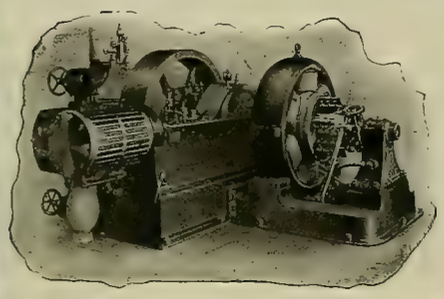

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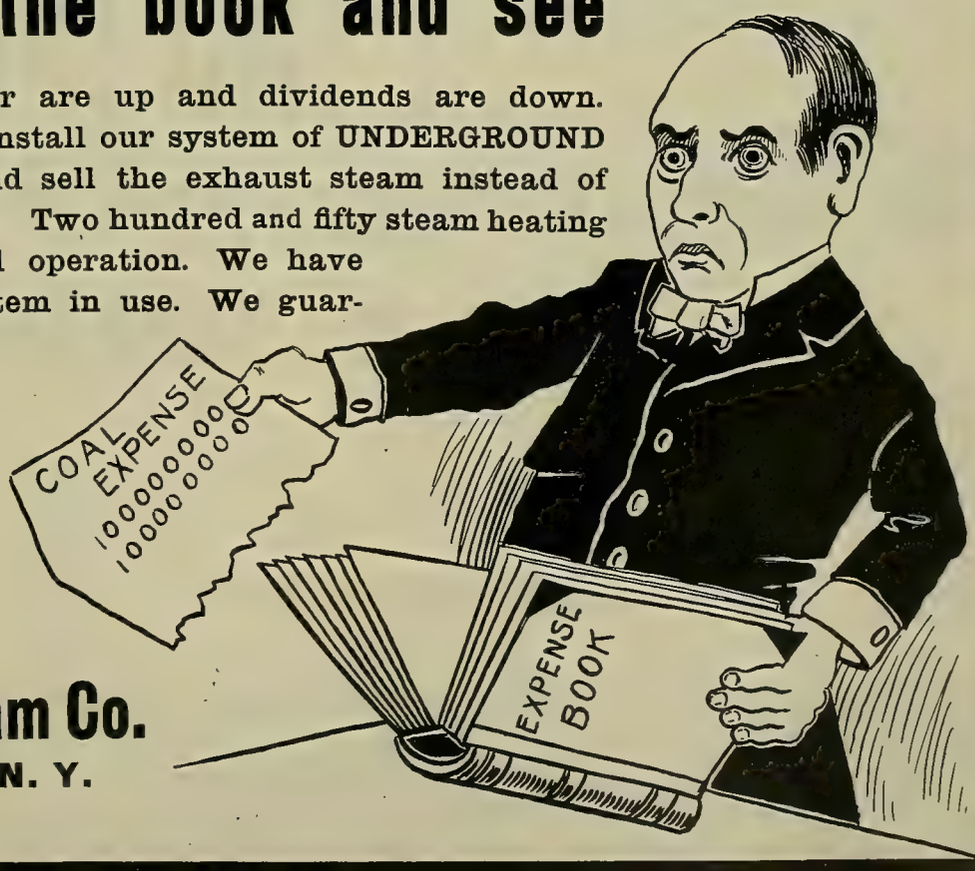

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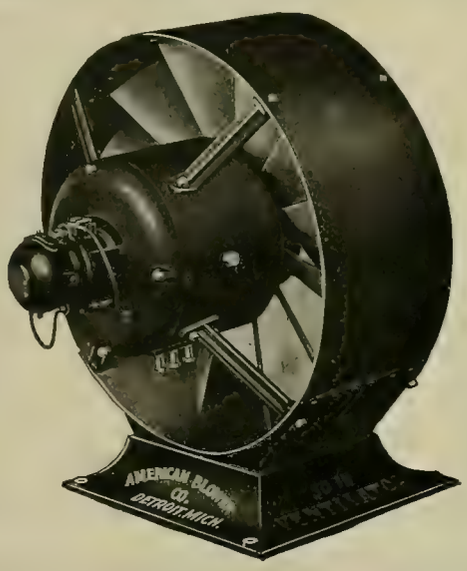

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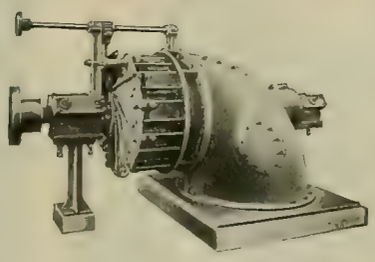

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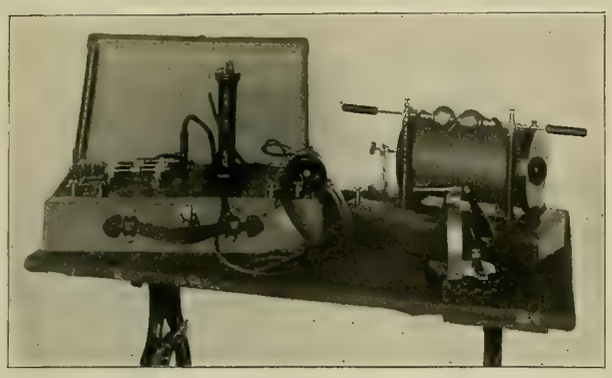

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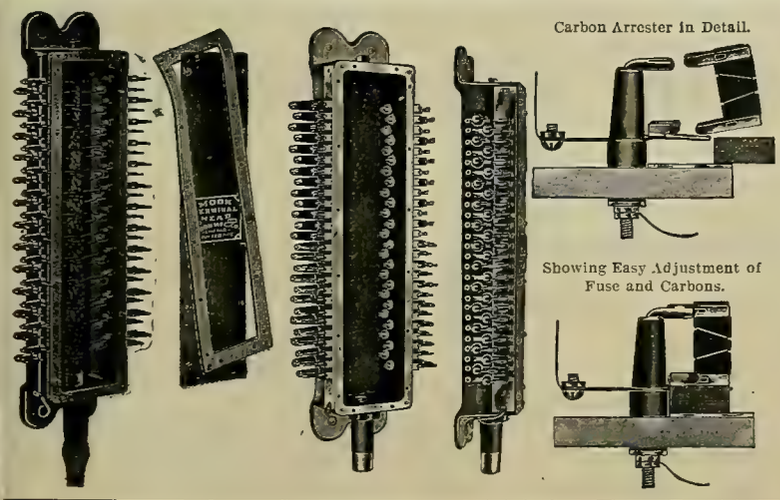

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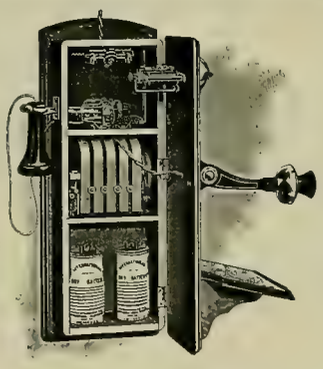
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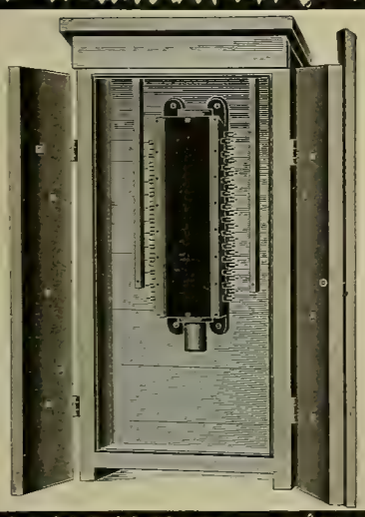

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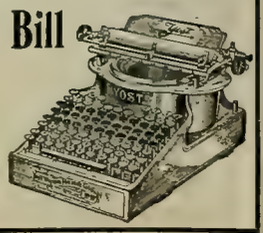

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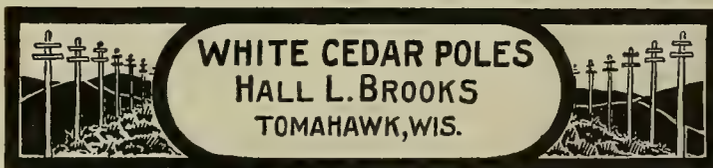

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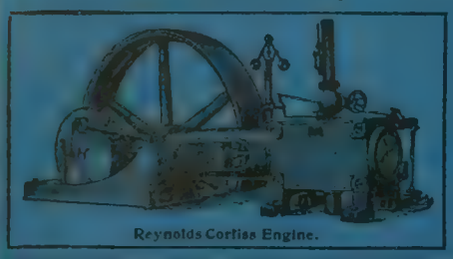
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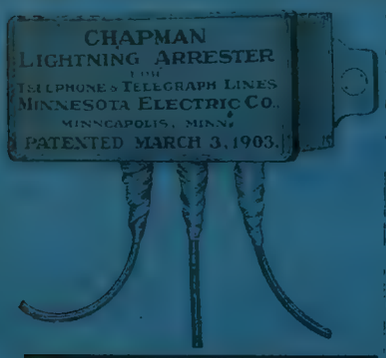

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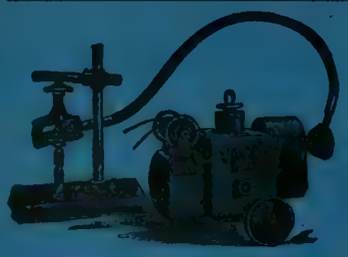

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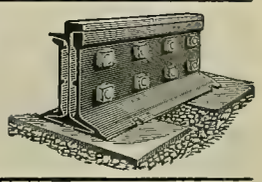

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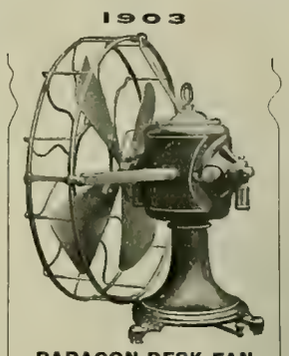

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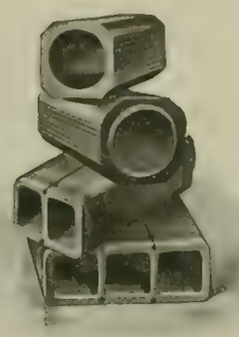
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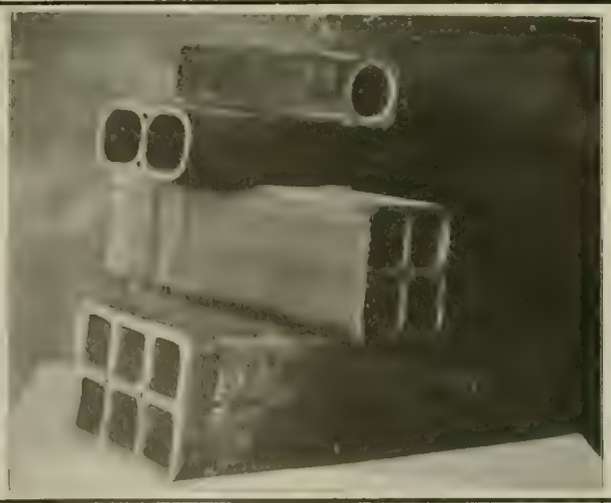

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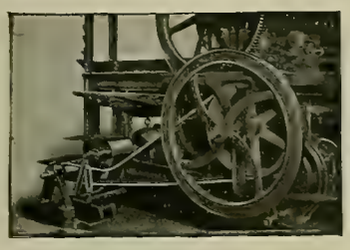

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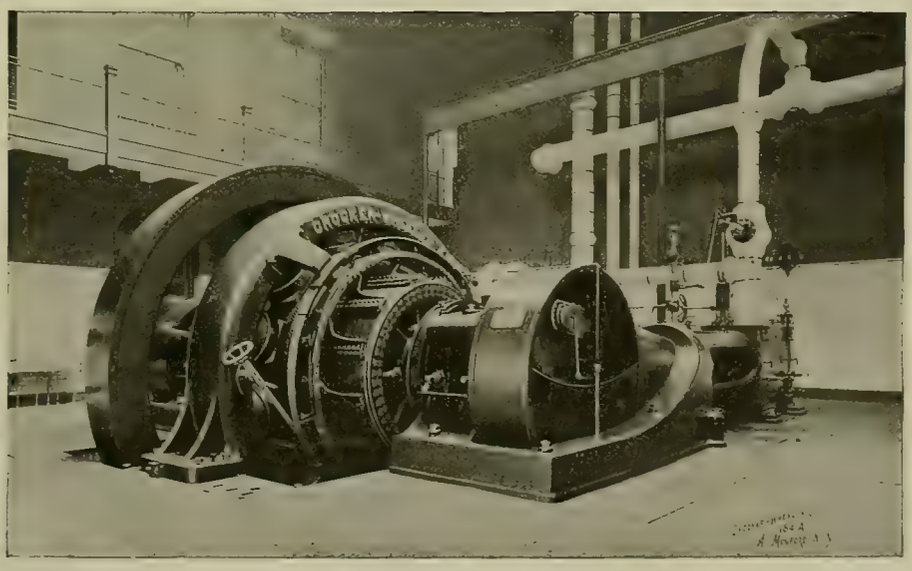

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Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
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Pignolet, L. M.
Stanley Instrument Co.
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Sturtevant Co., B. F.
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Electric Appliance Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Sterling Varnish Co.
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Lamps, Arc.
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General Electric Co.
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Economical Elec. Lamp Co.
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Shelby Electric Co.
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Sterling Electrical Mfg. Co.
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Sturtevant Co., B. F.

Mica.
Mica Insulator Co.
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Klein & Sons, Mathias.

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Johnston, Thomas J.

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Berthold & Jennings.
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Fowler, John H.
Fowler-Jacobs Company.
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Loud's Sons Co., H. M.
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O. C. Lumber Company.
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Perrizo & Sons.
Phelan, D. W.
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Standard Tie Company.
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Torrey Cedar Co.
Valentine-Clark Co., The
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Worcester Co., C. H

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Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
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Sterling Electric Co.
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Swedish-American Tel. Co.
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Turner Brass Works.

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Christensen Engineering Co
Crocker-Wheeler Company.
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Clark Wirel. Tel. & Tel. Co., T. E.

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Okonite Co., The.
Phillips, Eugene F.
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Standard Underground C. Co.
Waclark Wire Co.
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Woodwork, Electrical.
Noblett Co., E. J.

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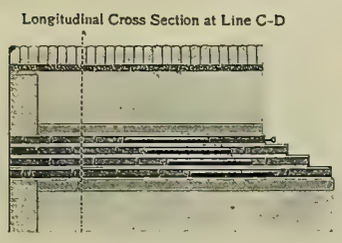
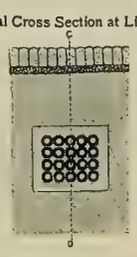
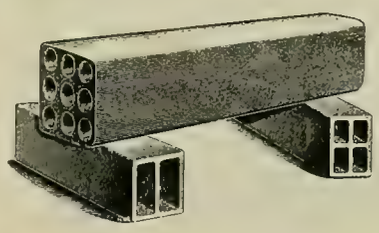
The H. B. CAMP CO.

Manufacturers of

"Camp" Standard Vitrified Clay Conduits for Under-ground Wires.

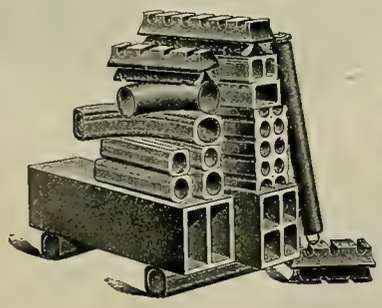




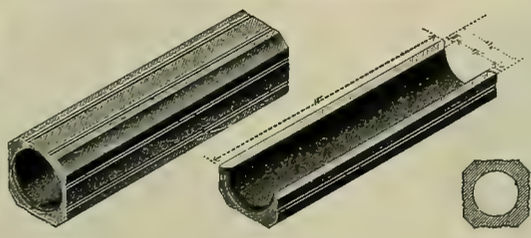


Mandrel. Patented Jan. 26, 1892

VITRIFIED CLAY CONDUIT PIPE.



End View



Isometric Section Cross Section

Installers of Complete Under-ground Conduit Systems.

Sales Offices

Room 85 Hartford Building, Chicago. 170 Broadway, New York

SOME REASONS WHY

NERNST LAMPS are becoming so popular.

1st They contain no cog wheels, chains, sliding rods nor clock work of any kind.

2nd They can be used on any alternating current circuit

3rd The efficiency is from 1.32 to 1.76 watts per candle-power.

4th They require a minimum amount of attention, and are positive in operation.

5th The cost of maintenance is low.

6th They require no carbons whatever.

7th They are substantially constructed of only the very best material.

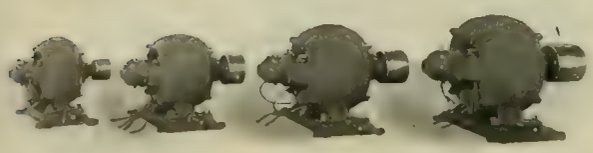
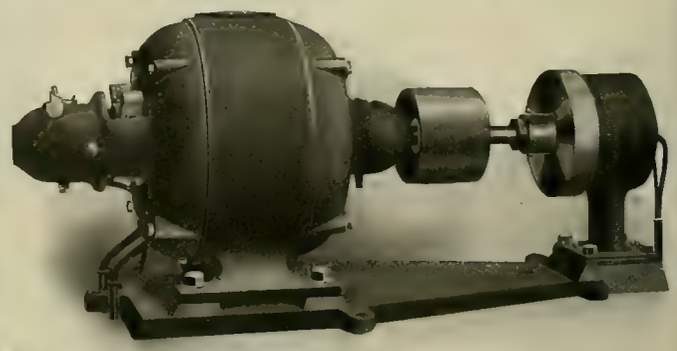
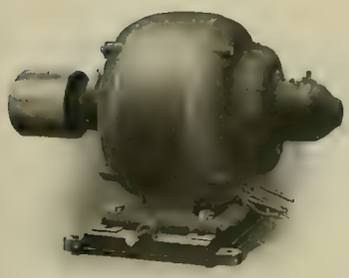
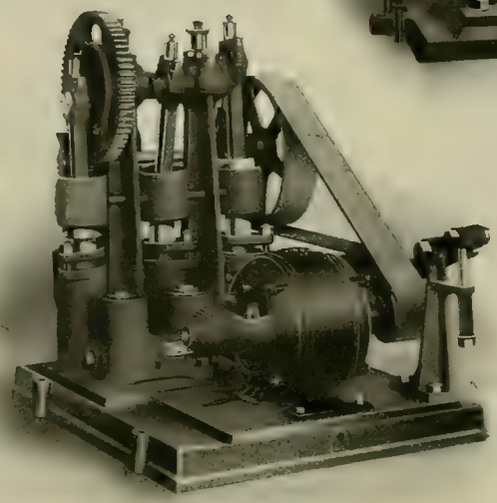
Write for further information

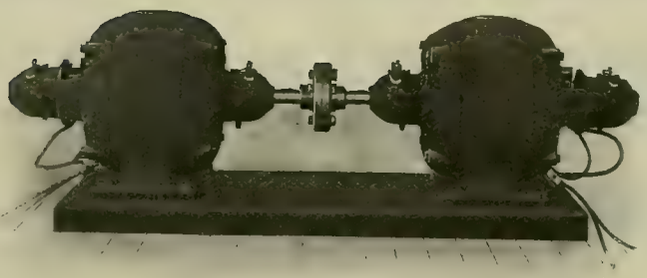
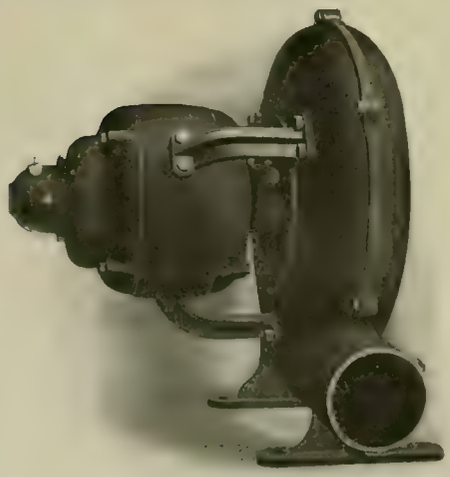
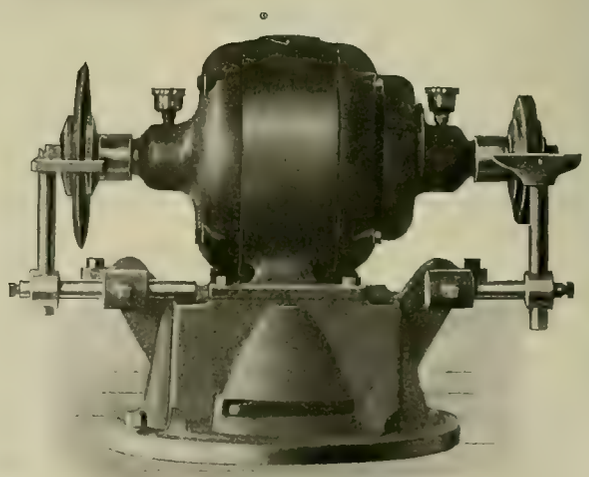
COMMERCIAL ELECTRICAL SUPPLY CO., 1000 Market St. ST. LOUIS, MO.

AGENTS FOR { Missouri, Texas, Iowa, Louisiana, Southern Illinois, Mississippi, Nebraska, Tennessee, Kansas, Alabama, Arkansas, Kentucky, and the Territories

WATSON MOTORS AND GENERATORS

WE BUILD SMALL MOTORS EXCLUSIVELY

DID YOU REALIZE THAT WE MADE ALL THESE TYPES?

WE BUILD SPECIAL DYNAMOS AND SPECIAL MOTORS **FOR SPECIAL PURPOSES.**

THE MECHANICAL APPLIANCE CO., MILWAUKEE, WIS.

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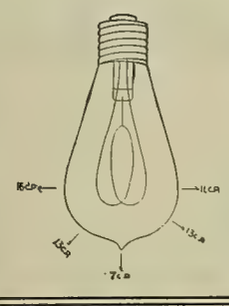


THE OTHER KIND.

Side .....16 Candle Power.
Angle .....13 " "
Tip..... 7 " "
Average.....12 " "

to contract for incandescent lamps rated at 16 candle power that on test give from the tip only 7 candle power, represented by

when you can get incandescent lamps not only rated at 16 candle power, but which actually deliver 16 candle power from the tip, represented by

Does it Pay

to buy incandescent lamps supposed to give 16 candle power, but which actually give 13 candle power at an angle of 45°, represented by

when you can purchase incandescents that give a full 16 candle power at the same angle (in addition to full rated candle power from the tip), represented by

Does it Pay

to order lamps and count on having 16 candle power, and then learn that you only get 7 c. p , from the tip, 13 c. p., at an angle of 45 degrees, and 16 c. p., horizontally—an average of 12 c. p., represented by

when you can secure a lamp giving 16 candle power in all three directions, represented by

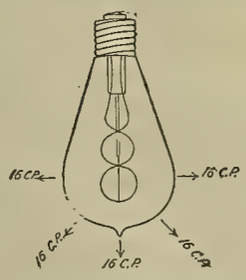
Does it Pay

at any time to "take a chance" when a positive way is provided whereby you are assured of getting exactly what you want?

Buy Sterling Specials

and thus get a lamp correctly rated. It ensures satisfaction to purchaser and user alike.

Send for Booklet.



Patented February 1, 1902.

THE STERLING SPECIAL.

Side .....16 Candle Power.
Angle .....16 " "
Tip .....16 " "
Average.....16 " "

STERLING ELECTRICAL MFG. CO.

NEW YORK
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WARREN, OHIO

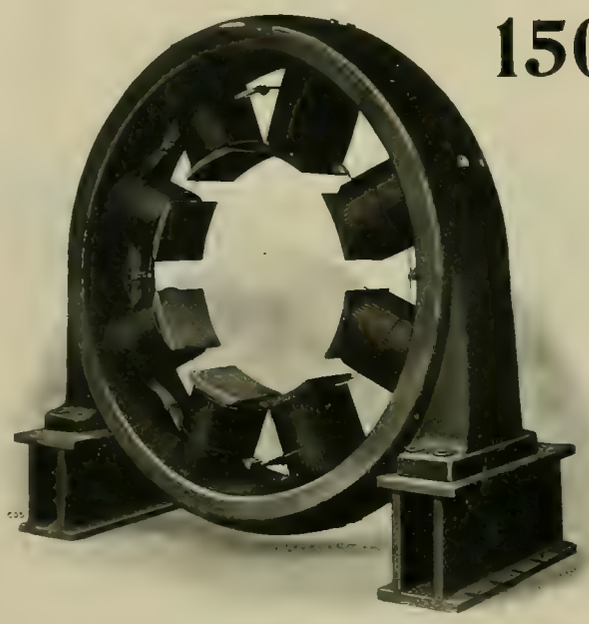
CHICAGO
57 Washington St.

Direct and Alternating Current

Generators

Built in Capacities up to

1500 K. W.



Frame for 200 K. W. Generator.
Engine Type.

Frame and Poles.

The magnet yokes are made of cast iron and divided horizontally.

The poles are of cast steel with laminated steel pole shoes, thereby eliminating losses due to eddy currents.

Poles and field coils can be removed without disturbing the armature.

Armatures.

Laminated discs, separately insulated, are built up on a cast iron spider which is keyed to the shaft.

Both radial and axial ventilating ducts are provided in the core.

Our method of constructing large armatures insures perfect ventilation.

Armature for Engine Type Generator.

National Electric Co.

Successor to

Christensen Engineering Co.

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Pittsburg: Gellatly & Co.

Milwaukee.

Seattle and San Francisco:
Kilbourne & Clark Co.

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"BRIGHTEST AND BEST"

Manf'rs. Adv. Bureau N.Y.

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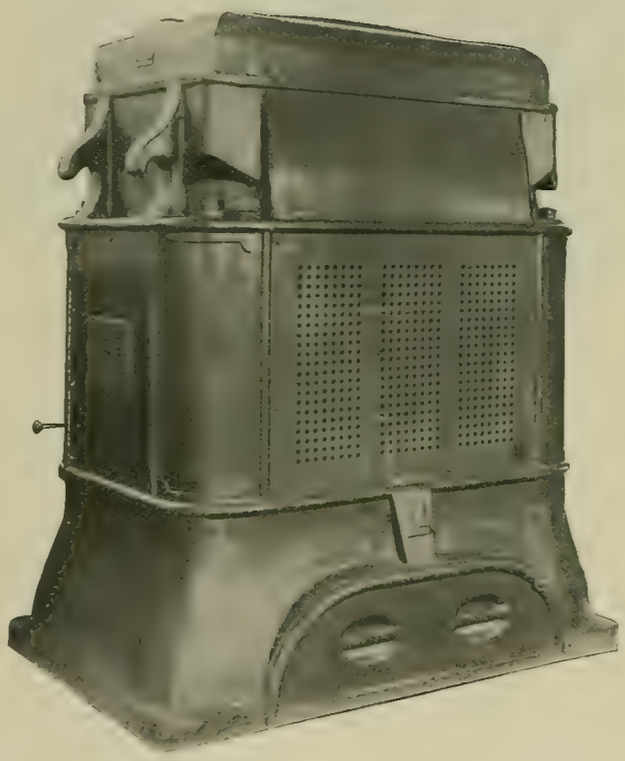
General Electric Company's

Three and Six Phase

Transformers



AIR BLAST TYPE.

The combination of three-phase or six-phase windings in one transformer presents many advantages over the use of two or three single-phase units when used with other multiphase apparatus.

Some of these advantages are:

REDUCED NUMBER OF UNITS.
LESS WEIGHT AND FLOOR SPACE.
SIMPLICITY OF TERMINAL CONNECTIONS.

Write for information.

GENERAL OFFICES: Schenectady, N. Y.

Chicago Office, Monadnock Block.

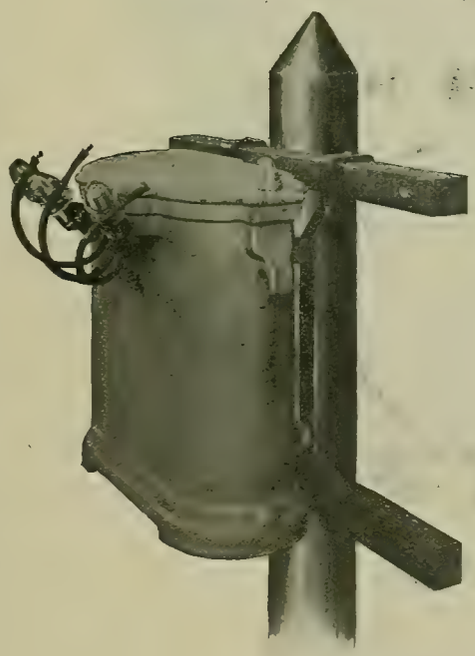
Sales Offices in all Large Cities.

THE

General Electric Company's

Three and Six-Phase

Transformers



TYPE H, OIL COOLED.

The combination of three-phase or six-phase windings in one transformer presents many advantages over the use of two or three single-phase units when used with small Rotary Converters and Induction Motors.

Some of these advantages are:

EASILY INSTALLED ON POLE.
IMPROVED APPEARANCE OF INSTALLATION.
REDUCED WEIGHT.
SIMPLICITY OF WIRING BETWEEN TRANSFORMER AND OTHER APPARATUS.

Write for Information.

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BRYAN-MARSH COMPANY

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The Chip on his Shoulder

Independent—
And we are.

WE INTEND TO SUCCEED BY DESERVING SUCCESS

JUDGING from the support that has been given us, consumers are tired of the rash claims of some makers, and appreciate not only our independent position, but our conservative claims, which we can carry out to the letter.

Remember that we can furnish you everything in incandescent lamps, we ship no sample, picked lamps. If our lamps do not suit you, send them back—if they do, they are the kind you can always depend on getting from us.

Our 220-volt lamps in 10, 16 or 32 c. p. will please you as well as our regular line. We know, and we want the chance of proving to you, that we are the people you have been looking for. Just give us the chance. Address,

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INCANDESCENT
LAMP COMPANY

CLEVELAND, OHIO.

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OFFICE: ROSE BUILDING

GREAT OAKS FROM LITTLE ACORNS GROW.

SERIES ALTERNATING ARC LIGHTING SYSTEM

WESTERN ELECTRIC COMPANY

CHICAGO NEW YORK

St. Louis Denver Philadelphia

About Time You Were Getting Next

To a good thing. Remember our trade mark says something interesting,—and that something is backed up by a company that is "up to snuff."

Seven big floors of goods to ship from; and bye the bye, they've been keeping our shipping clerk pretty busy of late.

What you don't know about us, you can "look it up in the Green Book," a volume of good sense and low prices.

Dynamos, Motors, Lamps, everything electrical.

Ewing-Merkle Electric Co.,
ST. LOUIS.

Gould Storage Battery Co.

NEW YORK

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CENTRAL STATION EQUIPMENT

of any size for

LIGHTING AND POWER

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PITTSBURG ENGINEERING COMPANY, PITTSBURG, PA.

WORKS: DEPEW, N. Y.

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INTEGRATING WATTMETER

FOR

DIRECT CURRENT

LIGHTING AND POWER SERVICE

PLAIN, ORNAMENTAL AND SWITCHBOARD TYPES

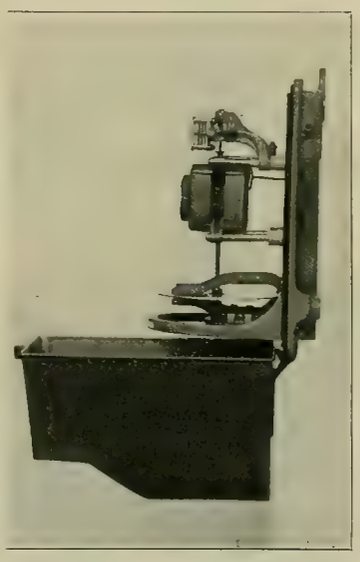
SIZES

2½

TO

2500

AMPERES



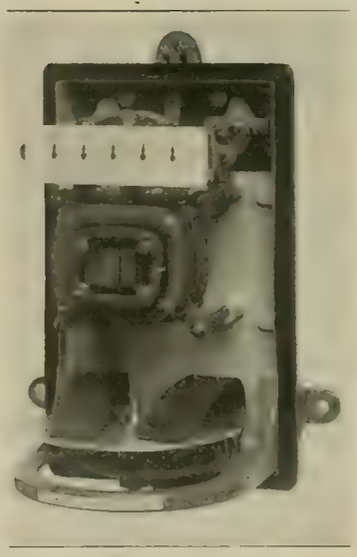
HIGH TORQUE

DIRECT READING

DUSTPROOF

ACCURATE

EFFICIENT



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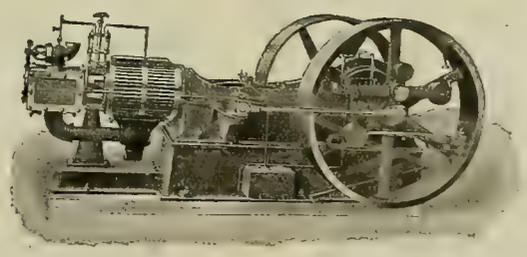

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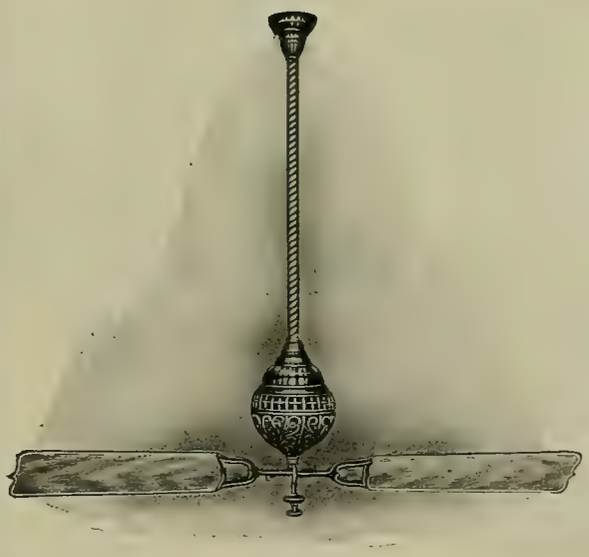

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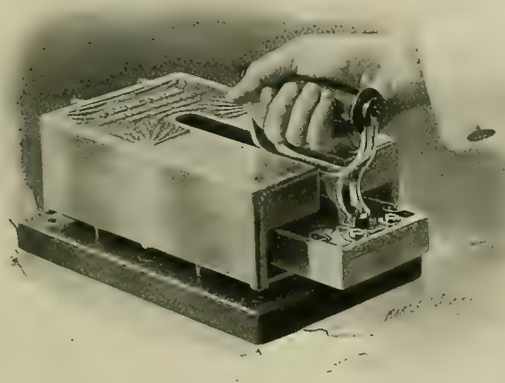

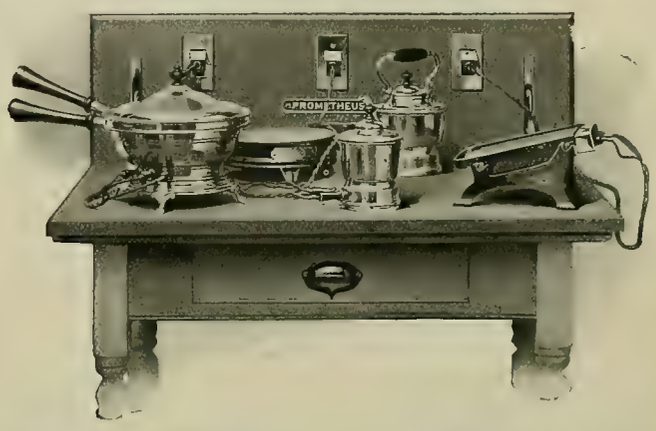

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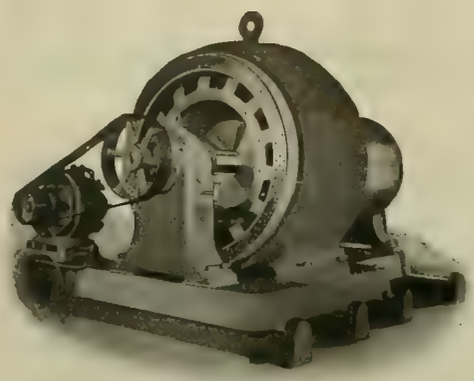
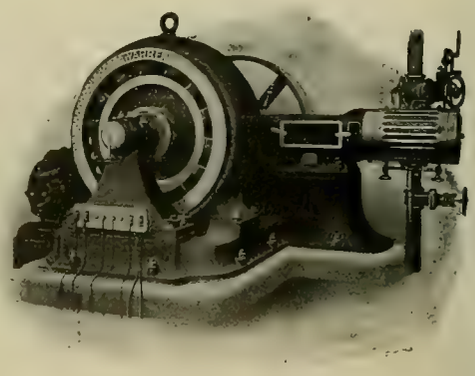


BELTED TYPE.



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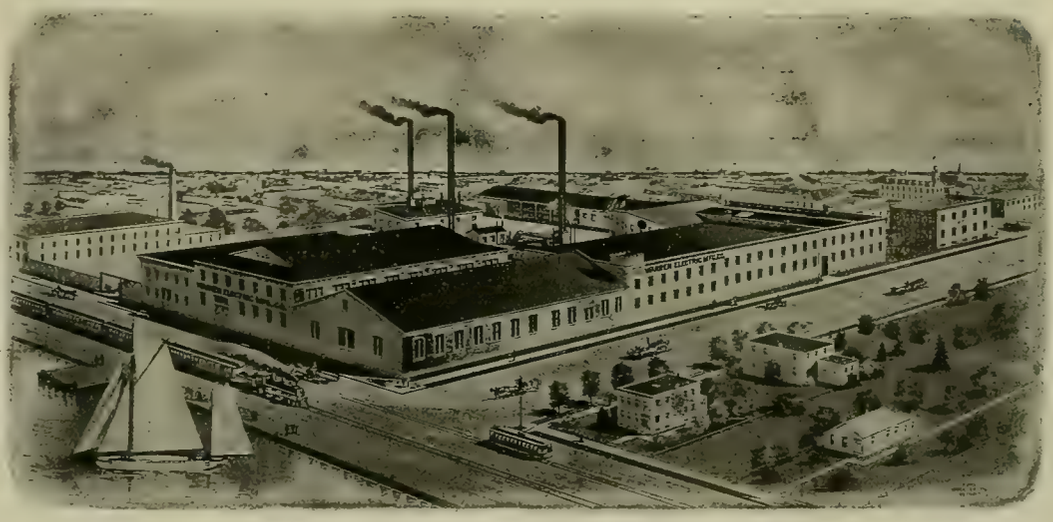

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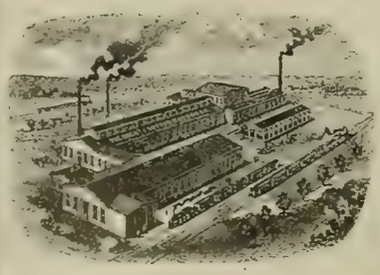

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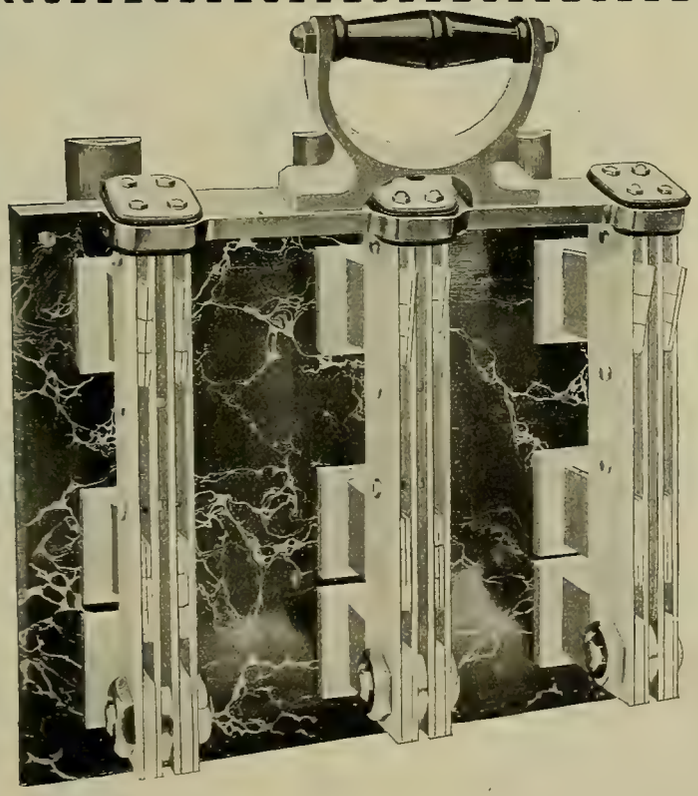

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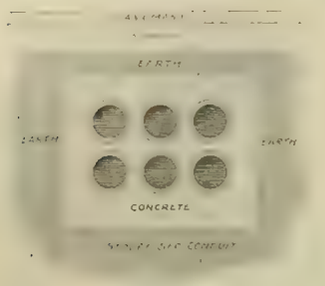

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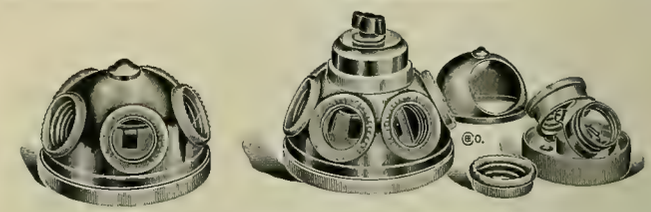

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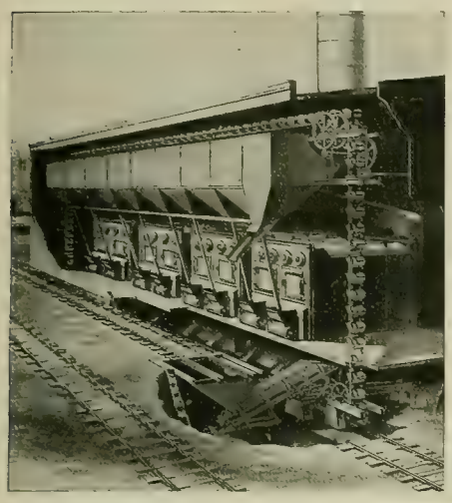

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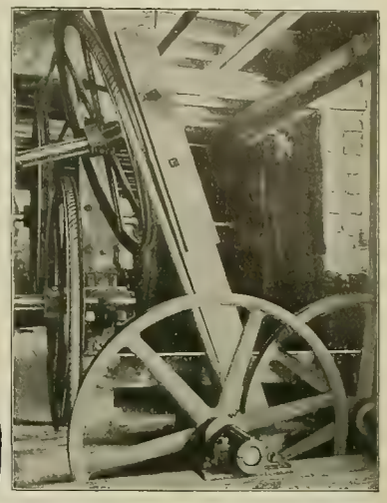

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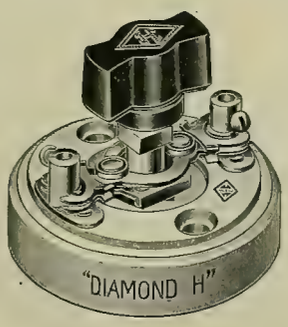

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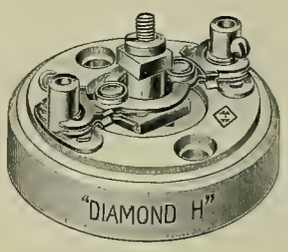

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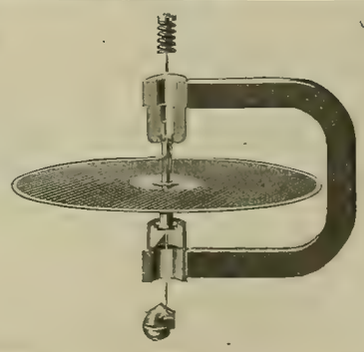

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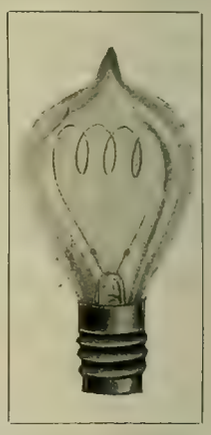

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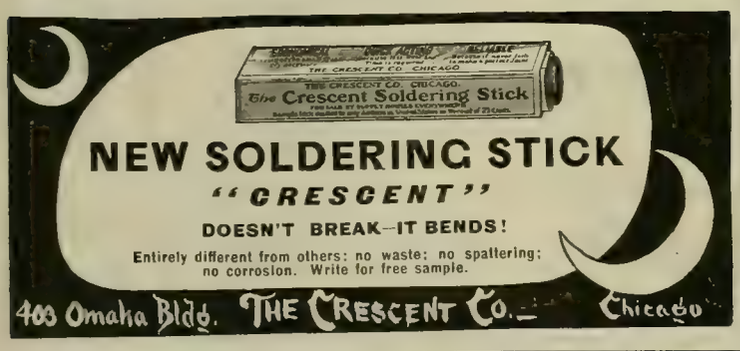

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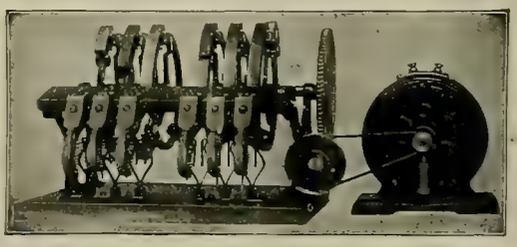

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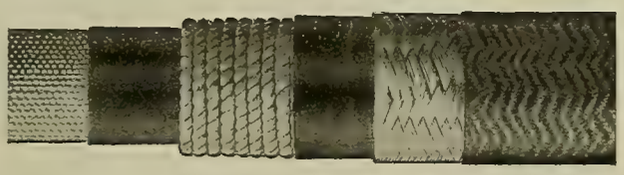

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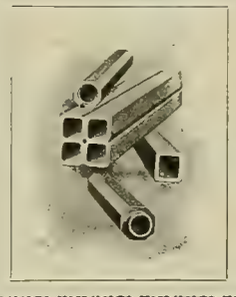

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OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,
MANUFACTURERS OF

ELECTROLYSIS PROOF CONDUIT

BITUMINIZED FIBRE. (Patented.)

OFFICES:
720 Arcade Building, Philadelphia, Pa.
822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

FACTORIES:
Chester, Pa.
Chicago, Ill.
Los Angeles, Cal.

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1 00 an insertion: additional words 2c each.*

POSITION WANTED.

As superintendent or manager of an electric-light plant by a thoroughly practical and theoretical experienced man in all branches of the work, including steam and water power: married and strictly temperate: at present superintendent of a plant. Good references can be given. Address BOX 206, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

POSITION WANTED.

In the West by a practical electrician, nineteen years' experience; fully qualified to take charge of lighting station or repair shop: thoroughly familiar with all leading systems: able to install plant or make all necessary repairs: desires a position where it may be considered permanent to the right man. Age 38, highest reference. Address F. WALTON, 5 S. Weber St., Colorado Springs, Colo.

WANTED.

One experienced incandescent lamp salesman, at once. Address THE SHELBY ELECTRIC CO., Shelby, Ohio.

WANTED.

Three experienced incandescent lamp salesmen, by an old and well-established company not in the trust. Applicants will please state age, experience and salary wanted. Address BOX 199, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Competent man to take care of motors, electric cranes and wiring in large manufacturing plant. Give references, experience, and wages expected. THE FALK COMPANY, Milwaukee, Wis.

WANTED.

Two good reliable electrical supply salesmen. None but experienced men wanted. Correspondence confidential. COMMERCIAL ELECTRICAL SUPPLY CO., 1007 Market St., St. Louis, Mo.

FOR SALE.

One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¾ cut-off and 275 R. P. M. Wheels, 56x12½ Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

FOR SALE.

The City of Casselton, N. D., offers for sale at a reasonable price its Electric Light Plant. Will accept lighting for city in whole or part payment of purchase price, if desired. Plant is well equipped and doing a good business. Address all inquiries to BRUCE D. YOUELLS, City Auditor.

BELTING.

All Kinds of old belting purchased. Machinery and old material of all kinds bought.
WALSH'S SONS & CO.,
261 Washington St., Newark, N. J.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

All dynamos, motors, meters and transformers listed by this Company are at their warehouses ready for immediate delivery.

FOR SALE.

Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings), Big bargain.
2—150 K. W. General Electric monocyclic.
2—120 K. W. Westinghouse.
1—120 K. W. General Electric type A. S. 120.
12—120 K. W. General Electric type A. 120.
2— 90 K. W. General Electric type A. S. 90.
1— 90 K. W. Westinghouse.
4— 75 K. W. Wood.
6— 60 K. W. General Electric A. 60.
2— 60 K. W. Westinghouse.
Large stock of direct-current machines.
Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

REPAIRS

Motors, Dynamos, Arc Lamps, Transformers. Best Work. Best Prices.

MIDLAND ELECTRIC CO., Des Moines, Iowa.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

NOTICE.

COMPTROLLER'S OFFICE.
CITY OF NEW ORLEANS.

NEW ORLEANS, May 18th, 1903.

Pursuant to Ordinance No. 1717 N. C. S. Sealed proposals will be received at this office until the hour of 2:30 p. m., Monday, June 8th, 1903, for the construction of an electric lighting and power system for the City of New Orleans in accordance with plans and specifications on file in the office of the City Engineer. Deposit $10,000 with the City Treasurer, and his receipt enclosed with bid. Bond $100,000. Hon. W. J. Hardee, City Engineer, will furnish bidders with a blank form of proposal; no proposal will be considered unless submitted on such form. The City reserves the right to reject any and all bids.

V. TUJAGUE,
Comptroller.

ELECTRICAL BOOKS.

All Kinds.

ELECTRICIAN PUBLISHING COMPANY,
Suite 510 Marquette Bldg., CHICAGO

"All roads lead to Rome."

And all business in New York seems to tend toward

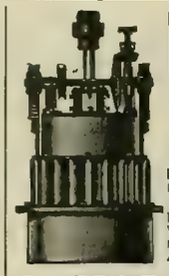
Grand Central Station.

This great building, which covers the space of four city blocks, beginning at the corner of 4th Avenue and 42d Street, is the Metropolitan terminus of the

NEW YORK CENTRAL LINES

and is the center of the hotel, residence, club and theater district of the second city of the world. To reach it see that your ticket reads by the NEW YORK CENTRAL.

A copy of the 40-page illustrated catalogue of the "Four Track Series," New York Central's books of travel and education, will be sent free, post-paid, to any address on receipt of a postage stamp, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.



M'CORMICK TURBINE.

On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, **as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.**

S. MORGAN SMITH CO., York, Pa.

ENGINES.
2—20x36x36 Buckeye, tandem.
1—16½x28x27 Buckeye, cross.
2—13x22½x21 Buckeye, cross
2—11½x7½x16 Buckeye, cross.
1—22x33 Buckeye.
1—20x40 Buckeye.
2—13x21 Buckeye.
1—18x36 Cummer, 4 valve.
1—20x42 Fitchburg Corliss.
1—18x42 Wright Corliss.
1—16x36 Frick Corliss.
2—12x36 Green Corliss.
1—13x20½x15 A. & S.
1—13x19x15 McI. & Seymour.
1—18x20 Porter Allen.
1—18x36 Wright Corliss.
2—15x20 Russell, 4 valve.
2—16x16 Erie Ball.
2—13x12 Armington & Sims.
1—9x9 New York Safety.
3—7½x7 Westinghouse.

BOILERS.
1—375 H. P. National, 150 lbs.
1—267 H. P. Abendroth & Root, 150 lbs.
1—250 H. P., B & W., 150 lbs.
1—250 H. P. Sterling, 150 lbs.
3—300 H P. Climax, 150 lbs.
2—125 H. P. tubular, 120 lbs.
2—100 H. P. tubular 100 lbs.
2—40 H. P. tubular, 100 lbs.

RY. GENERATORS.
1—250 K. W. Gen'l Electric
1—200 K. W. Westinghouse.
2—150 K. W. Edison bipolar.
1—120 K. W. C. & C., 6 pole.
1—100 K. W. C. & C., 6 pole.
4—100 K. W. Gen'l Electric.
2—75 K. W. Westinghouse.
2—60 K. W. Edison bipolar.
5—D62 K. W. T. H. bipolar.
1—35 K. W. Ft. Wayne, M. P.
1—50 K. W. Detroit.

ALTERNATORS.
All sizes in 60 & 125 cycles.

MOTORS & DYNAMOS.
All sizes and voltages.

ARC DYNAMOS.
STEAM AND ELECTRICAL MACHINERY.

THOMPSON, SON & CO.
114-118 Liberty Street,
NEW YORK CITY.

REPAIRS AND SECOND-HAND MACHINERY.

STREET RAILWAY, LIGHTING AND POWER.
Write for List of Machines.
ILLINOIS ELECTRICAL MFG. CO., PEORIA, ILL.

FOR SALE.

ENGINES.
34x60 950-H. P. International Power Corliss,
28x48 750-H. P. Harris Double Eccentric Corliss
23x60 450 H. P. George H. Corliss.
20x48 300-H P. Harris Corliss.
18x42 250-H. P. Greene Corliss, Db. Eccentrics.
14x36 135-H. P. Hamilton Corliss.
12x36 100-H. P. St. Louis Corliss.
12x36 100-H. P. Hamilton Corliss.
24x48 500-H. P. Buckeye Automatic.
15 and 23x17 300 H. P. McIntosh & Seymour Tandem Compound Railway Engine.

BOILERS.
1—325-H. P. Heine Watertube Boiler.
2—300 H. P. Heine Watertube Boilers.
2—250-H. P. Babcock & Wilcox Watertube Boil.
2—150-H. P. Babcock & Wilcox Watertube Boil.
2—72x18 Tubular boilers, 125 pounds.
3—72x16 Tubular boilers, 100 pounds.
3—66x16 Tubular boilers, 100 pounds.
2—60x18 Tubular boilers, 100 pounds.
6—60x16 Tubular boilers, 100 pounds.
1—56x16 Tubular boiler, 100 pounds.
2—54x14 Tubular boilers, 100 pounds.

HEATERS, ETC.
500-H. P. Excelsior Heater.
300-H. P. Wheeler Heater.
300-H. P. Baragwanath Heater.
200-H. P. Kroeschell Heater.
150-H. P. Berryman Heater.

WHITEHEAD MACHINERY CO., Davenport, Iowa.

FOR IMMEDIATE DELIVERY.

600 H. P. 21 and 36x30 Williams tandem compound engine.
250 H. P. 12 and 24x18 Williams tandem compound engine.
250 H. P. 13 and 20½x15 Armington & Sims cross compound.
300 H. P. 20x18 Erie Ball automatic.
75 H. P. 10x13 Frost automatic.

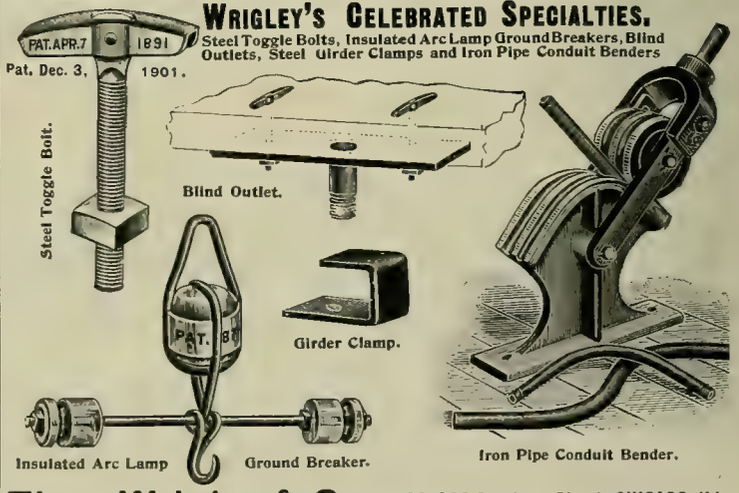
DYNAMOS.
180 K. W. and 120 K. W., G. E., 60 cy. A. S. type 1,100 or 2,200 V. alternators.
120 K. W. and 60 K. W., G. E., 133 cy. 1,100 and 2,200 V. alternators.
150 K. W. Wood and 50 K. W., Siemens-Halske 60 K. W., Siemens-Halske 2,000 V. alternators.
200 H. P. Edison 200 V. motor.
Direct current 110 V. generators, all sizes.

Write for complete stock list No. 51.

ILLINOIS MAINTENANCE COMPANY,
1625 MARQUETTE BUILDING, - - - - - CHICAGO.

WRIGLEY'S CELEBRATED SPECIALTIES.

Steel Toggle Bolts, Insulated Arc Lamp Ground Breakers, Blind Outlets, Steel Girder Clamps and Iron Pipe Conduit Benders



Thos. Wrigley & Co. 300-306 Dearborn Street, CHICAGO, ILL.

CHICAGO EDISON COMPANY REPAIR SHOPS

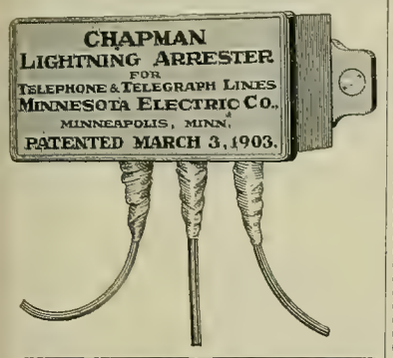
76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.

Machine and Carpenter Work of All Kinds Correspondence Solicited.

OPEN DAY AND NIGHT.

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.



A wireman always finds

SIX GOOD

"P=K"

250 VOLT

Attachment Plugs out of every half-dozen.

THERE ARE NO BROKEN CAPS.

H. T. PAISTE CO.,

Chicago. Philadelphia. New York.

GOT A CATALOG?

SENT UPON REQUEST.

SENT UPON REQUEST.

When in search of a position advertise in the WESTERN ELECTRICIAN.

The Franklin Model Shop

Experimental work for inventors; anything in metal from a single piece to a complete working model. Apparatus for colleges. Exhibition models. Introduction samples of patented articles. Special tools for making metal novelties. Inventions perfected. Drawings and designs worked out from inventors' ideas. Send for circular 16.

PARSELL & WEED,
129-131 W. 31st Street, New York.

ROBT. FERRIS' BOOK ON METERS

IS SO SIMPLE THAT ONE WONDERS AT THE COURAGE OF THE AUTHOR

IT TELLS JUST WHAT SOME PEOPLE THINK THEY KNOW.

Written expressly for the men who handle the pliers.
Sent prepaid on receipt of $1.00. Address

ELECTRICIAN PUB. CO.,
510 Marquette Bldg., CHICAGO.

APPARATUS

For Central Station and Power House Equipment

A three hundred kilowatt alternating unit, consisting of one 300 K. W. Stanley, two-phase, 60-cycle, 2,400-volt alternator, directly connected to a 16-32x24 McIntosh, Seymour & Co. vertical cross-compound engine.

ALTERNATORS.

One 250 K. W. General Electric, 2,400 volts, 50 cycles, three-phase.
One 200 K. W. General Electric, 2,300 volts, 40 cycles, three-phase.
One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 180 K. W. Westinghouse 2,200 volts, 60 cycles two-phase.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase.
One 150 K. W. Stanley, 1,100-2,200 volts, 133 cycles, two-phase.
Two 120 K. W. General Electric, 1,040 volts, 125 cycles, single-phase.
One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 75 K. W. Stanley, 1,200-2,400 volts, 133 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
One 45 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase.

RAILWAY GENERATORS 500-550 VOLTS.

Two 500 K. W. General Electric, 6-pole, speed, 300 R. P. M.
Two 300 K. W. General Electric, 4-pole, speed, 400 R. P. M.
Two 225 K. W. General Electric, 6-pole, speed, 465 R. P. M.
One 200 K. W. Westinghouse, 6-pole, speed, 510 R. P. M.
Two 200 K. W. General Electric, 4-pole, speed, 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed, 535 R. P. M.
One 110 K. W. Eddy, 4-pole speed, 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed, 650 R. P. M.
One 100 K. W. Walker, 4-pole, speed, 750 R. P. M.
Two 100 K. W. Edison, bi-polar, speed, 620 R. P. M.
One 90 K. W. Thomson-Houston, 4-pole, speed, 700 R. P. M.
One 80 K. W. General Electric, 4-pole, speed, 700 R. P. M.
Two 80 K. W. Detroit, bi-polar, speed, 620 R. P. M.
Five 62 K. W. Thomson-Houston, type D, speed, 900 R. P. M.
One 50 K. W. Brush, type Q, speed, 1,050 R. P. M.

DIRECT CONNECTED UNITS.

One 200 K. W. Westinghouse, 8-pole, 500-550-volt generator, with 18-30x16 Westinghouse compound engine.
One 130 K. W. General Electric, 8-pole, 125-volt generator, with 12-20x16 Erie Ball tandem compound engine.
One 60 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Buffalo Forge engine. Brand new.
One 50 K. W. Commercial, 6-pole, 125-volt generator, with 8½-13x12 Armington & Sims tandem compound engine.
One 50 K. W. Eddy, 4-pole, 125-volt generator, with 13x12 Harrisburg Ideal engine.
One 50 K. W. unit, consisting of two 25 K. W. General Electric, 4-pole, 125-volt generators, with one triple expansion vertical engine.
One 30 K. W. Eddy, 4-pole, 125-volt generator, with 10x12 Watertown engine.
One 25 K. W. General Electric, 6-pole, 125-volt generator, with 9½x10 Armington & Sims engine.
Two 25 K. W. Westinghouse 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

ENGINES.

One 26x48 Harris Corliss, 500 H. P.
One 18-34x48 Cooper Corliss, cross compound, 500 H. P.
One 23x48 Harris Corliss, 400 H. P.
One 20x36 Hewes & Phillips, 200 H. P.
One 18x48 George H. Corliss, 250 H. P.
One 16x42 Providence Greene, 200 H. P.
Two 18-30x16 Westinghouse compound, 250 H. P. each.
Three 18½x18 Armington & Sims, 250 H. P. each.
One 18½x18 New York Safety, 250 H. P.
Two 10-18x20 Payne tandem compound, 150 H. P. each.
One 13-19x15 McIntosh, Seymour & Co. tandem, 175 H. P.
Two 14x13 Armington & Sims, 150 H. P.
One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
One 12x10 Westinghouse Junior, 75 H. P.
One 8x10 B. F. Sturtevant, 40 H. P.
One 7x8 Payne, 20 H. P.
Three 6x5 Westinghouse Junior, 12 H. P. each,
Two 5x4 Westinghouse Junior, 6 H. P. each.

Direct current generators and motors, 110, 220 and 500 volts.
Alternating-current motors, 60 and 125 cycles.
Brush and Thomson-Houston arc generators—all sizes.
Babcock & Wilcox and water tube boilers.
Transformers, arc lamps, street railway motor equipments.

SEND FOR BULLETINS GIVING ITEMIZED LISTS.

Charles E. Dustin Co.

11 Broadway, NEW YORK. Storehouse: ORANGEBURGH, N. Y.

We Buy or Sell

Generators and Motors

Engines and Boilers

REPAIR SHOP
OPEN DAY AND NIGHT

TELEPHONE US.

Armature Fields Rewound

FOR SALE.

GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
Two General Electric, 100 K. W., 6 pole.
Six Edison, No. 60, 175 K. W.
Six T. H., D62.
One Edison No. 20, 60 K. W.

GENERATORS—110 Volts.

Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
Four 60 K. W. Edison.
Two 46 K. W. Edison.

ALTERNATING GENERATORS.

One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
Two 100 K. W., G.E. 3 phase, 60 cycle generator, complete.
Two 100 K. W., G. E., 1100 volts monocyclic, complete.
One 60 K. W., Westinghouse, 1100 volts.
One 35 K. W., Westinghouse, 1100 volts, complete.

STREET CAR EQUIPMENT.

One hundred and eighty 25 H. P. motors, new and complete with pinions, gear and gear cases.
One hundred and eighty "K" Controllers.
Twenty-five K-2 Controllers.

ENGINES.

Six 36 and 60x60, Cooper cross-compound non-condensing, new, never shipped from factory.
One 30x54 St. Louis Corliss.
Two 24x60 Lane & Bodley, designed for rolling mill work.
One 28x60 Pennsylvania Iron Works Co.
One 20x48 Wheelock.
One 20x48 Double Wheelock.
One 20x42 Wheelock.
One 14x42 Hamilton Corliss.
Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
Five 12 and 20x16 tandem compound Ball.
Two 11 and 17x14 cross-compound Ideal.
Two 9 and 16x12 tandem compound Ball.
One 8 and 13x12 tandem compound Ball.
Three 17x18, Skinner, with air cylinders attached.
Two 16x20 Porter-Allen.
Two 15x20 Automatic Russell.
One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
One 15x15 Armington & Sims simple automatic, 270 R. P. M.
One 13½x15 Armington & Sims high speed simple automatic, 300 R. P. M.
One 14x17 Fisher, new.

BOILERS.

Four 66x18 with 66 4-inch tubes. A complete battery at a great bargain.
Three 66 x 14, with 66 4-inch tubes.
Two 72 in. x 18 ft., with 66 4-inch tubes.
Five 60x16 ft. high pressure boilers
Two Sterling Water Tube Boilers, 250 H.P. each.
Two 500 H. P. Hazelton.

FERRIS WHEEL.

One 60 ft. Ferris Wheel, electrically driven.

AT A BARGAIN — A complete Edison 3-wire plant of 300 K. W. capacity.

It will be profitable to wire or write us giving requirements of machinery wanted or for sale.

JOHN A. STEWART ELECTRIC CO.

Offices: 430 Sycamore St. Factory and Warehouse: LUDLOW, KY

CINCINNATI, OHIO.

A REVOLUTION IN FUSES!

BETTER THAN THE BEST.

ARKLESS FUSE McBRIDE MFG. CO. DETROIT, MICH.

CHEAPER THAN THE CHEAPEST.

THE McBRIDE "ARKLESS"

ABSOLUTELY SAFE, EFFICIENT, NON-ARCING.

CONFORMS WITH UNDERWRITERS' REQUIREMENTS.

POPULAR AND SUCCESSFUL BECAUSE

It gives the maximum efficiency at minimum cost.
It is especially adapted to the old open-link cut-outs—it makes them safe.
It is just the thing for tablet boards and fusible knife switches.
It is creating the greatest sensation in the trade.

MADE FOR 125 AND 250 VOLTS. FROM 6 TO 30 AMPERES.

McBRIDE MFG. CO.,
11 E. Woodbridge St., DETROIT, MICH.

Crimshaw.

Raven White Core.

Raven Black Core.

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 33 Second St.

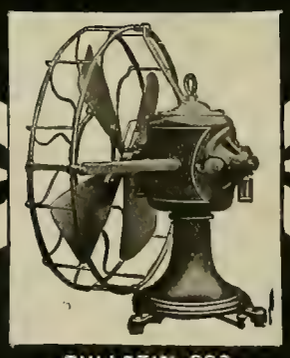
G. I. Co.
PARAGON

MECHANICALLY AND ELECTRICALLY PERFECT.

NO REPAIRS! NO NOISE! NO TROUBLE!

DESK BRACKET

TRUNION FANS



BULLETIN 262.

MAXIMUM VOLUME OF AIR

MINIMUM COST OF CURRENT

Manufactured by

General Incandescent Arc Light Co.

NEW YORK, U. S. A.

CHICAGO. CLEVELAND. CINCINNATI. ST. LOUIS. DENVER. BOSTON. SAN FRANCISCO. PHILADELPHIA.

CHICAGO OFFICE REMOVED TO 1218-19 MARQUETTE BUILDING.

C & H

MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE

(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER

Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WIS.

CHICAGO, 1232 MONADNOCK BLDG. | NEW YORK, 136 LIBERTY ST. | PITTSBURG, 319 FRICK BLDG.

HART & CO. : 1702-1704 Monadnock Bldg., CHICAGO.

"CARBON FIGURES"

416 TOWNS IN THE UNITED STATES OF 10,000 POPULATION OR OVER.

529 CENTRAL LIGHTING STATIONS IN THESE TOWNS.

43 HAVE NO ENCLOSED LAMPS.

486 HAVE ENCLOSED LAMPS.

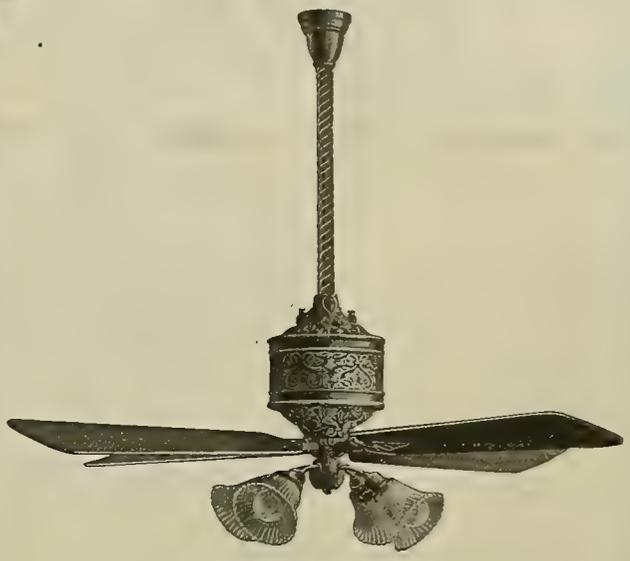
440 Using Columbia Carbons.

46 USING IMPORTED AND OTHER DOMESTIC BRANDS.

THIS TELLS THE STORY.

NATIONAL CARBON CO.
CLEVELAND, O.

Diehl Fan Motors



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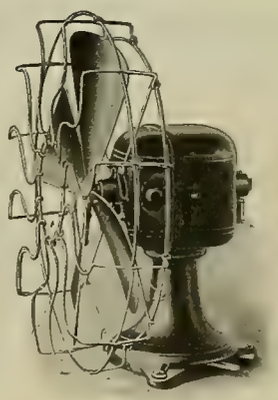

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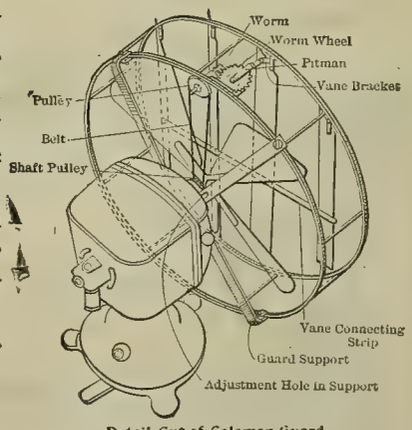

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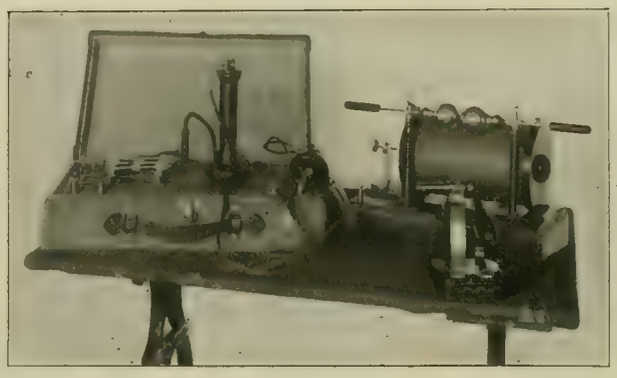

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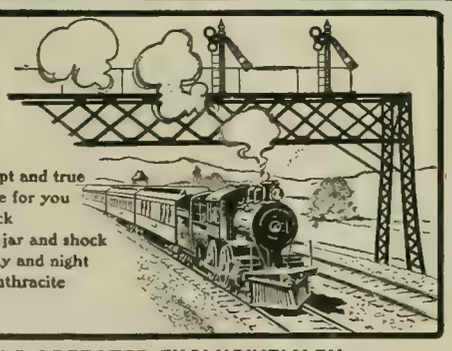

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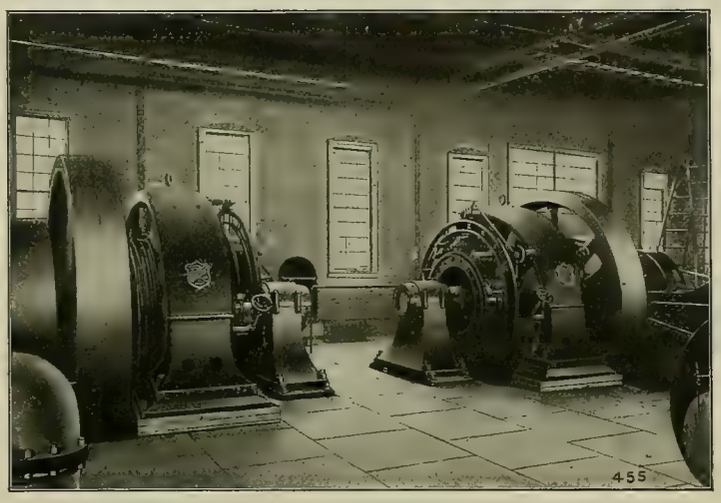

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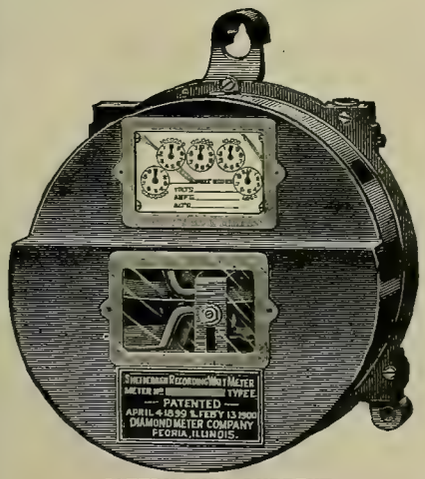

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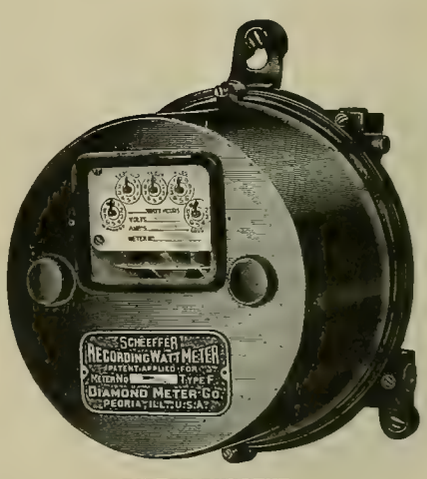

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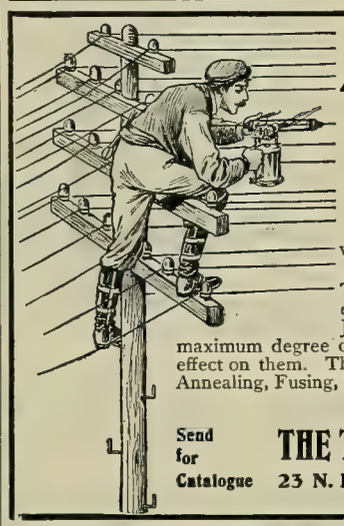

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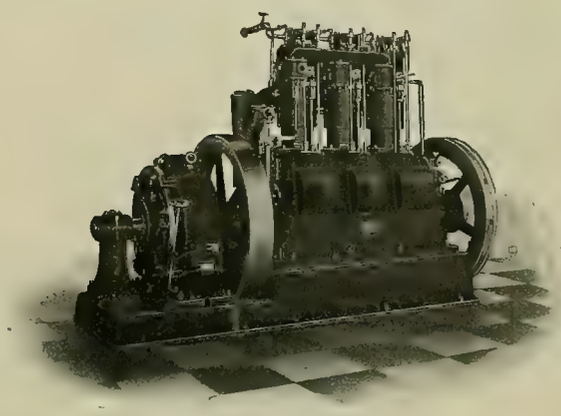

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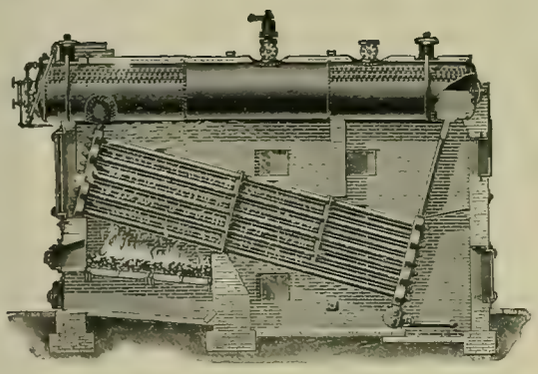

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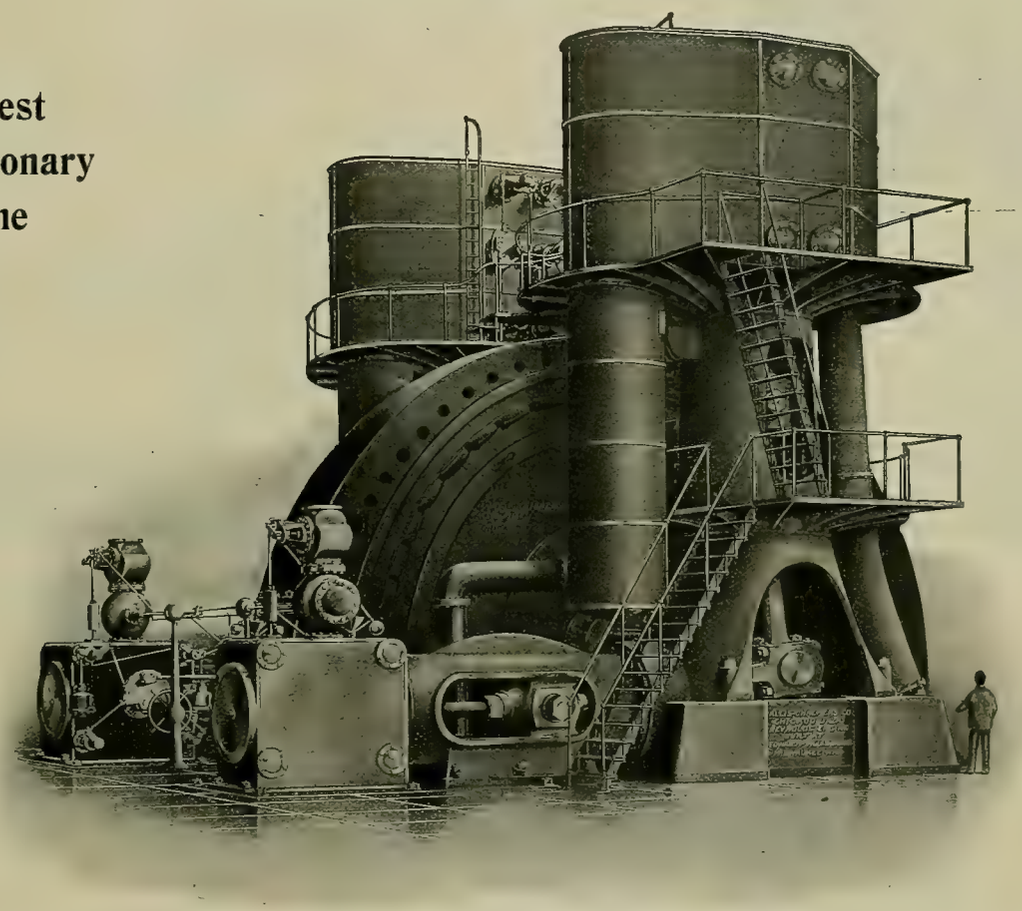

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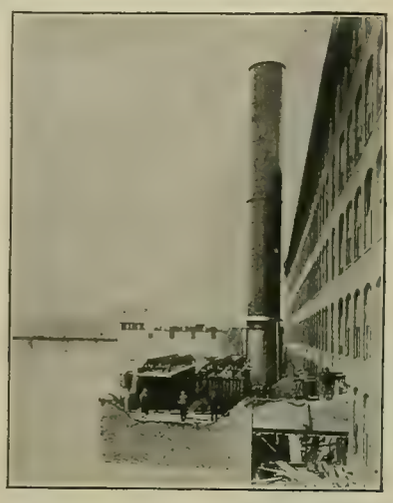

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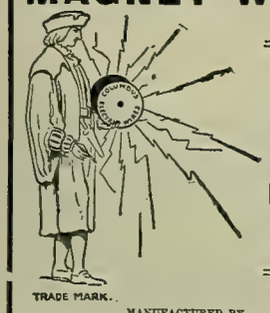

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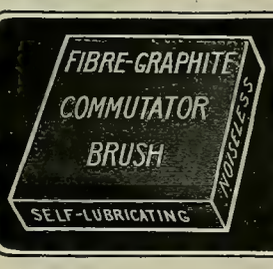

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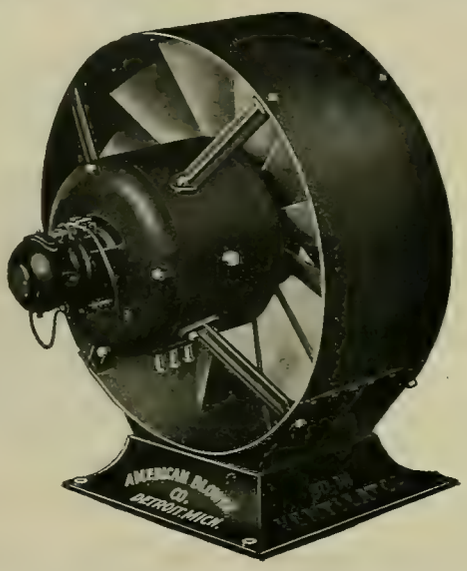

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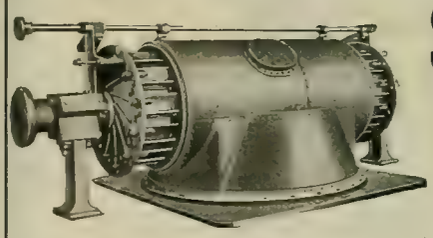

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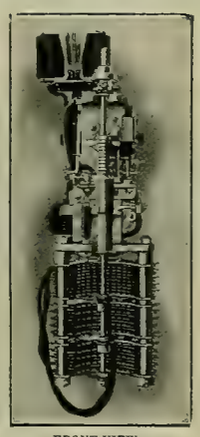
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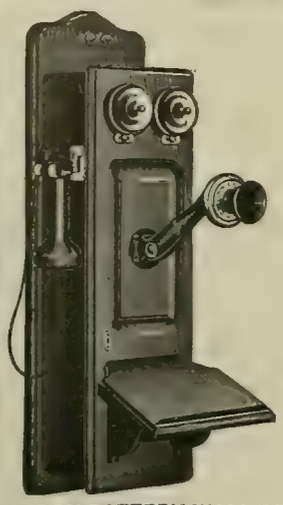

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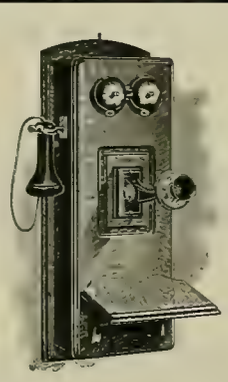

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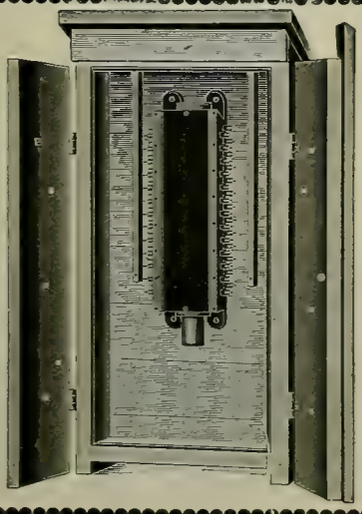

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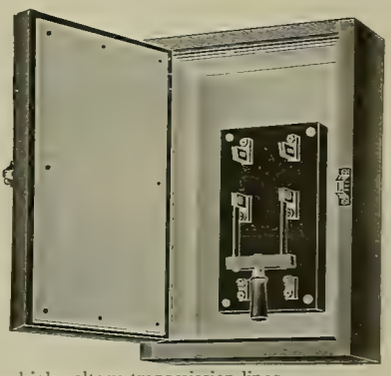

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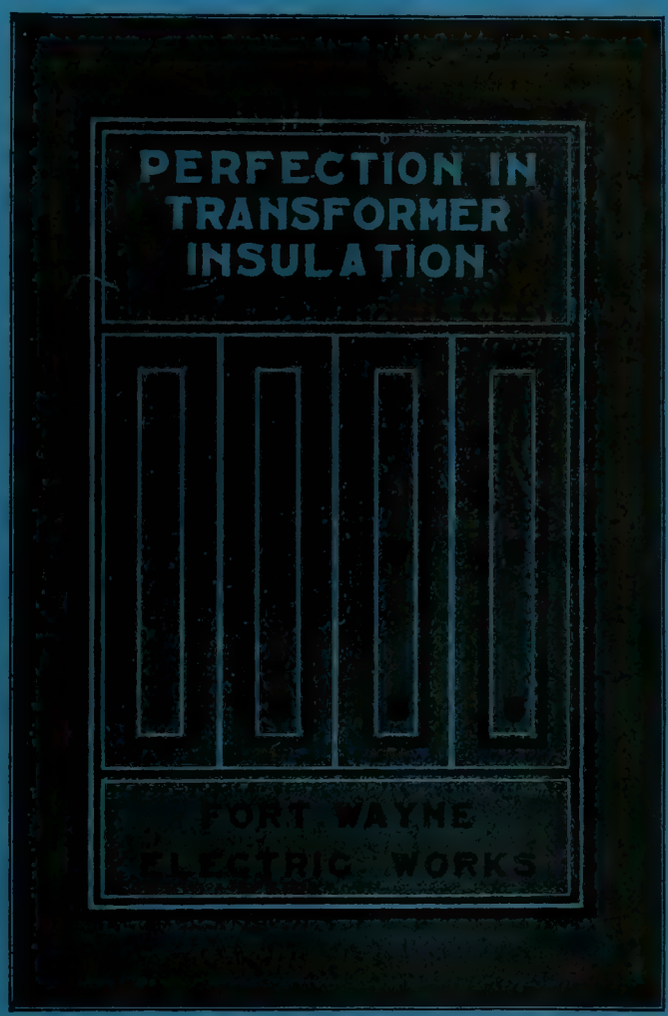

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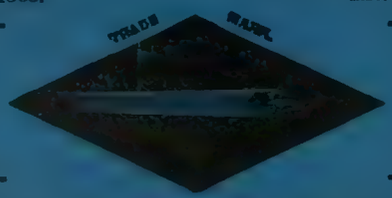

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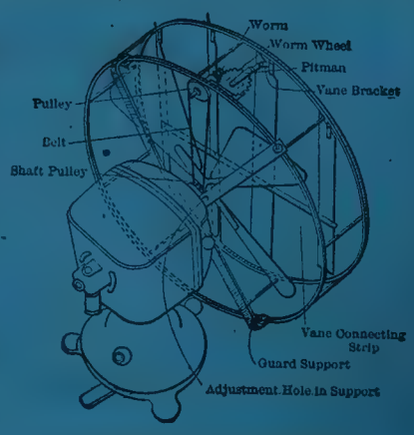

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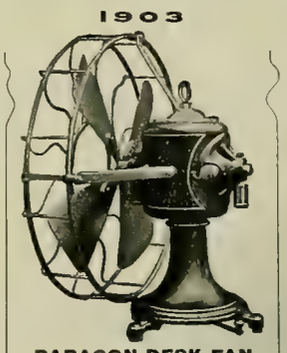

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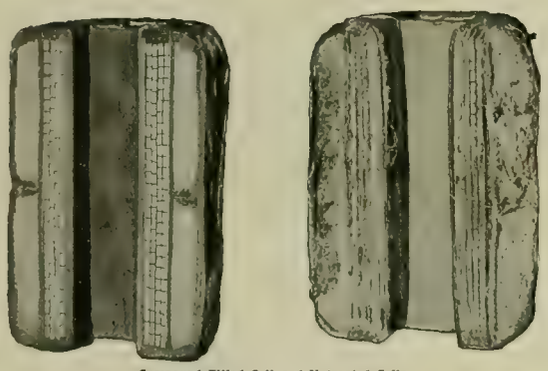
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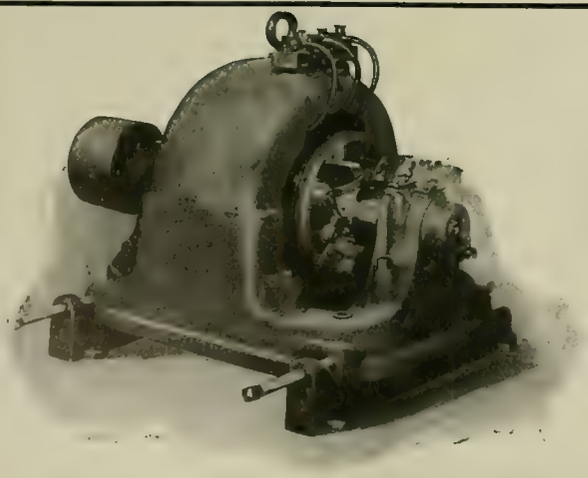

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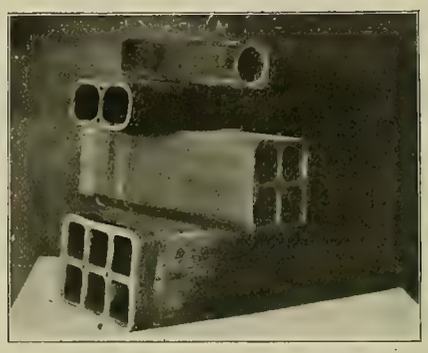

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WORKS: DEPEW, N. Y.

Bulletin No. 2, describing "GOULD BOOSTER SYSTEMS," on application.

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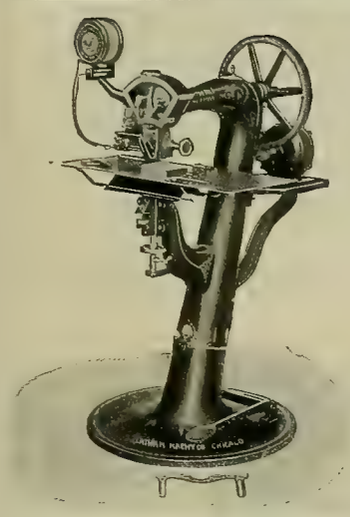

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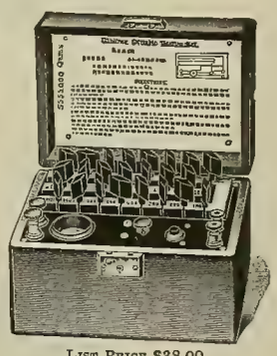

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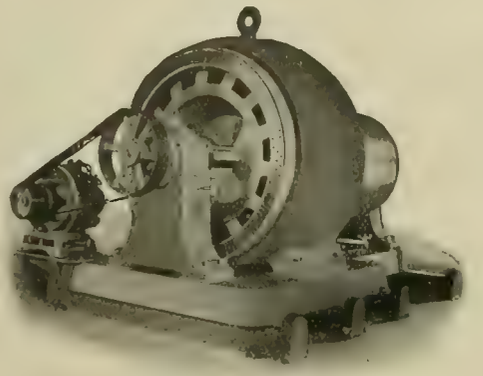

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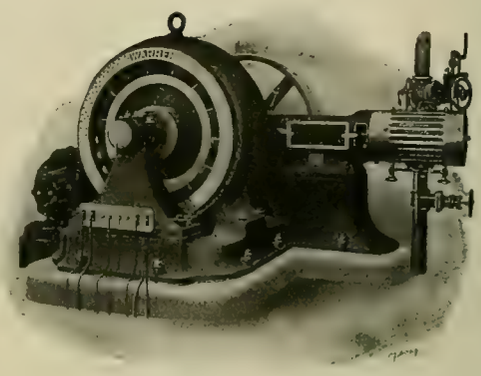

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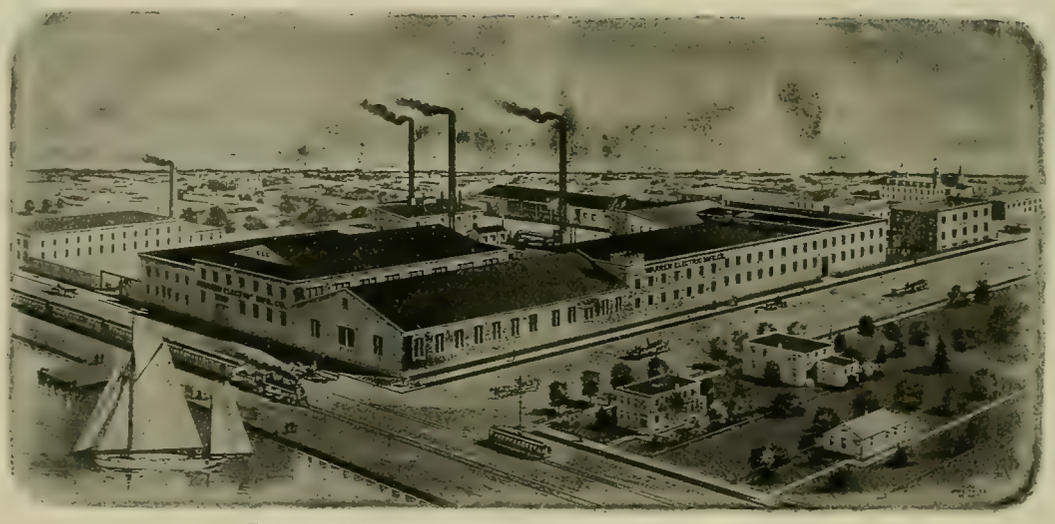

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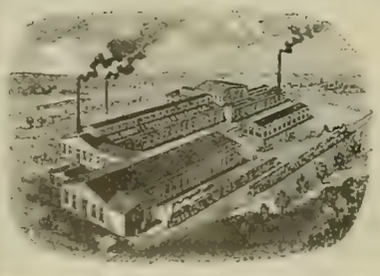

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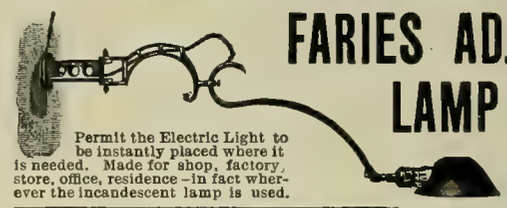

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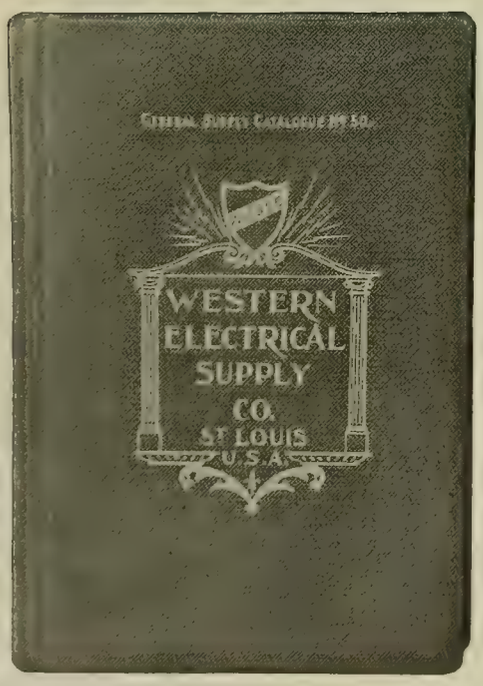

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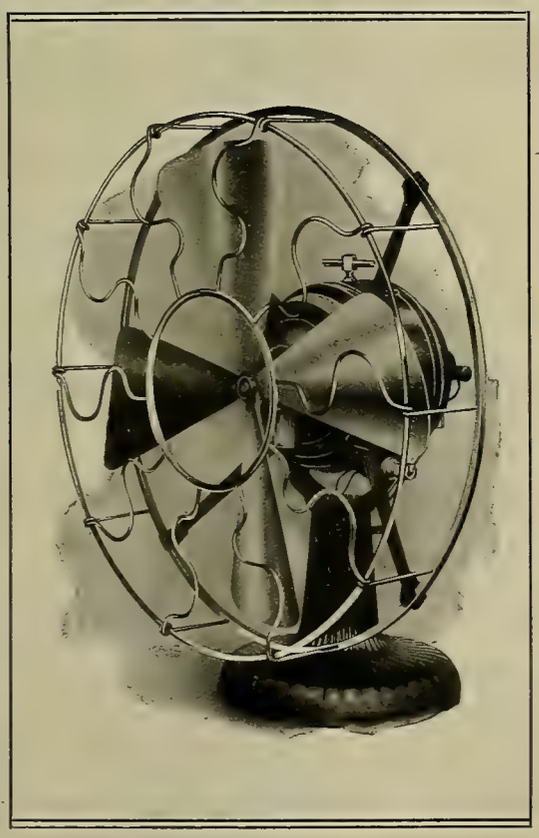

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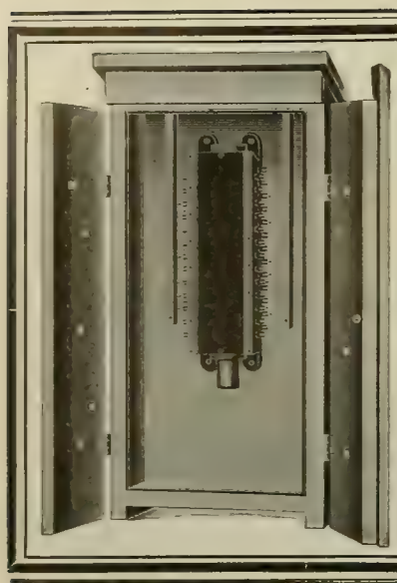

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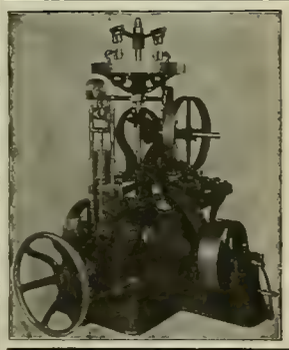

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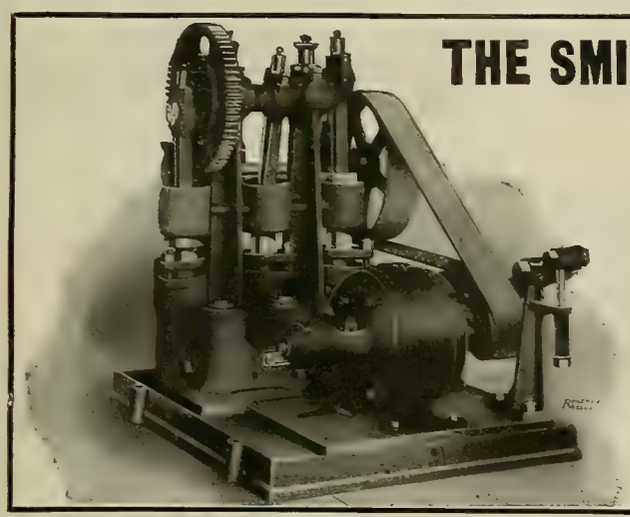

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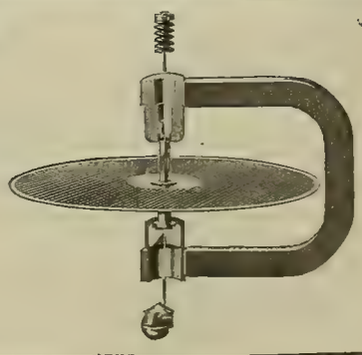

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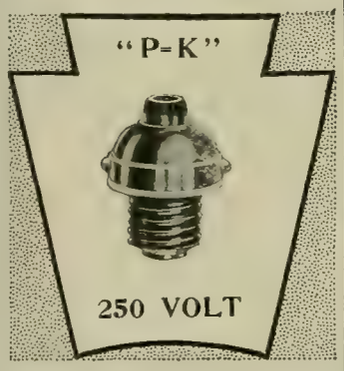

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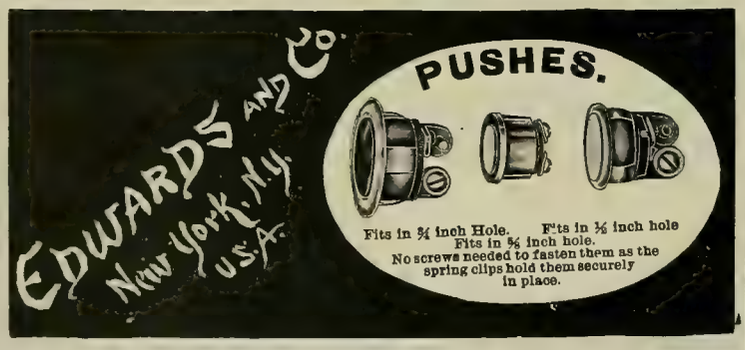

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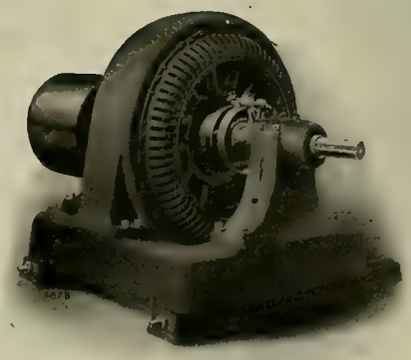

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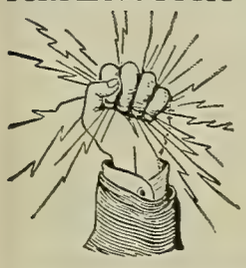

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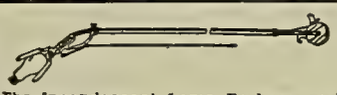

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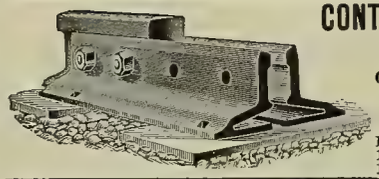

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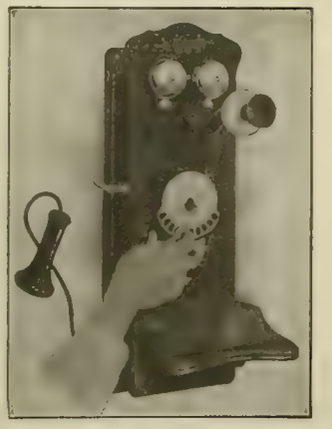

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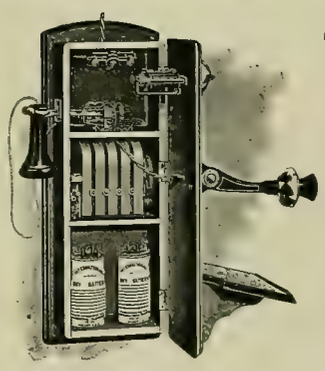

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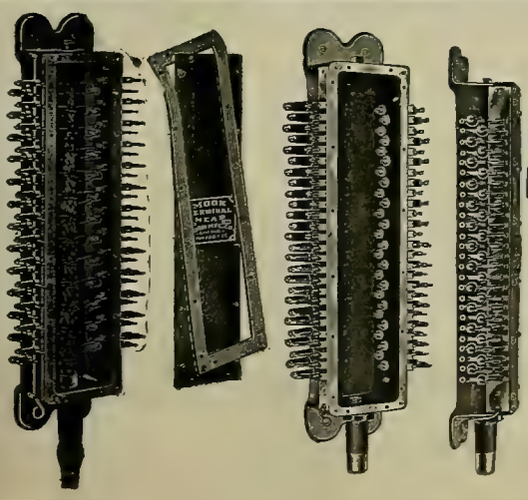

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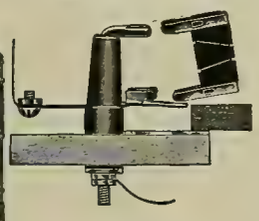

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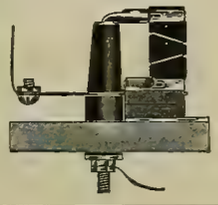

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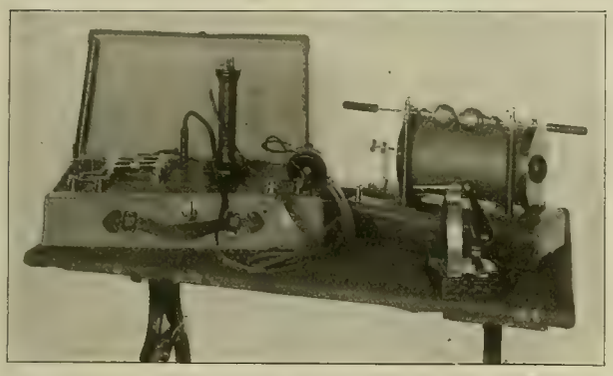

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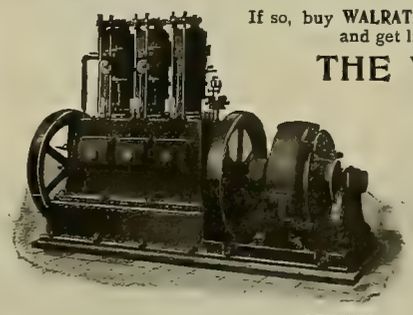

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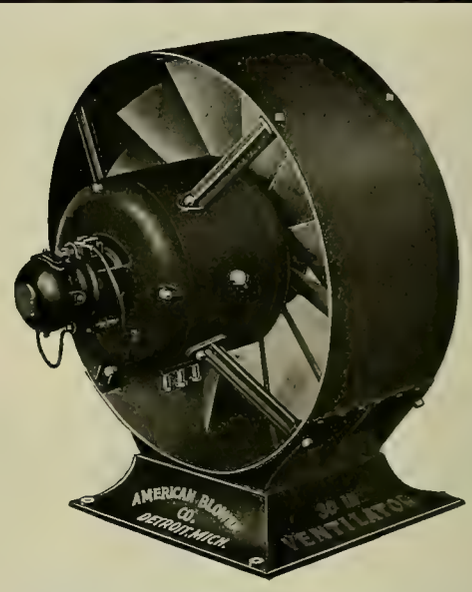

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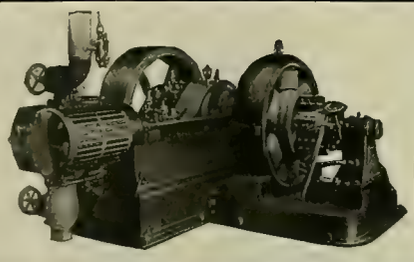

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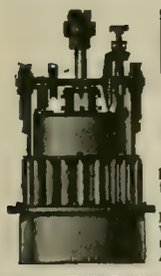

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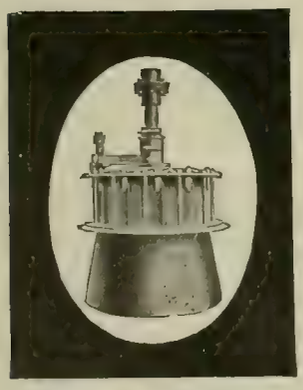

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It is electro-pneumatic.

It is operated by compressed air controlled by storage battery magnets. It is independent of line current. It is not affected by sleet, snow, ice, defective contact with third rail, or by fluctuating voltage.

Instead of blowing fuses, any excessive current will open circuit breaker.

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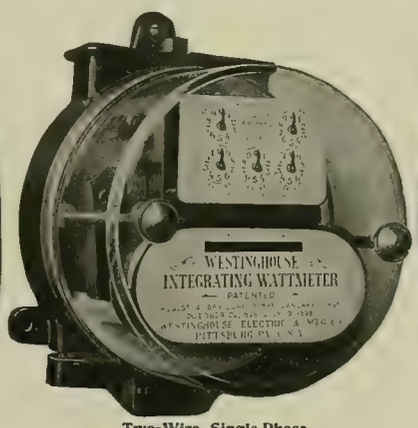

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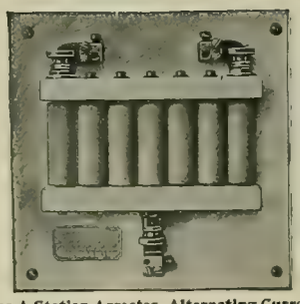
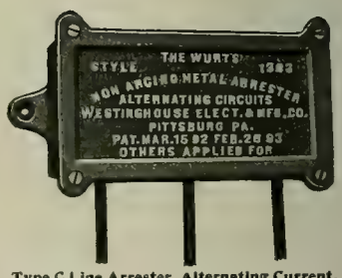


Type A Station Arrester, Alternating Current.



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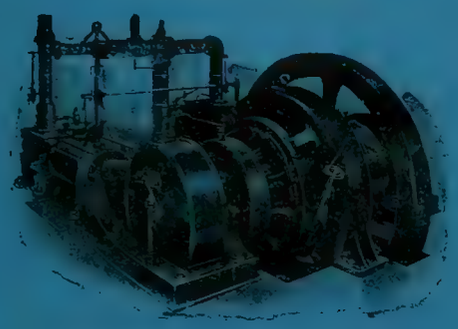

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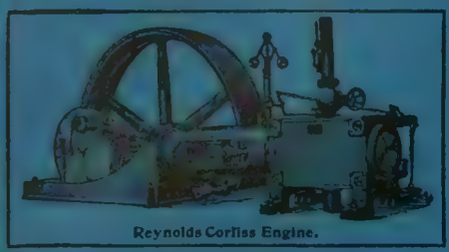
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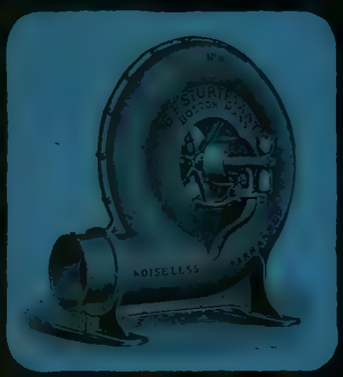

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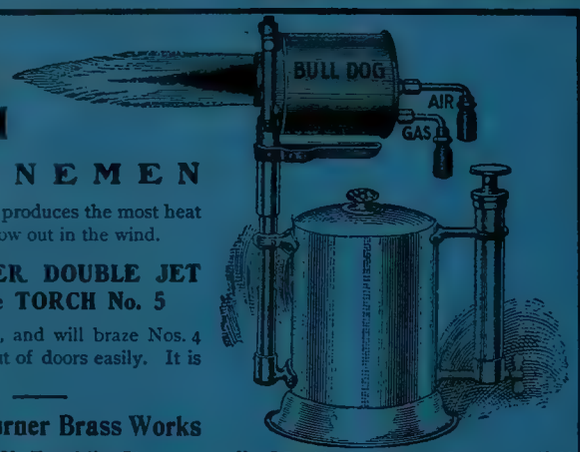

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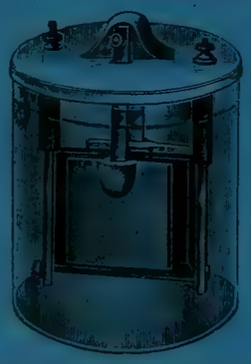

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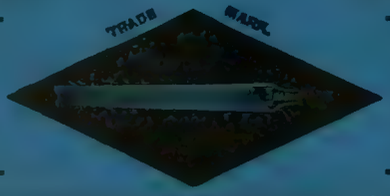

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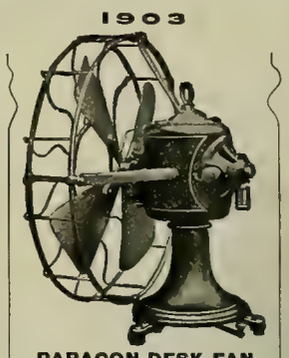

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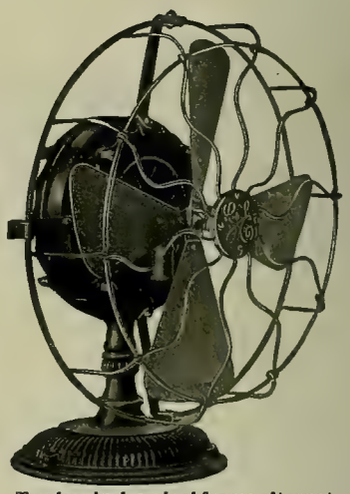
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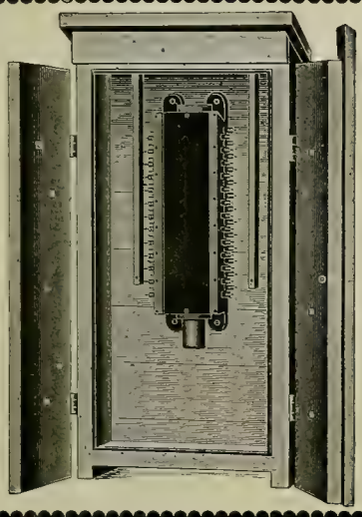

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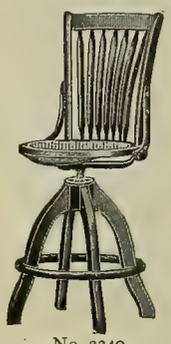

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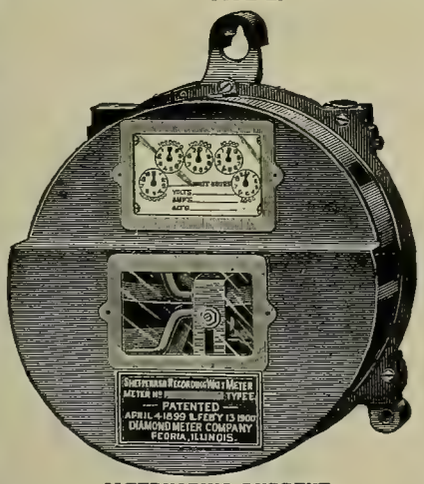

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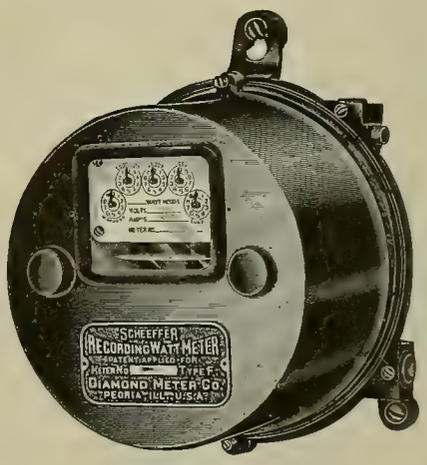

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Duncan Elec. Mfg. Co.
Electric Appliance Co.
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General Electric Co.
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Illinois Elec. Specialty Co.
Jewell Elec'l Inst. Co.
Machado & Roller.
Norton Elec'l Instrument Co.
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Stanley Instrument Co.
Wagner Electric Mfg. Co.
Western Electric Co.
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Vulcanized Fibre Co.

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Chicago Fuse Wire & Mfg.Co.
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McBride Mfg. Co.
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Western Electric Co
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Incandesent Electric Light Manipulator Co.

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Kartavert Mfg. Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
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Western Elect. Supply Co.
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Ewing-Merkle Elec. Co.
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Munsell & Co., Eugene.

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Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

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Phosphor BronzeSm.Co.,Ltd.

Platinum.
Baker & Company.

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Page & Hill Company.
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Smith Co., S. Morgan.
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Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Re-Winding-Repairs.
Chicago Edison Co.
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Schools and Colleges.
Electrical Engineer Inst.
Internat'l Corresp. Schools.
Pratt Institute.
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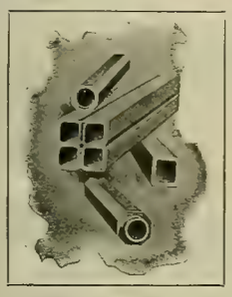

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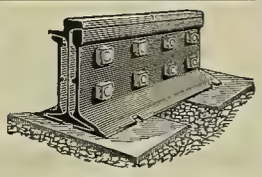

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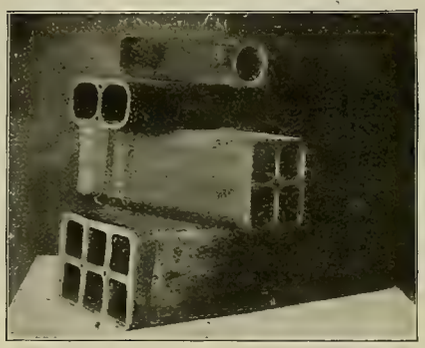

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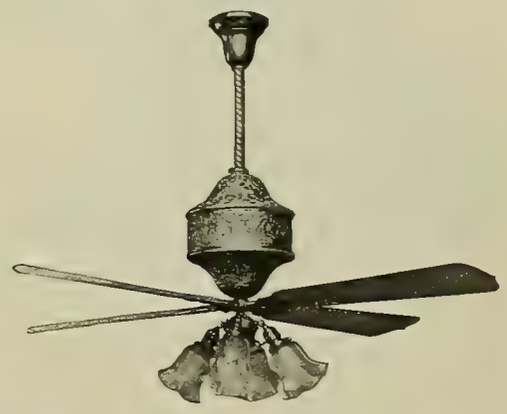

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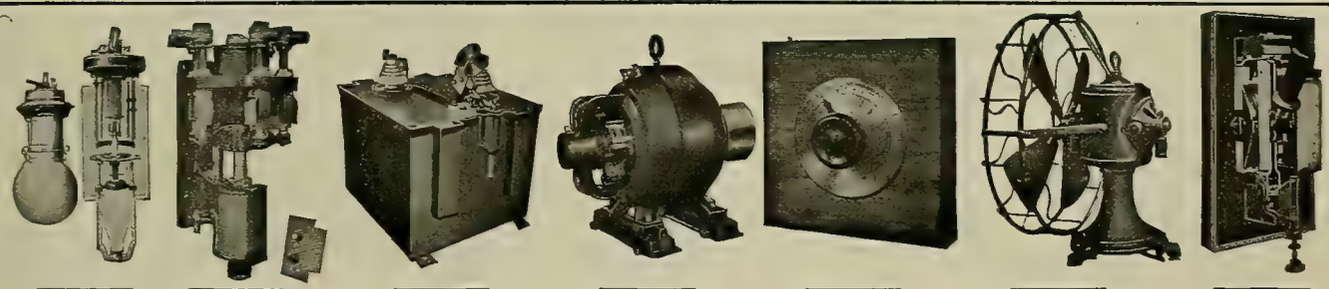

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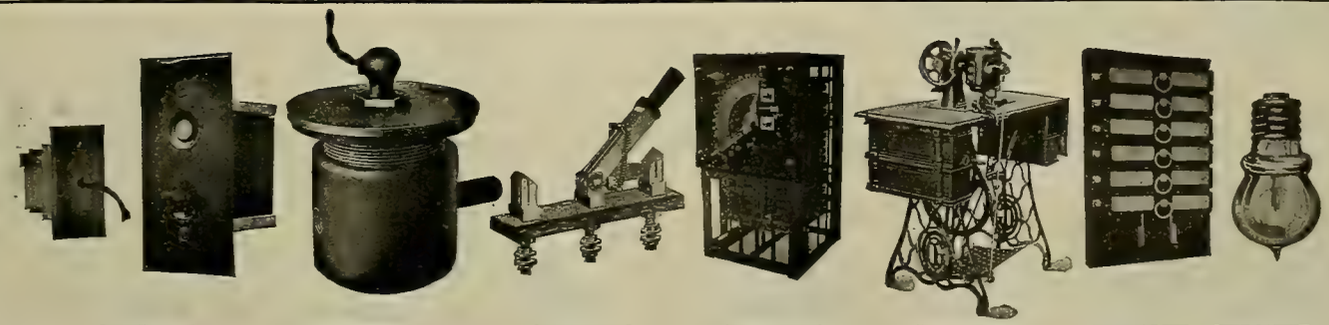

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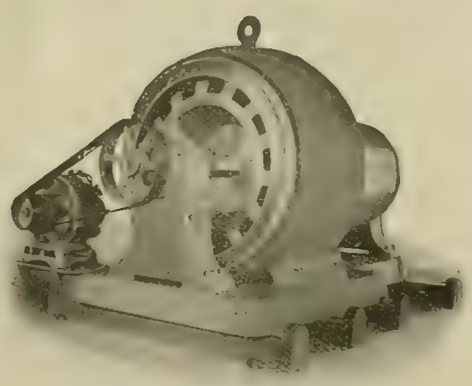

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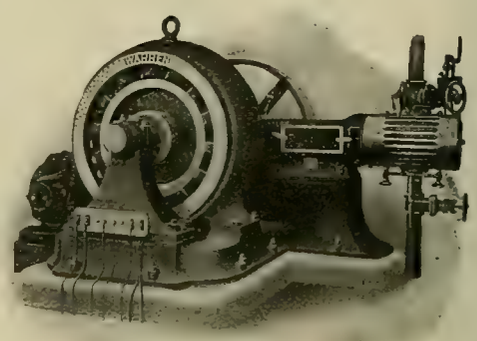

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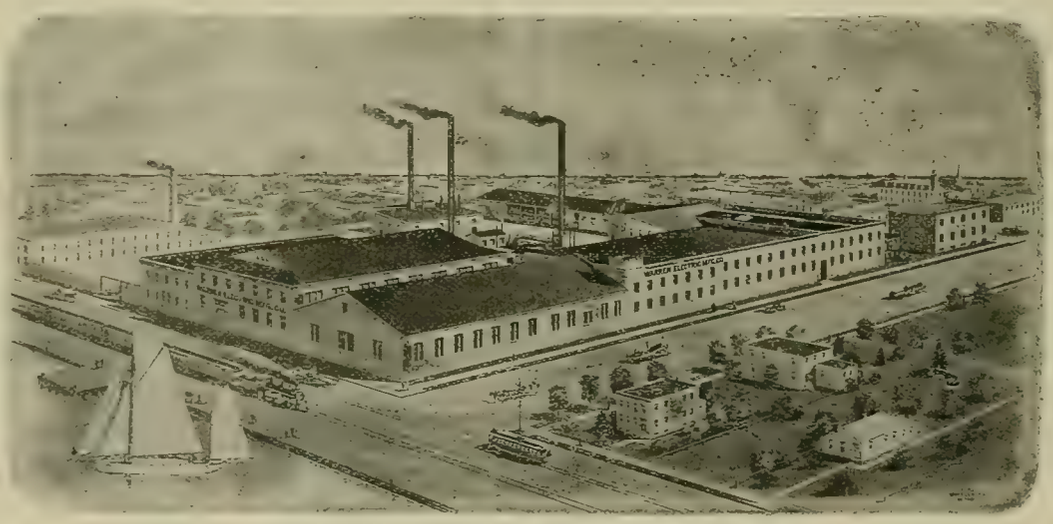

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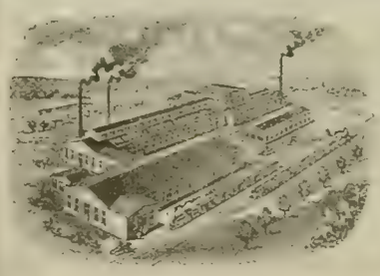

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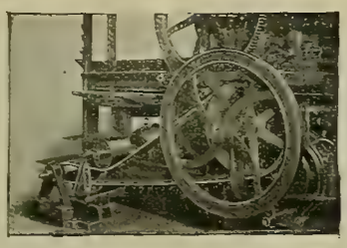

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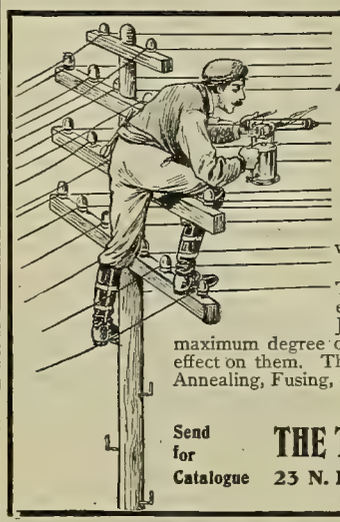

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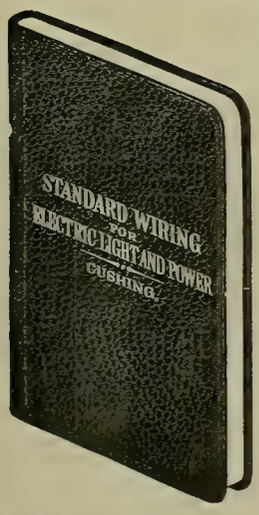

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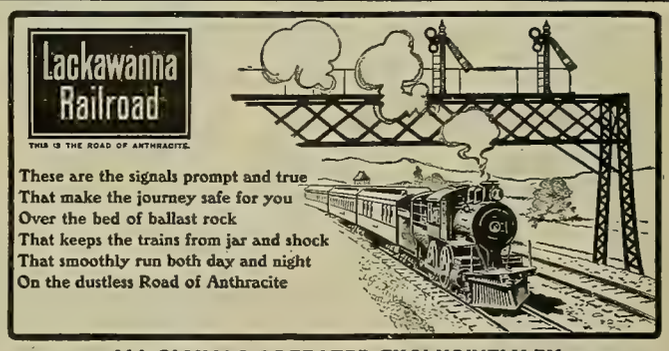

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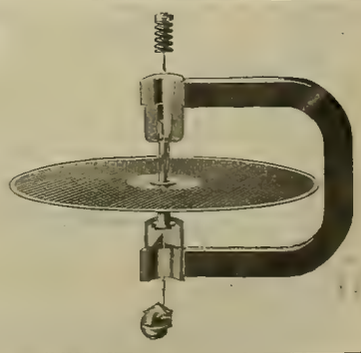

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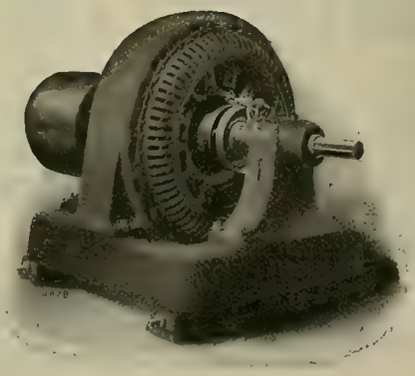

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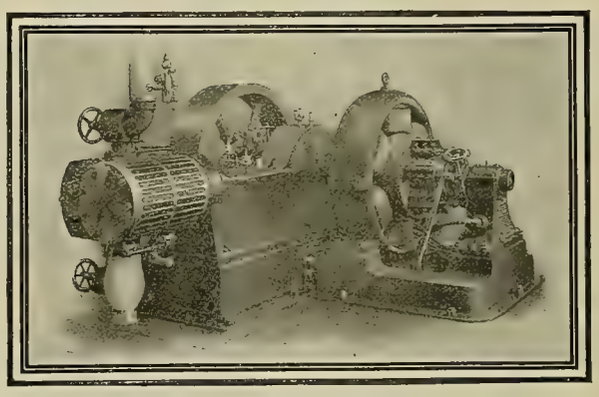

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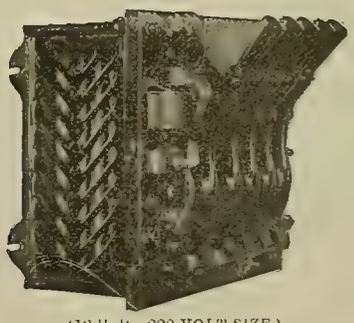

(10 H. P. 220-VOLT SIZE.)

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Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

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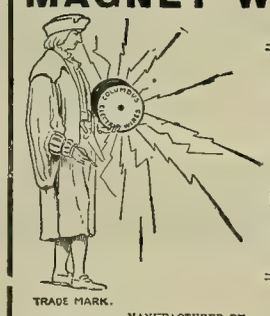

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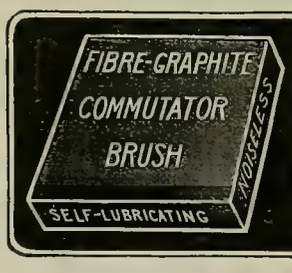

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One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase.
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One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
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One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
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Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase.

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Two 100 K. W. Edison, bi-polar, speed, 620 R. P. M.
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Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
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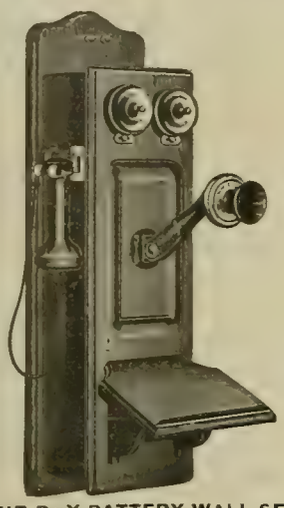

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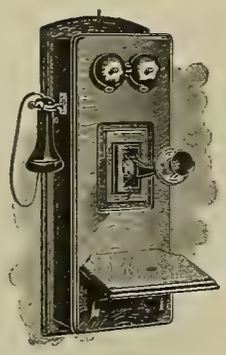

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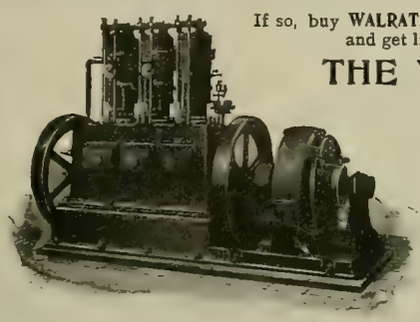

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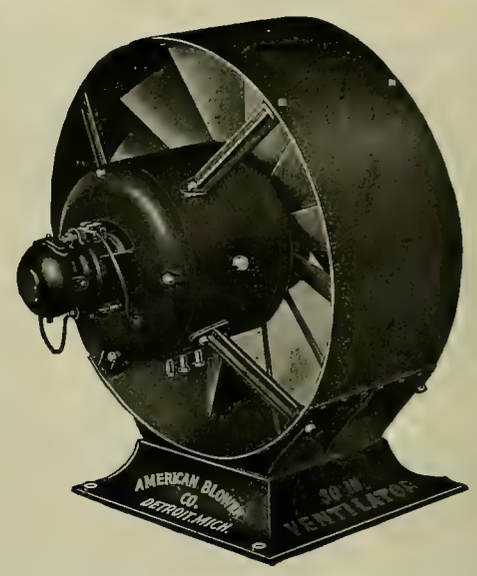

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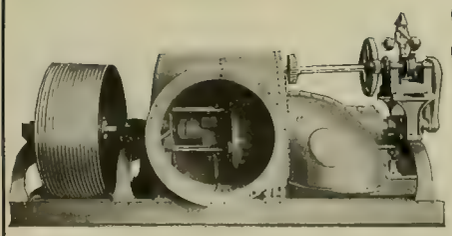

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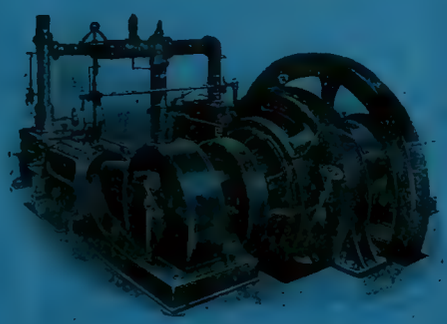

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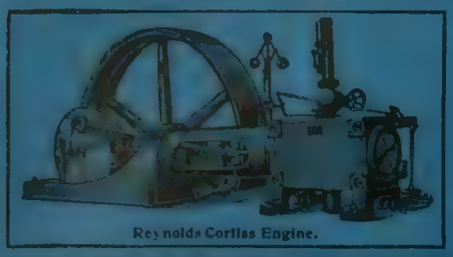
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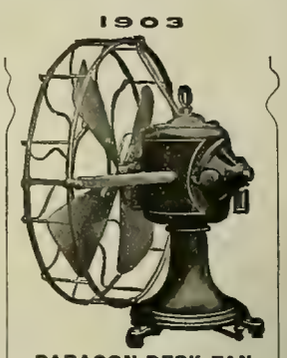

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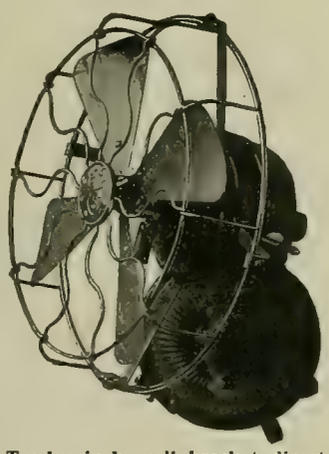
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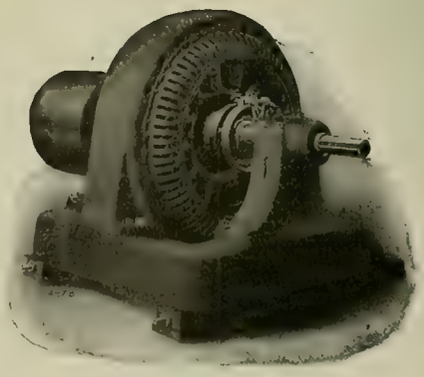
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Boats.
Racine Boat Mfg. Co.

Boiler Cleaners.
Mechanical BoilerCleaner Co.

Boiler Compounds.
Dearborn Drug & Chem. Wks.

Boilers.
Illinois Maintenance Co.
N. Y. Safety Steam Power Co.
Whitehead Machinery Co.

Books, Electrical.
Electrician Publishing Co.

Brushes.
Central Electric Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Western Electric Company.

Cable Hangers.
Western Electric Co.

Cables. (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
Consumers Carbon Co.
Dickey-Sutton Carbon Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Western Elect. Supply Co.

Castings.
Christensen Engineering Co.
New England Butt Co.
Smith Co., S. Morgan.

Chains.
Jeffrey Mfg. Co.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coils and Magnets.
Western Electric Co.

Commutator Compound.
Allen Co., L. B.
Hart & Company.
McLennan & Co., K.

Conduit and Conduits.
Alphaduct Mfg. Co.
American Conduit Company.
American Stone Conduit Co.
Camp Company, H. B.
Central Electric Co.
Electric Appliance Co.
Field, C. J.
Pittsburg Sewer Pipe & Conduit Co.
Sprague Electric Co.
Standard Vitrified Cond. Co.
Western Elect. Supply Co.

Contractors and Electric Light Plants.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Sprague Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec.&Mfg.Co.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Carolina Loc. Pin & Mica Co.
Central Electric Co.
Central Manufacturing Co.
Standard Pole & Tie Co.
Western Elect. Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Hart Manufacturing Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro. Co.

Dynamos and Motors.
Central Electric Co.
Christensen Engineering Co.
Commercial Elec'l Supply Co.
Crocker-Wheeler Co.
Dustin Co., Chas. E.
Ewing-Merkle Elec. Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Illinois Maintenance Co.
Mechanical Appliance Co.
National Electric Co.
Schureman & Hayden.
Sprague Electric Co.
Stewart Elec. Co., John A.
Stow Manufacturing Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Whitehead Machinery Co.

Economizers Fuel
Green Fuel Economizer Co.

Electric Heating Appl.
American Elec. Heater Co.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Crocker-Wheeler Company.
General Electric Co.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Elec. Power Stat'n Co.
Badt, F. B.
Baker & Co., W. E.
Bissell, G. W.
Brown, Chas. L.
Bryan, Wm. H
Burch, Edward P.
Butterfield J. F.
Carman & Co., Chas. Whitney.
Crumb & Company, W. H.
Felt & Co., Chas. E.
Humphrey, Henry H.
Jackson, D. C. & W. B.
Kohler Brothers.
Michaels & Hilly.
Orne Electric Co.
Sargent & Lundy.
Schott, W. H.
Stanton, Le Roy W.
Wilmerding, C. H.

Electrical Instruments.
(Recording and Testing.)
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Illinois Elec. Specialty Co.
Jewell Elec'l Inst. Co.
Machado & Roller.
Norton Elec'l Instrument Co.
Pignolet, L. M.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Plating Mach'y.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.

Engines, Gas and Gasoline.
Lowell Model Co.
Marinette Iron Wks. Mfg. Co.

Engines, Steam.
Allis-Chalmers Company.
Buffalo Forge Co.
Dustin Co., Chas. E.
Illinois Maintenance Co.
N. Y. Safety Steam Power Co.
Stewart Elec. Co., John A.
Sturtevant Co., B. F.
Whitehead Machinery Co.

Fans and Fan Motors.
American Blower Company.
Buffalo Forge Co.
Central Electric Co.
Crocker-Wheeler Company.
Diehl Manufacturing Co.
Edison Mfg. Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Sprague Electric Co.
Sturtevant Co., B. F.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Financial Institutions.
Royal Trust Company.

Fire Extinguishers.
Monarch Fire Appliance Co.

Fixtures, Gas and Elec.
Bearaslee Chandelier Mfg. Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Buffalo Forge Co.
Sturtevant Co., B. F.

Fuses and Fuse Wire.
Central Electric Co.
Chicago Die & Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Electric Appliance Co.
McBride Mfg. Co.
Western Electric Company.
Western Elect. Supply Co.

Globes, Reflectors and Shades.
American Refl. & Lighting Co.
Faries Manufacturing Co.
Phœnix Glass Co.
Western Electric Co.
Western Elect. Supply Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Heating and Ventilating Apparatus.
American Blower Company.
Buffalo Forge Co.
Sturtevant Co., B. F.

Holders, Inc. Lamps.
Incandesent Electric Light Manipulator Co.

Inspection & Insurance.
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
New England Butt Co.

Insulators and Insulating Materials.
Akron Smoking Pipe Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Inc. Arc Light Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Standard Vitrified Cond. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lamps, Arc.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Nernst Lamp Co.
Osborn-Morgan Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economical Elec. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Independent Incan. Lamp Co.
Nernst Lamp Co.
Phelps Company.
Rooney-Westbury El. Lmp. Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sterling Electrical Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

Lamps, Nernst.
Commercial Elec. Supply Co.
Nernst Lamp Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Minnesota Electric Co.
Western Electric Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnet Steel.
Leslie & Co., A. C.

Magnet Wires.
(See Wires and Cables.)

Manufacturers' Agent.
Raymond III, Francis.

Mechanical Draft.
American Blower Company.
Buffalo Forge Co.
Sturtevant Co., B. F.

Mica.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Name Plates.
Turner Brass Works.

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

Phosphor Bronze.
Phosphor BronzeSm.Co., Ltd.

Platinum.
American Platinum Works.
Baker & Company.

Poles and Ties.
Beidler & Co., Francis.
Berthold & Jennings.
Brooks, Hall L.
Carney Bros. Co.
Chicago Lumber & Coal Co.
Coolidge, Marshall H.
Fowler, John H.
Fowler-Jacobs Company.
Fulmer Lumber Co., D. M.
Hopkins & Co., A. P.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Lumber Co.
Morse Cedar Co.
Mueller Company, William.
O. C. Lumber Company.
Page & Hill Company.
Pendleton & Gilkey.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Reynolds, W. T.
Standard Pole & Tie Co.
Standard Tie Company.
Sterling & Son, W. C.
Superior Cedar & Lumber Co.
Torrey Cedar Co.
Valentine-Clark Co., The.
Western Lumber & Pole Co.
Whitmore, A. E.
Worcester Co., C. H

Polish (Metal).
Hoffman, Geo. W.

Porcelain.
Akron Smoking Pipe Co.

Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Pulleys.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Schureman & Hayden.
Stewart Elec. Co., John A.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Schools and Colleges.
Electrical Engineer Inst.
Internat'l Corresp. Schools.
Pratt Institute.
Rose Polytechnic Institute.

Second-Hand Mach'y.
Dustin Co., Chas. E.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
Matthews & Bro., W. N.
Schureman & Hayden.
Stewart Electric Co., John A.
Walsh's Sons & Co.
Whitehead Machinery Co.

Slate.
Maley, Martin.
McNamara Brothers.
Monson Burmah Slate Co.
Young, A. B.

Sockets & Receptacles.
Paiste Co., H. T.
Yost Elec. Mfg. Co.

Soldering Sticks, Salts and Paste.
Allen Co., L. B.
Crescent Co.
Western Electric Co.

Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Weston Electrical Inst Co.

Springs.
American Steel & Wire Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

Supplies, General Elec.
Central Electric Co.
Chicago Edison Co.
Commercial Elec. Supply Co.
Electric Appliance Co.
Ewing-Merkle Electric Co.
General Electric Co.
Manhattan Elect'l Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Automatic Electric Co.
Central Electric Co.
Fahnestock Transmitter Co.
Farr Tel. & Const. Supply Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
Murdock & Co., Wm. J.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co.
Swedish-American Tel. Co.
Western Electric Co.
Western Elec. Supply Co.

Tools.
Klein & Sons, Mathias.
Western Electric Co.

Torches and Brazing Apparatus.
Turner Brass Works.

Transformers.
Central Electric Company.
Christensen Engineering Co
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
National Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbines, Water Wheels
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Water Wheel Governors
Replogle Governor Works.

Wireless Tel. Apparatus.
Clark Wirel. Tel. & Tel. Co., T. E.

Wires and Cables—Magnet Wires.
American Electrical Works.
Amer. Insul. Wire & Cable Co.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Columbus Ins. Wire & Brass Co.
Crescent Ins. Wire & Cbl. Co.
Electric Appliance Co.
Empire Wire Co.
General Electric Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co. J. A.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Waclark Wire Co.
Western Elec. Supply Co.
Western Electric Company.

Woodwork, Electrical.
Noblett Co., E. J.

For Alphabetical Index of Advertisements See Page 3.

THE H. B. CAMP CO.

MANUFACTURERS OF

"Camp" Standard Vitrified Clay Conduits for Underground Wires.

Installers of Complete Underground Conduit Systems.

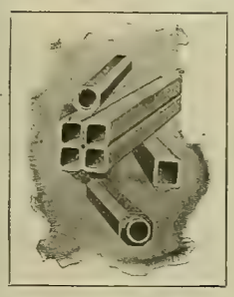
SALES OFFICES

Room 85 Hartford Building, Chicago. 170 Broadway, New York.

STONE CONDUIT

For Underground Wires. The Only Conduit that Improves with Age.

AMERICAN STONE CONDUIT CO., Suite 29 94 La Salle St., Chicago, Ill.



FIELD CLAY CONDUITS.

ALL TYPES.

Multiple Conduits Single.

Large Factories in East and West.

Moderate Prices.

Prompt Deliveries.

Write or telephone your requirements and we will submit samples and prices.

Telephone 5928 Broad. C. J. FIELD, 29 Broadway, New York.

USE

"SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE.

M. B. AUSTIN & CO.,

CHICAGO REPRESENTATIVE.

THE SAFETY INSULATED WIRE & CABLE CO.,

WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

Platinum

In Sheet or Wire for all Purposes.

SCRAP PURCHASED.

AMERICAN PLATINUM WORKS

Formerly C. F. Croselmire.

CHAS. ENGELHARD, Gen. Mgr.

251 to 255 New Jersey R. R. Ave., Newark, N. J.

ELECTROLYSIS-PROOF

UNDERGROUND CONDUIT

OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, 66,000 VOLTS.

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,

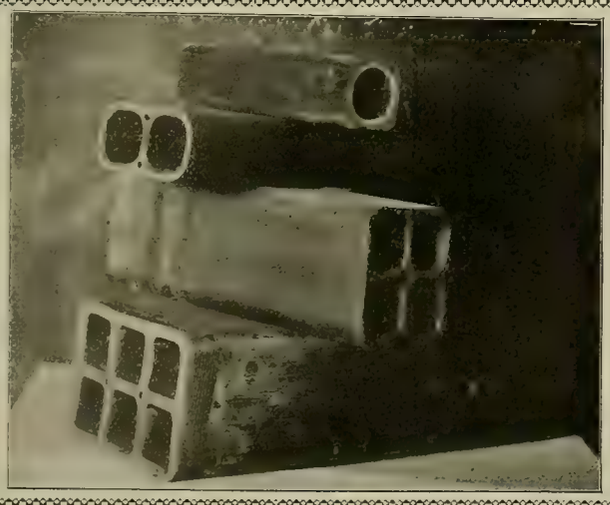
MANUFACTURERS OF

ELECTROLYSIS PROOF CONDUIT

BITUMINIZED FIBRE. (Patented.)

OFFICES:
720 Arcade Building, Philadelphia, Pa.
822 Manhattan Building, Chicago, Ill.
336 Macy Street, Los Angeles, Cal.

FACTORIES:
Chester, Pa.
Chicago, Ill.
Los Angeles, Cal.



PITTSBURG SEWER PIPE & CONDUIT COMPANY

MANUFACTURERS OF

VITRIFIED CLAY CONDUITS

IN 1, 2, 3, 4 AND 6 DUCT.

Superior conduits for underground wires a specialty.

General Office and Factory, PITTSBURG, KAN.

Branch Office and Sale Yard, 2417 E. 18th St., KANSAS CITY, MO.

Announcement

Owing to various rumors recently circulated by competitors relative to the control of this company as to its ability and willingness to carry out future contracts for Independent telephone apparatus, we feel that the Independent telephone interests which are our present and prospective customers are entitled to some statement from us.

Suit was begun by minority stockholders in this company June 5th, which will be contested and which relates to matters of no material interest to our customers as long as the company continues in business along the same satisfactory lines as formerly. We desire to assure our present and prospective customers that the business of this company will be continued in the future as in the past.

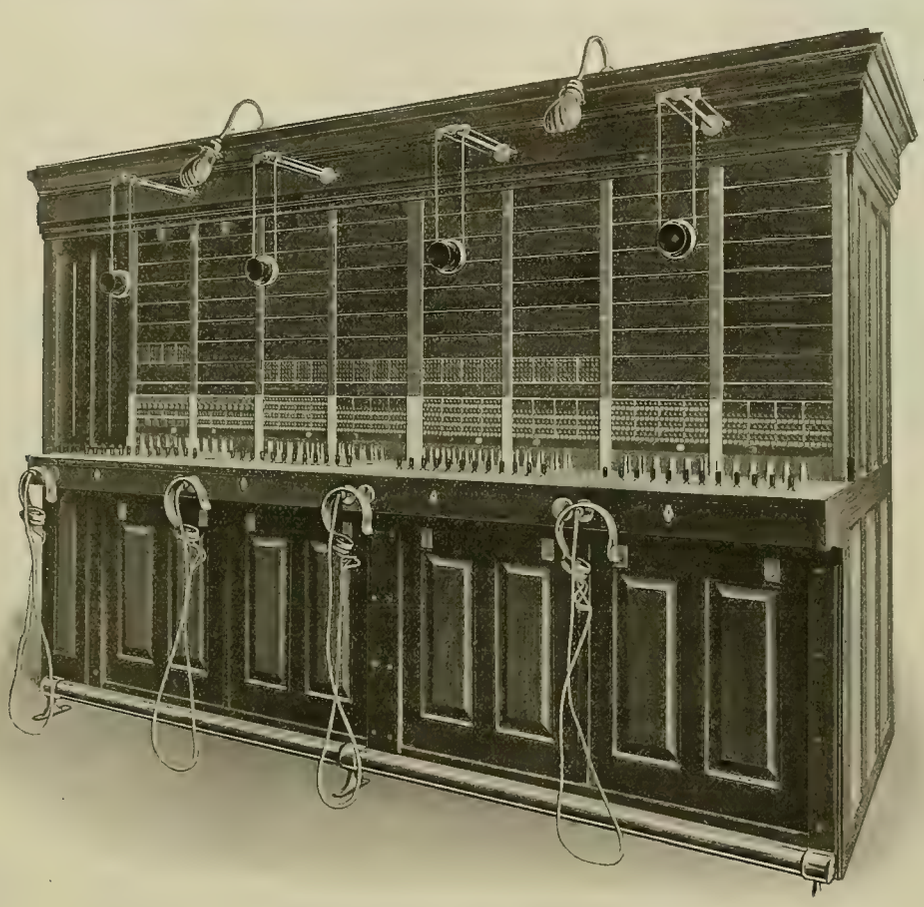
To assure customers of our entire good faith and intentions to continue in business as heretofore, we will furnish bonds to customers insuring the fulfillment of our contracts for new apparatus or for the furnishing of extensions of existing exchanges for a period of five years. Our customers will be as fully protected as ever.

Kellogg Switchboard & Supply Company

CHICAGO

THE KELLOGG SYSTEM NO EXPERIMENT

It is not necessary for the purchaser to carry on experimental work for the manufacturer when operating Kellogg systems. These systems have remained standard for over 2 ½ years, during which time the largest exchanges in this country have been equipped and show the highest efficiency in operation and lowest cost of maintenance.



STANDARD COMMON BATTERY SWITCHBOARD

The KELLOGG COMPANY is prepared to furnish complete equipment for any size exchange, large or small.

The Kellogg telephones have also long since passed the experimental stage and are now actually used as a standard of excellence.

Kellogg Switchboard and Supply Company

Green and Congress Streets, CHICAGO

346 Broadway
NEW YORK

Electric Building
CLEVELAND

Keystone Telephone Building
PHILADELPHIA

The Superiority

OF

Stromberg-Carlson Apparatus

No. 292 Cabinet

is proven when it comes to that test of all tests—service. Take the switchboards for example (our No. 292 cabinet, shown in illustration), the cabinet work (made in our own factory) is so much better finished and put together than the average board on the market that we sometimes hear the remark, "Guess you put most of your money in the cabinet."

The best evidence that we put money enough in the equipment as well is proven by the number of boards we have in use, the time they have been in use and the service they are giving.

The jacks are made of hard rubber, brass and german silver and provided with platinum contacts.

Lamp jacks, made of hard rubber, brass and german silver, mounted 5 or 10 per strip.

Keys have german silver springs and platinum contacts.

Plug shelf covered with heavy belt leather.

Relays mounted in upper part of cabinet, easily accessible.

There is nothing left undone that would tend to increase the efficiency or appearance.

Write for Bulletins.

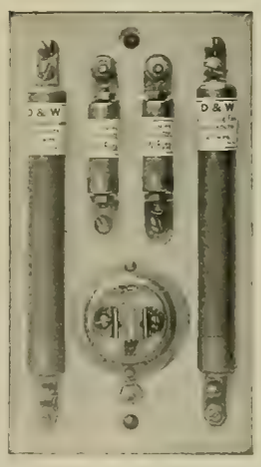
No. 1-E Railway Telephone Apparatus
No. 2-E Bridging Telephones
No. 3-E Construction Material

OTHERS TO FOLLOW

Stromberg-Carlson Telephone Manufacturing Company,

General and Eastern Sales Office,
ROCHESTER, N. Y.

Sales Department,
CHICAGO, ILLINOIS



Protect Your Telephone and Fire Alarm

With "D. & W." COMBINATION CUT-OUT.

ARRESTER ENCLOSED IN METAL CASING.

Either "AIR GAP TYPE" or our new "MOISTURE PROOF FILM."

Write for Price List No. 9 and Circular No. 102.

A FUSE, SNEAK COIL and ARRESTER MOUNTED ON ONE PORCELAIN.

D. & W. FUSE COMPANY, Providence, R. I.

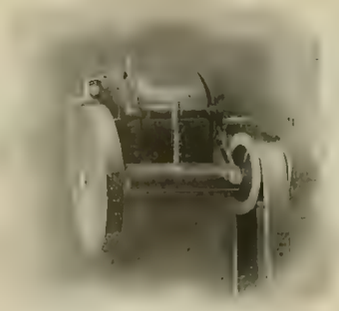
A. HALL BERRY, New York Representative, 92 William Street.

—OFFICES—

BOSTON, Pettingell-Andrews Co.
PHILADELPHIA, Western Electric Co.
CHICAGO, Central Electric Co.
NEW YORK, Western Electric Co.
ST. LOUIS, Western Electric Co.
SAN FRANCISCO, California Electrical Works.

SOME OF THE REASONS WHY

OUR MOTORS ARE BECOMING SO POPULAR AND GIVING SUCH UNIVERSAL SATISFACTION



1st—They are single phase, self-starting.
2nd—The only operation necessary to start them is to close either the primary or secondary circuit of your system by means of a double pole switch located, at any convenient point, however distant from the motor.
3rd—They require a minimum amount of attention.
4th—The cost of maintenance is negligible.
5th—The cost of installation is low, only requiring one transformer and two wires to supply current to the motor, whether on single or multiphase circuits.
6th—The transformer losses are less than with a multiphase motor.
7th—They are so constructed, of the best material, that they are always ready to run, and the most inexperienced can operate them with perfect results.

If you would know more of their salient features, write us

WAGNER ELECTRIC MFG. CO.

ST. LOUIS, MO., U. S. A.

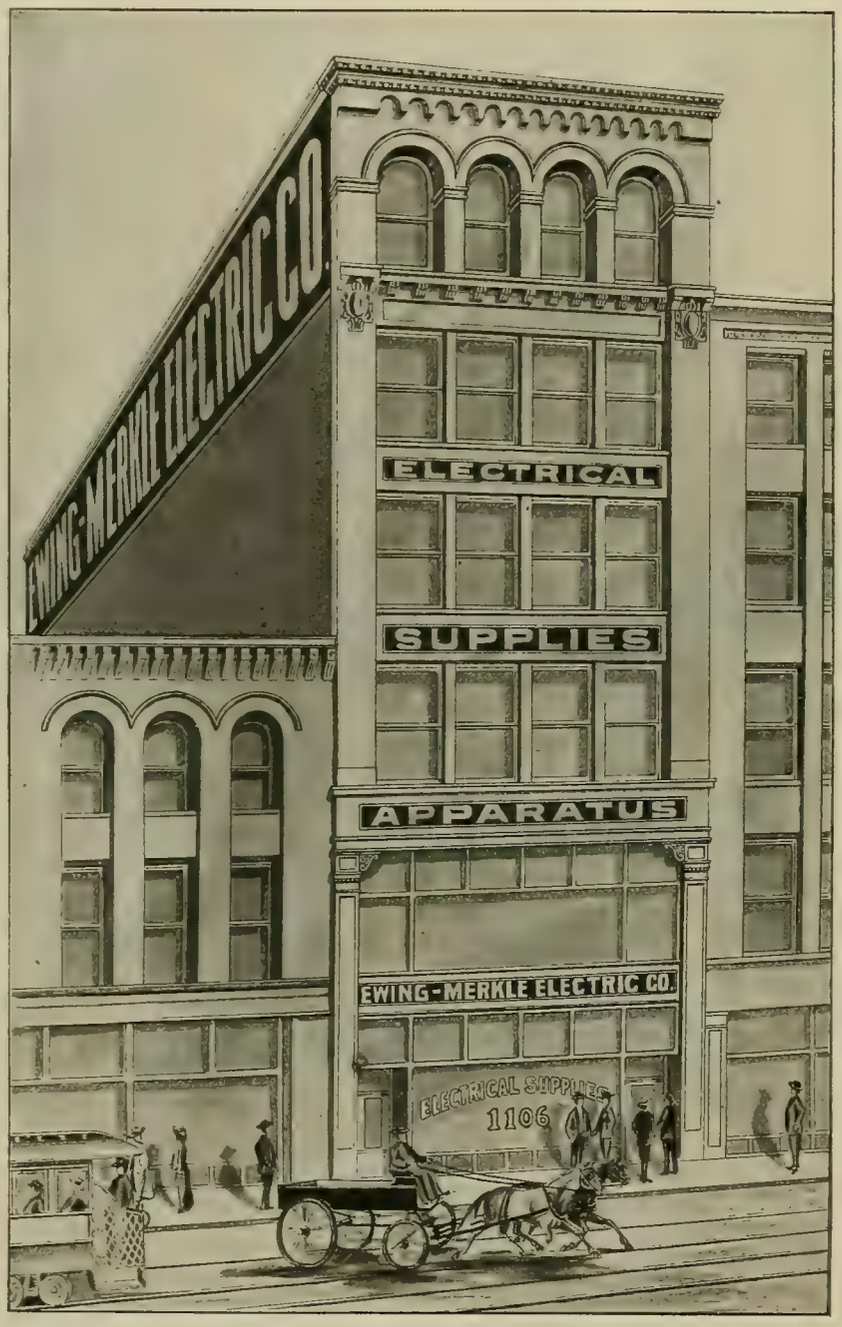
The Convention-al Star

"BRIGHTEST AND BEST"

EWING-MERKLE ELECTRIC CO

TRADE EVERBEST MARK.

Seven Big Floors Filled With Things Electrical Which Wait Your Order in Person, By Mail Or By Wire.



TRADE EVERBEST MARK.

At your Service Ever With the Goods to Deliver, The Price Right And Promptness Guaranteed in Every Shipment.

TRADE EVERBEST MARK.

Arc and Incandescent Lamps, Dynamos, Motors, Watchman's Registers, Telephones, Signal Apparatus and every conceivable article and material used by Lighting Stations, Street Railways, Engineers, Contractors and Builders.

TRADE EVERBEST MARK.

EWING-MERKLE ELECTRIC CO

SAINT LOUIS, - MO.

The Automatic Electric Company invites you, while in Chicago during the Convention of the Independent Telephone Association, to visit its new factory corner of Morgan and Van Buren Streets. Through the courtesy of the Illinois Telephone and Telegraph Company, you are also promised an inspection of the tunnels which that company has completed under Chicago, and the ten thousand station automatic telephone exchange which will soon be ready for service. A line of automobile swill be placed at your disposal by the Automatic Electric Company to convey you to its factory, to the tunnels and the exchange.

New Standard Specialties.

DRY CELL.

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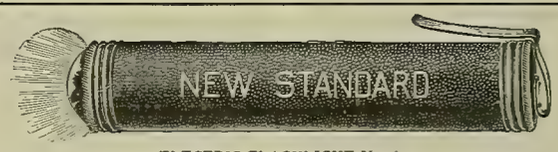

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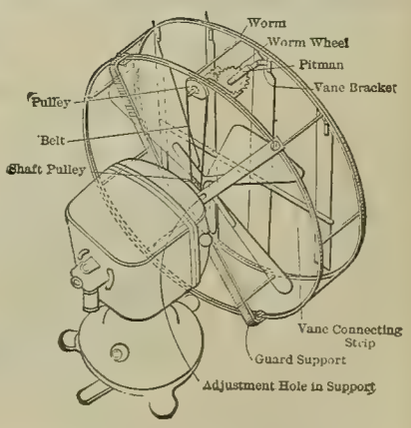

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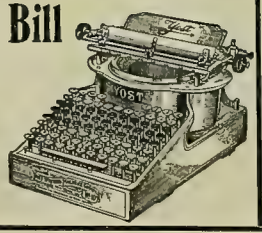

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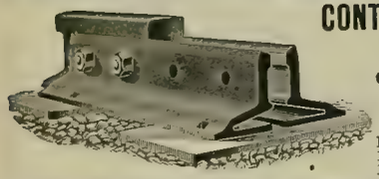

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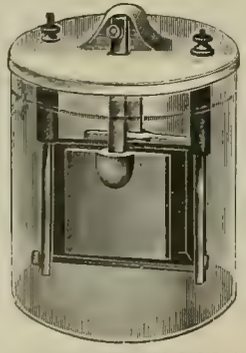

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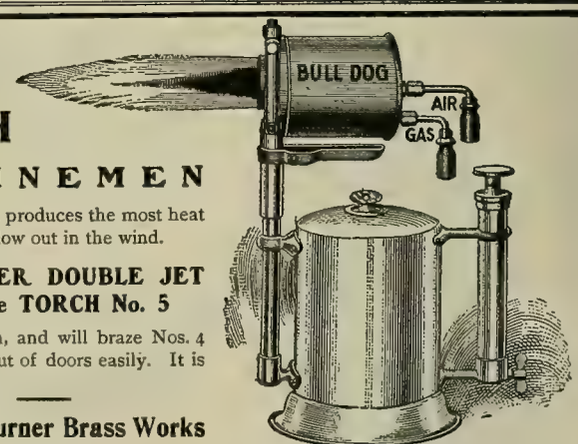

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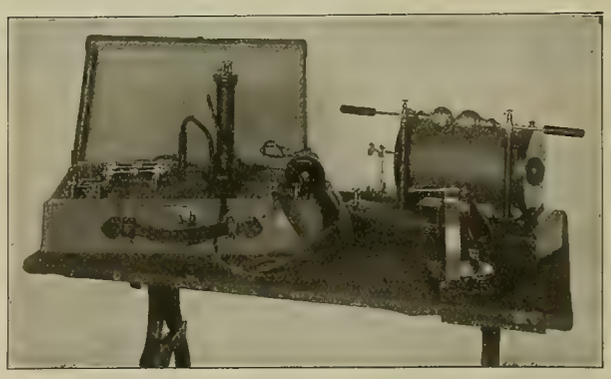

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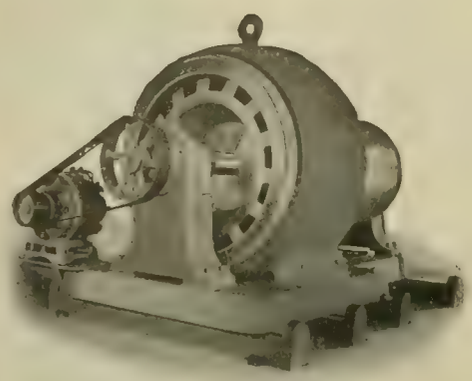

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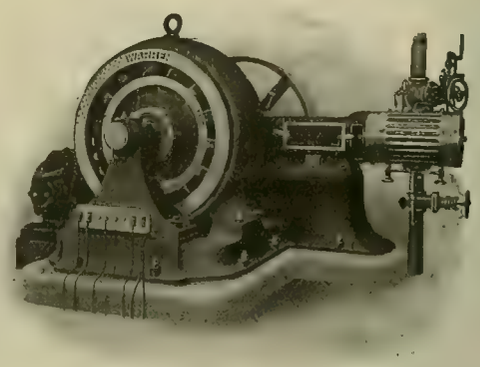

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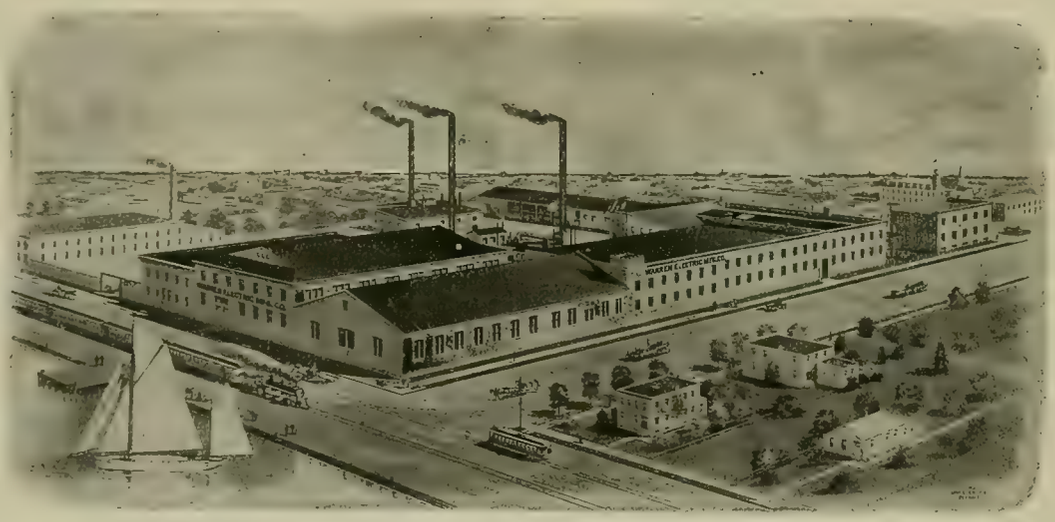

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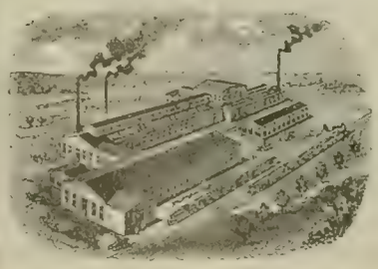

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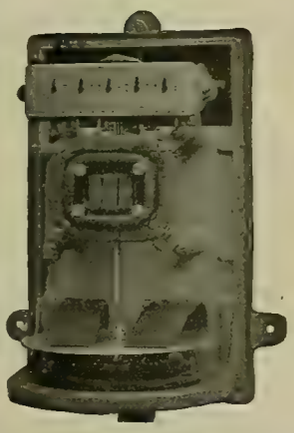

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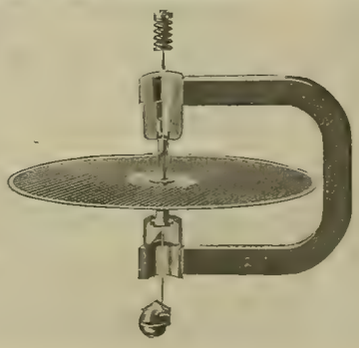

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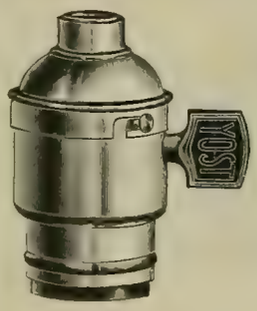

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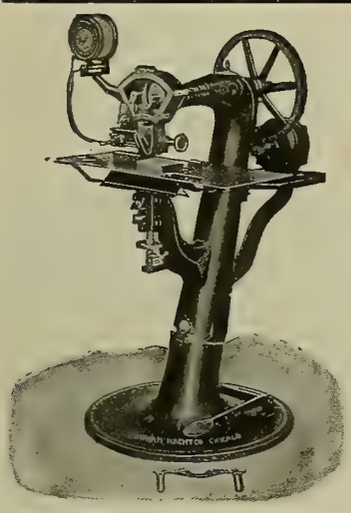

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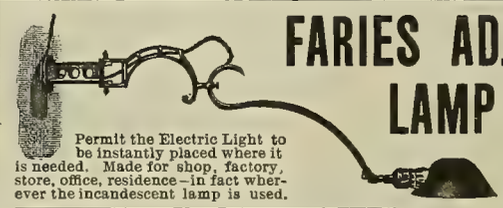

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Chief engineer, large corporation, previously sales representative prominent electric company again desires engagement in latter position in Chicago and vicinity for one or more companies. Resident here a number of years and well acquainted. Exceptional ability, knowledge, experience. Excellent references. Write for details. BOX 212, care Western Electrician, 510 Marquette Bldg., Chicago.

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One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¾ cut-off and 275 R. P. M. Wheels, 56x12½. Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

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12—120 K. W. General Electric type A. 120.
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Large stock of direct-current machines.

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One 13 x 13 Armington & Sims engine, one L. D. T. H. arc machine, both in operation; one 50 h. p. slide valve, Atlas engine, 275 rev. Address JOHN H. PACKER, Gen. Mgr. The Council Grove Electric Light & Power Co., Council Grove, Kan.

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PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 12 o'clock noon, June 23, 1903, and publicly opened immediately thereafter, to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York; League Island, Pa.; Washington, D. C.; Norfolk, Va., and Pensacola, Fla., a quantity of anchors, boat chains, **cable, electrical supplies,** bolts, nuts, rivets, brushes, cement, sand, fire brick, stone, paving blocks, canvas, twine, hemp, **wire rope,** curled hair, dry goods, table linen, thread, bunting, enameled cloth, blankets, burlap, fuel, kitchen utensils, locks, screws, nails, hardware, tins, frogs, switches, tools, jacks, shovels, crucibles, binnacles, spikes, peloruses, instruments, **lamps and fixtures,** lamp wick, leather, **belting,** lumber, knees, piles, blocks, iron, steel, metals, castings, forgings, shapes, billets, torpedoes and supplies, hose, packing, alcohol, paints, chemicals, glue, putty, varnishes, oils, turpentine, tar, gauge glasses, pipe, pipe fittings, boiler tubes, valves, biscuit, condensed milk, diving apparatus, cork jackets, stationery, blue-print paper, ranges, ovens, kettles, emery cloth, garnet paper, trucks, candles, fire grenades, and fire extinguishers. Blank proposals will be furnished upon application to the navy pay offices, New York; Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; Philadelphia, Pa.; Norfolk, Va., and Pensacola, Fla. A. S. KENNY, *Paymaster General, U. S. N.* 5-28-03

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75 H. P. 10x13 Frost automatic.

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180 K. W. and 120 K. W., G. E., 60 cy. A. S. type 1,100 or 2,200 V. alternators.
120 K. W. and 60 K. W., G. E., 133 cy. 1,100 and 2,200 V. alternators.
150 K. W. Wood and 50 K. W., Siemens-Halske 60 K. W., Siemens-Halske 2,000 V. alternators.
200 H. P. Edison 200 V. motor.
Direct current 110 V. generators, all sizes.

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28x48 750-H. P. Harris Double Eccentric Corliss
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20x48 300-H. P. Harris Corliss.
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12 and 22x42 250-H. P. Atlas Tandem Compound Corliss.
16x42 175 H. P. Allis Corliss.
16x42 175-H. P. Hamilton Corliss
12x36 100-H. P. St. Louis Heavy Duty Corliss.
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16½ and 28½x27 400-H. P. Buckeye Cross Compound Automatic.
15 and 23x17 250-H. P. McIntosh, Seymour & Company Tandem Compound Automatic.
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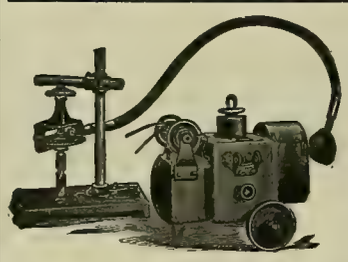

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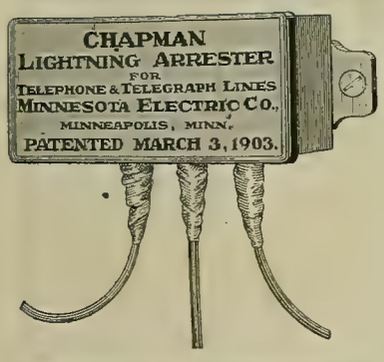

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For Central Station and Power House Equipment

A three hundred kilowatt alternating unit, consisting of one 300 K. W. Stanley, two-phase, 60-cycle, 2,400-volt alternator, directly connected to a 16-32x24 McIntosh, Seymour & Co. vertical cross-compound engine.

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One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 180 K. W. Westinghouse 2,200 volts, 60 cycles two-phase.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase.
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One 120 K. W. General Electric, 2,080 volts, 125 cycles, single-phase.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 75 K. W. Stanley, 1,200-2,400 volts, 133 cycles, two-phase.
One 60 K W. Westinghouse, 2,200 volts, 60 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
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Two 25 K. W. Westinghouse 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

ENGINES.

One 26x48 Harris Corliss, 500 H. P.
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One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
One 12x10 Westinghouse Junior, 75 H. P.
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Alternating-current motors, 60 and 125 cycles.
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Two T. H., 500 K. W.
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One Westinghouse, 175 K. W.
Two General Electric, 100 K. W., 4 pole.
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Two 210 K. W., G. E. design, 14 pole, for direct connection, at a speed of 120 R. P. M.
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One 750 K.W., Westinghouse 60-cycle, 2-phase, 2,200 volt generator, belted to one 24 and 48x60 cross-compound condensing Cooper Corliss engine, complete.
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Two 21x18 Armington & Sims.
Four 16 and 22x22 Houston, Stanwood & Gamble, cross-compound.
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Two 9 and 16x12 tandem compound Ball.
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One 15½x15 Armington & Sims high speed simple automatic, 270 R. P. M.
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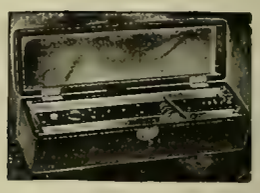

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Patent of A. G. Bell, No. 174,465. Patent of Emile Berliner, No. 233,969. Patent of Emile Berliner, No. 463,569. Patents of Emile Berliner in Parallel Columns. Patent of C. A. Cheever, No. 208,463. Patent of H. H. Eldred, No. 303,714. Patent of Thos. A. Watson, No. 256,258. Patent of L. B. Firman, No. 283,334 Patent of M. G. Kellogg, No. 247,199. Patent of C. E. Scribner, No. 330,058. Patent of C. E. Scribner, No. 300,144. Trunking Principle. Patent of Shaw & Childs, No. 319,856. Mann System. Patent of L. B. Firman, No. 252,576. Western Union Pin Switch. Express System. Patent of Sabin & Hampton, No. 513,534. Subscriber's Automatic Signal. Raverot-Hess System. Patent of M. J. Carney, No. 258,886. Apostoloff System.

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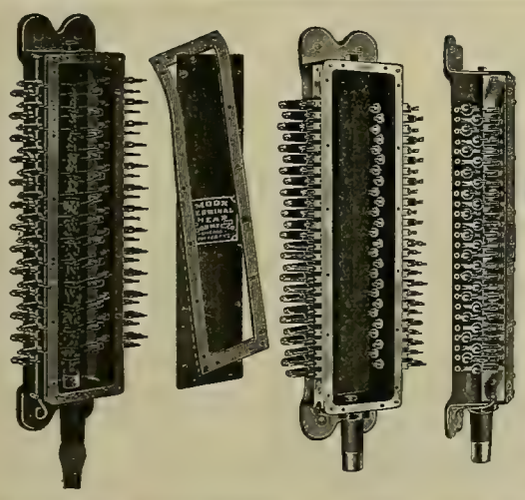

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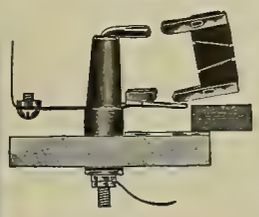

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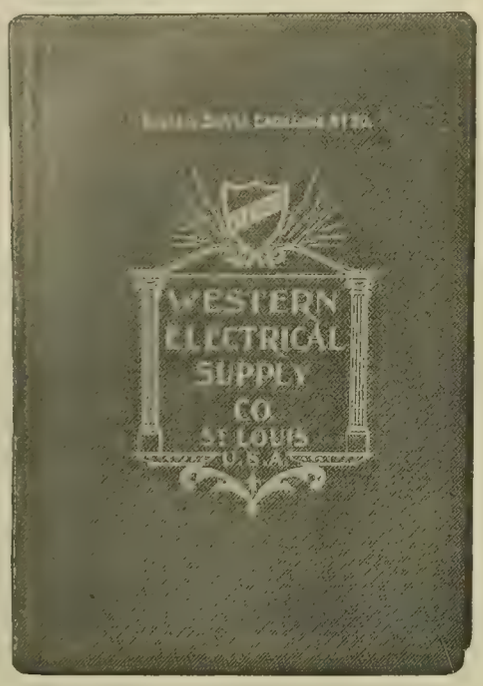

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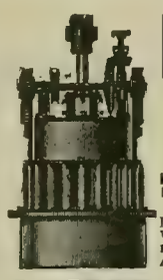

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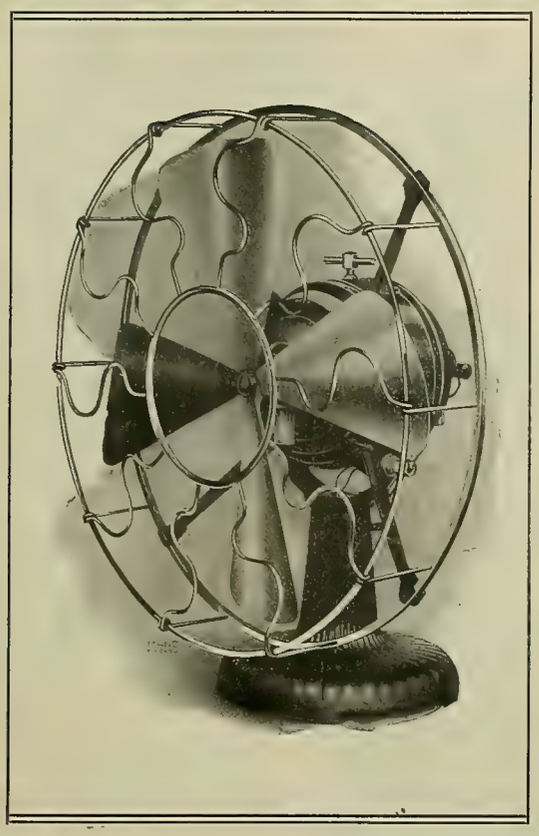

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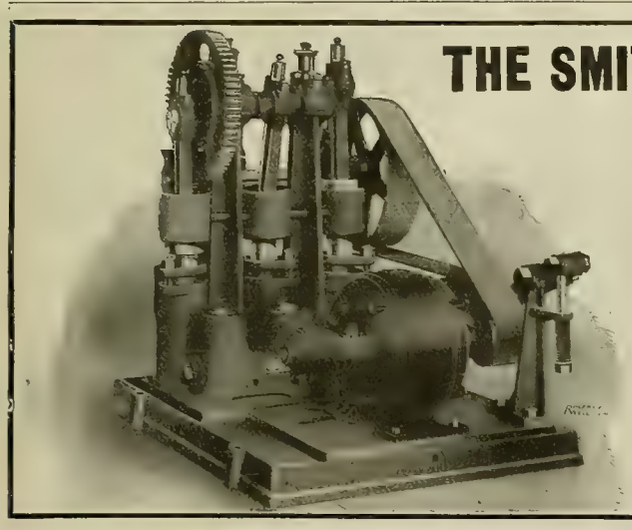

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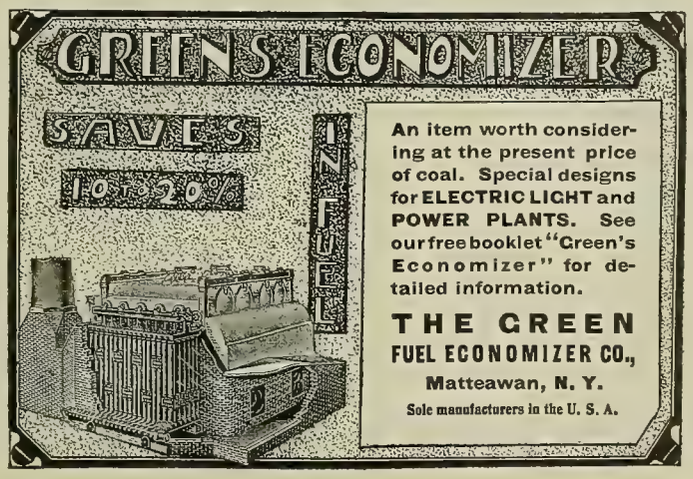

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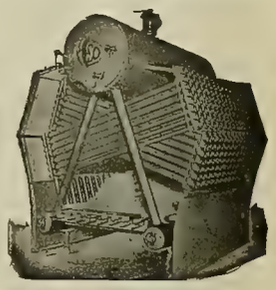

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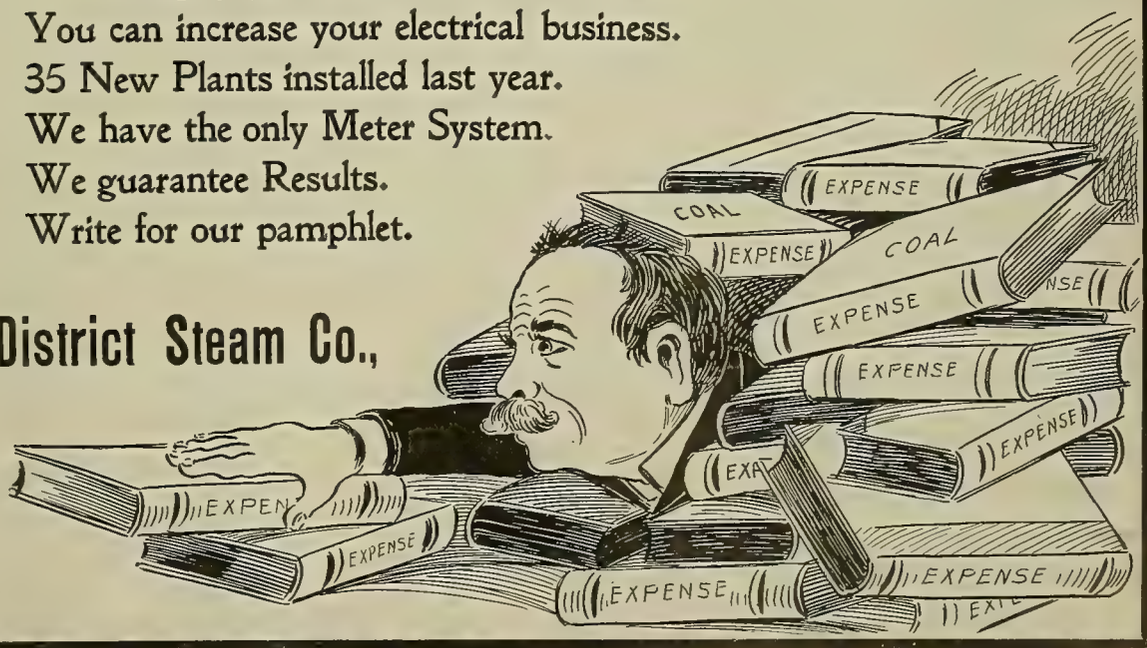

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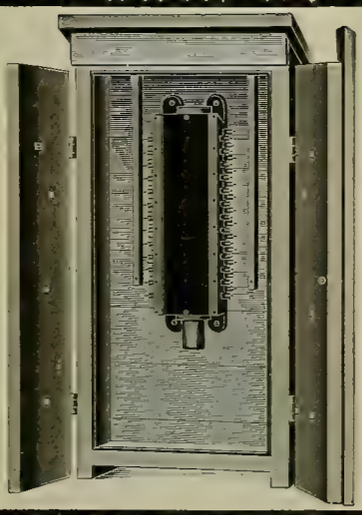

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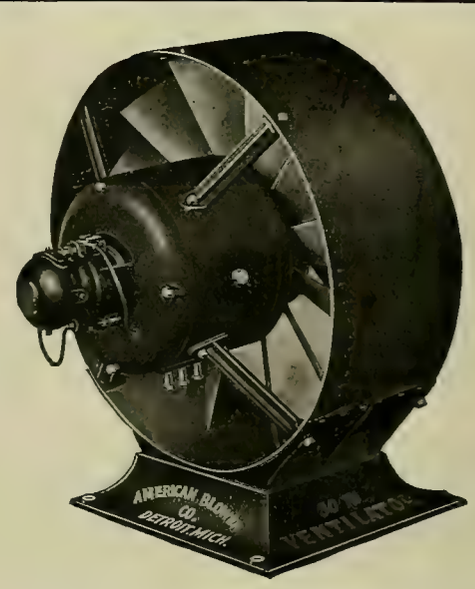

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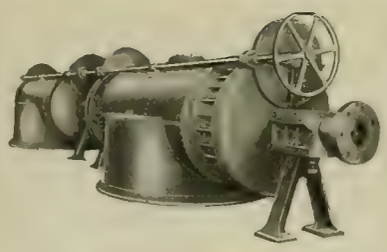

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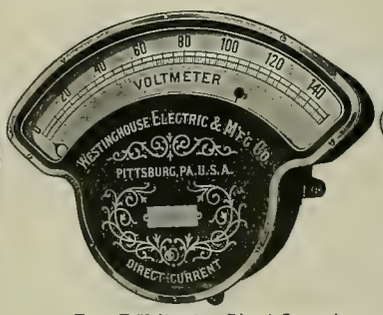

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Type D Voltmeter, Direct Current

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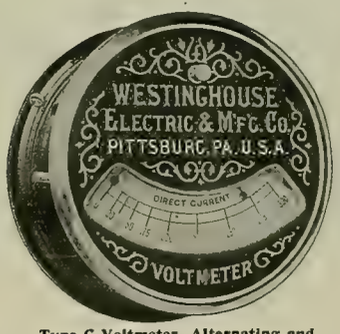

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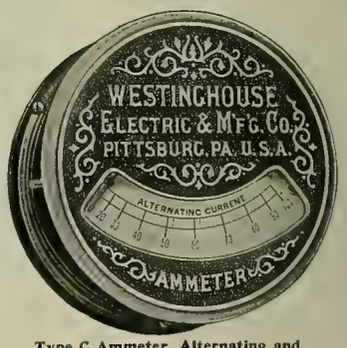

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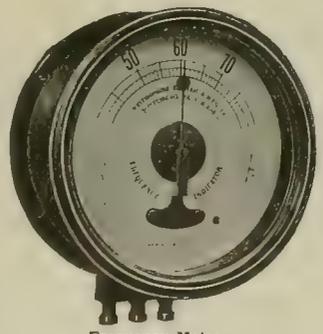

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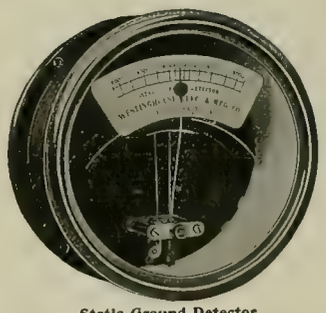

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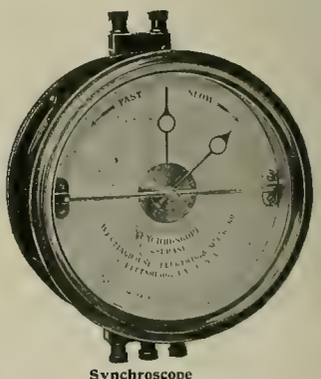

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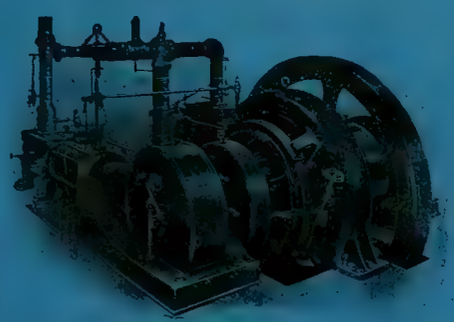

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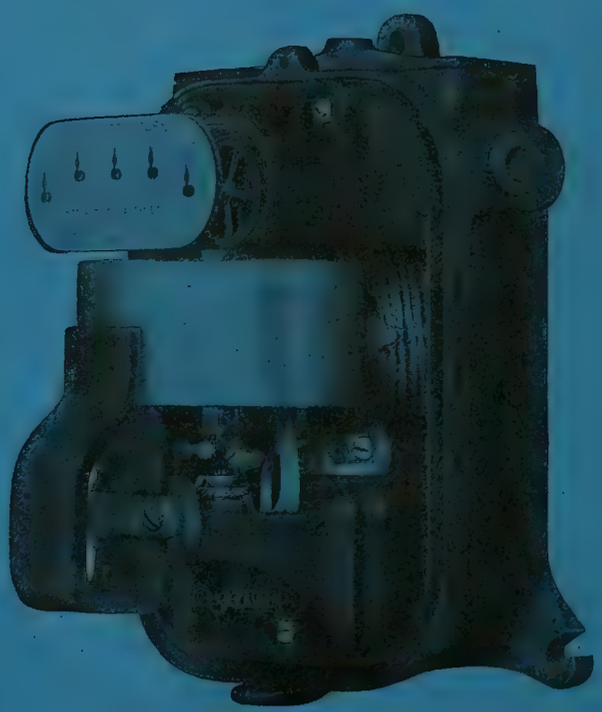

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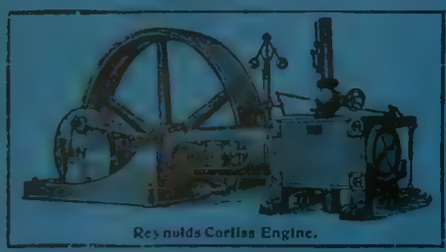
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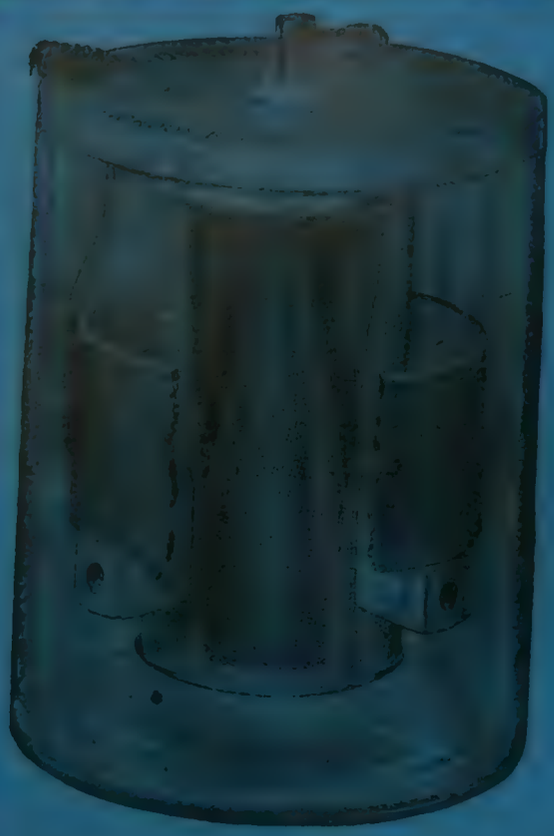

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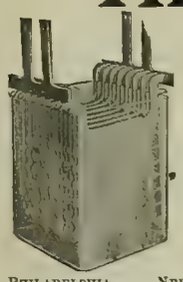

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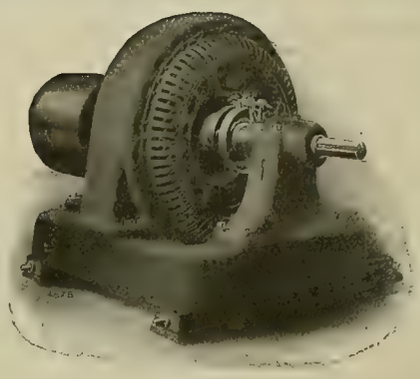

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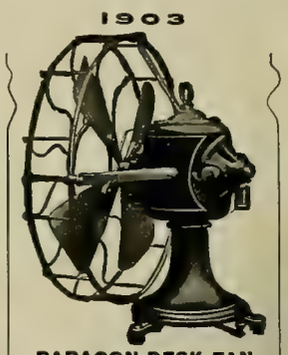

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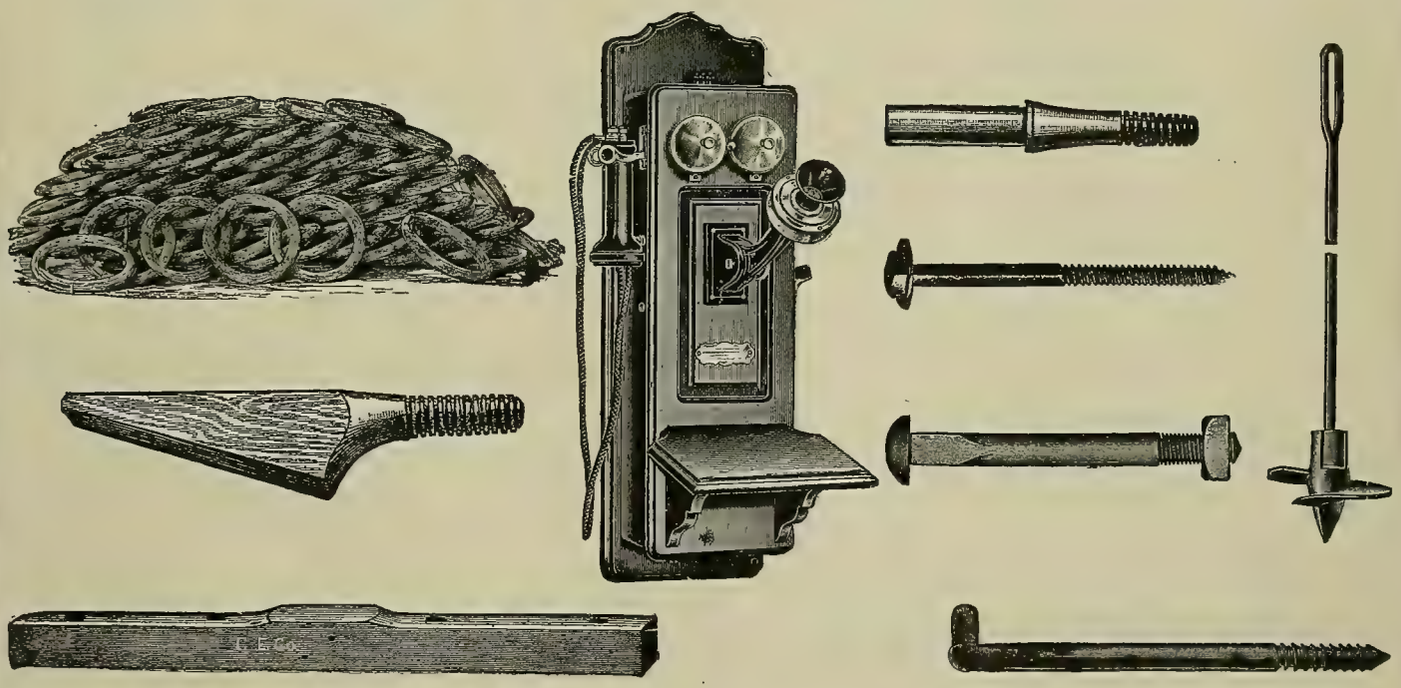

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Buffalo Forge Co.
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Central Electric Co.
Chicago Edison Co.
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Economical Elec. Lamp Co.
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Electric Appliance Co.
Ewing-Merkle Elec. Co.
General Electric Co.
General Inc. Arc Light Co.
Nernst Lamp Co.
Phelps Company.
Rooney-Westbury El. Lmp. Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sterling Electrical Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.

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Nernst Lamp Co.

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General Electric Co.
Minnesota Electric Co.
Western Electric Co.

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Leslie & Co., A. C.

Magnet Wires.
(See Wires and Cables.)

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Buffalo Forge Co.
Sturtevant Co., B. F.

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Mica Insulator Co.
Munsell & Co., Eugene.

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Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Motors. (See Dynamos and Motors).

Name Plates.
Turner Brass Works.

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Johnston, Thomas J.

Phosphor Bronze.
Phosphor BronzeSm.Co.,Ltd.

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Baker & Company.

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Berthold & Jennings.
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Eccleston Lumber Co.
Fowler, John H.
Fowler-Jacobs Company.
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Loud's Sons Co., H. M.
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O. C. Lumber Company.
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Akron Smoking Pipe Co.

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Stilwell-Bierce Smith-Valle.

Pulleys.
Smith Co., S. Morgan.
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American Steel & Wire Co

Rail Joints.
Continuous Rail Joint Company of America.

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Gregory Electric Co.
Illinois Electrical Mfg. Co.
Schureman & Hayden.
Stewart Elec. Co., John A.

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Cutler-Hammer Mfg. Co.
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Gen'l Inc. Arc Lt. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Internat'l Corresp. Schools.
Pratt Institute.
Rose Polytechnic Institute.

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Dustin Co., Chas. E.
Gregory Electric Co.
Illinois Electrical Mfg. Co.
Ill. Maintenance Co.
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Schureman & Hayden.
Stewart Electric Co., John A.
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Whitehead Machinery Co.

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Monson Burmah Slate Co.
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Edwards & Company.
Electric Appliance Co
Western Electric Co.
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Weston Electrical Inst. Co.

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American Steel & Wire Co.

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American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

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Electric Appliance Co.
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General Electric Co.
Manhattan Elect'l Supply Co.
Western Electric Co.
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Fahnestock Transmitter Co.
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International Tel. Mfg. Co.
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Kokomo Tel. & El. Mfg. Co.
Metropolitan Tel. & Elec. Co.
Moon Mfg. Co., The.
Murdock & Co., Wm. J.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel Co.
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Tools.
Klein & Sons, Mathias.
Western Electric Co.

Torches and Brazing Apparatus.
Turner Brass Works.

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Central Electric Company.
Christensen Engineering Co
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
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Stilwell-Bierce Smith-Valle

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Vulcanized Fibre Co.

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Western Electric Company.

Woodwork, Electrical.
Noblett Co., E. J.

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Installers of Complete Underground Conduit Systems.

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For Underground Wires. The Only Conduit that Improves with Age.
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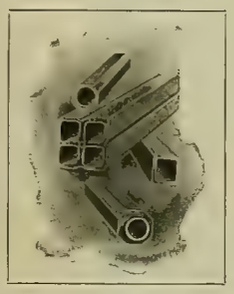

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Multiple Conduits Single.

Large Factories in East and West.

Moderate Prices.

Prompt Deliveries.

Write or telephone your requirements and we will submit samples and prices.

Telephone 5928 Broad. C. J. FIELD, 29 Broadway, New York.

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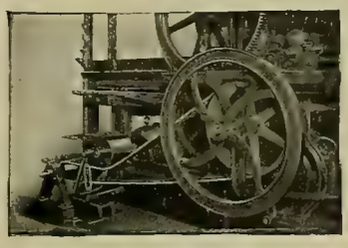

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have enabled many printers to increase their business. They can increase your profits also. Write for booklet No. 03211.

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OUR CONDUIT IS { *Absolutely— Electrolysis-Proof, Non-Abrasive, Moisture-Proof, Non-Corrosive, Perfect Insulator.* }

Insulation Test, **66,000 VOLTS.**

A perfect joint which is self-aligning, making the conduit line a solid tube from manhole to manhole.

Construction simple, rapid and inexpensive, requires no skilled labor.

Cables drawn more easily and a longer distance than in any other.

Resistance strength when underground as great as any.

Life of Conduit everlasting. Asphalt never deteriorates.

AMERICAN CONDUIT COMPANY,

MANUFACTURERS OF

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BITUMINIZED FIBRE. (Patented.)

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336 Macy Street, Los Angeles, Cal.

FACTORIES:
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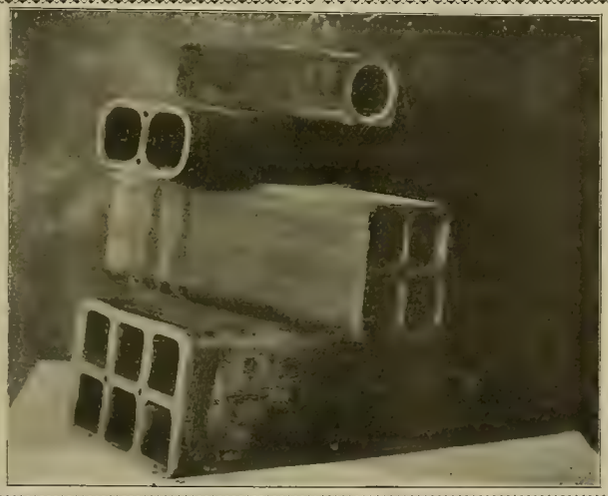

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IN 1, 2, 3, 4 AND 6 DUCT.

Superior conduits for underground wires a specialty.

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Alternating and Direct Current

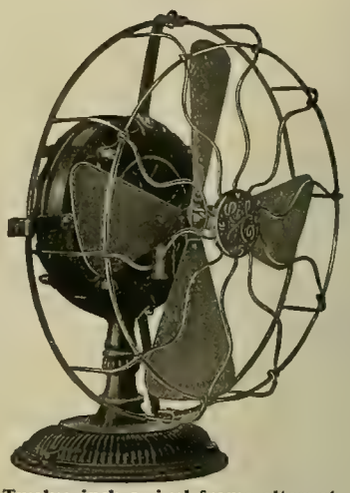
Fan Motors

Twelve-inch swivel and trunnion frame direct current fan motor.

May be relied upon for continuous service, season after season.

THIS PLATE

ON EVERY MOTOR



Twelve-inch swivel frame alternating current fan motors.

GENERAL OFFICE: SCHENECTADY, N. Y.

Chicago Office, Monadnock Blk. Sales Offices in all Large Cities.

Diehl Fan Motors

Catalogue No. 46.

THE NEW DIEHL FAN

With or without lights; 2 or 3 speeds; special Nyssa wood blades; artistic design. Our 1903 catalogue shows 14 designs of ceiling, also new desk and the Coleman device. *Send for it.*

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EUREKA WINS.

Defeats American Electric Telephone Company and J. B. Overshiner In Patent Suits.

Friday, June 19th, 1903, Judge Shiras of the United States Circuit Court for the northern district of Iowa, sitting at Dubuque, dismissed all suits filed in the Meissner and Overshiner patent suits, against the County Telephone & Telegraph Company of Waterloo, Iowa. These suits were filed by the American Electric Company and J. B. Overshiner of Chicago and were defended by the Eureka Electric Company of Chicago in making good their guarantees to users of Eureka apparatus.

The Eureka Electric Company wishes to reassure its patrons that it stands back of all of its guarantees and will defend any and all suits that may be filed against its patrons for the use of its apparatus on any claims of alleged infringement.

Our new handsome catalogue No. 23 is now being distributed. If you have not received a copy, send for it at once.

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GENOA, ILL. CHICAGO, ILL.

OUR CHICAGO FACTORY

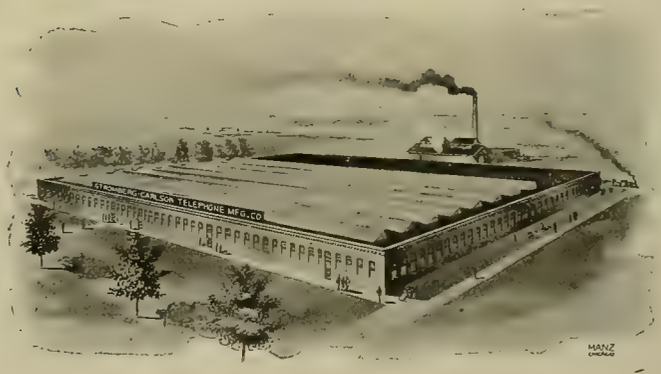
Engaged in the manufacture of telephone and switchboard apparatus exclusively for Independent Telephone Exchanges. Present daily output greater than that of any other four factories combined, and the demand for high-grade apparatus has made it.

OUR FINISHED PRODUCT

Switchboard of the Glen Telephone Co., Utica, N. Y. Capacity, 12,000 lines. Present equipment, 2,400 lines.

OUR ROCHESTER FACTORY

Engaged in the manufacture of cords, cable and insulated wire.



WRITE FOR BULLETINS
- No. 1-E Railway Apparatus
- No. 2-E Bridging Telephones (A Farmers' Book)
- No. 3-E Construction Material

Stromberg-Carlson Telephone Mfg. Co.

General and Eastern Sales Office
ROCHESTER, N. Y.

Sales Department
CHICAGO, ILLINOIS.

Announcement

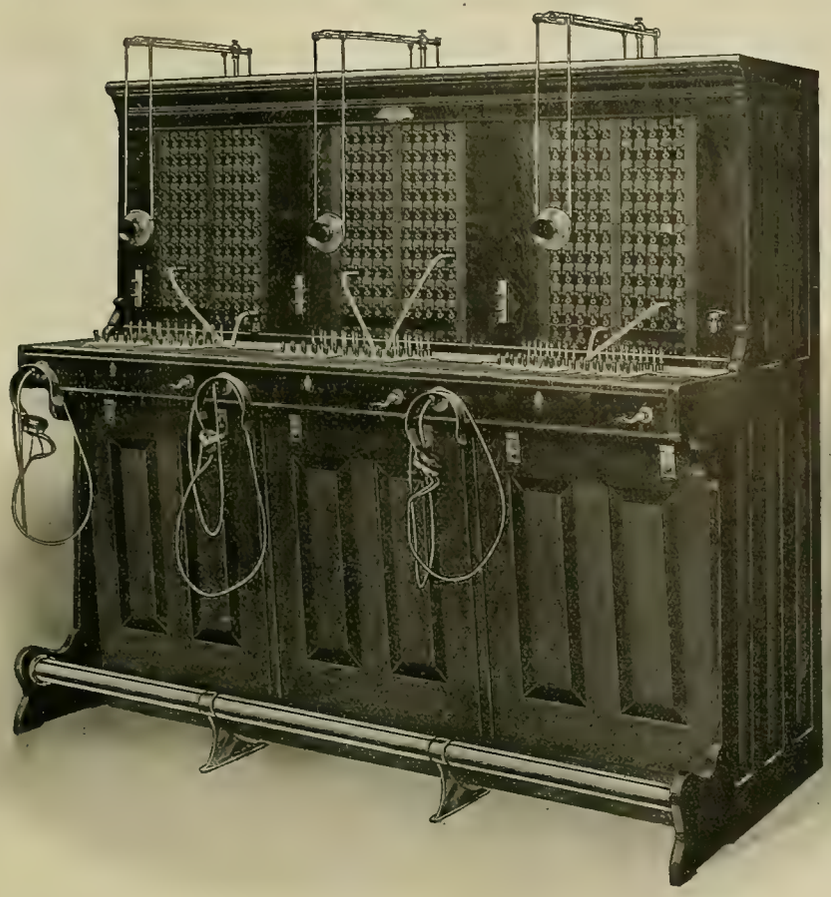
Owing to various rumors recently circulated by competitors relative to the control of this company as to its ability and willingness to carry out future contracts for Independent telephone apparatus, we feel that the Independent telephone interests which are our present and prospective customers are entitled to some statement from us.

We desire to assure our present and prospective customers that the business of this company will be continued in the future as in the past.

To assure customers of our entire good faith and intentions to continue in business as heretofore, we will furnish bonds to customers insuring the fulfillment of our contracts for new apparatus or for the furnishing of extensions of existing exchanges for a period of five years. Our customers will be as fully protected as ever.

Kellogg Switchboard & Supply Company

CHICAGO



Kellogg Apparatus IS NO EXPERIMENT

Experimental systems are expensive at any price.

It is not necessary for the purchaser to carry on experimental work for the manufacturer when operating Kellogg apparatus.

Two and a half years of positively successful work in the largest exchange in this country without any material change in the system is the best kind of guarantee. This period of time is a year and a half longer experience with standard multiple boards than that of any other independent telephone manufacturing company.

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GREEN AND CONGRESS STREETS, CHICAGO.

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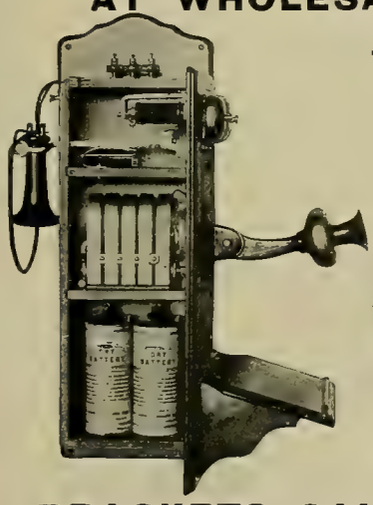
FARR TELEPHONES FOR COUNTRY LINES. FARR TELEPHONES FOR EXCHANGES. FARR TELEPHONES FOR PRIVATE LINES.

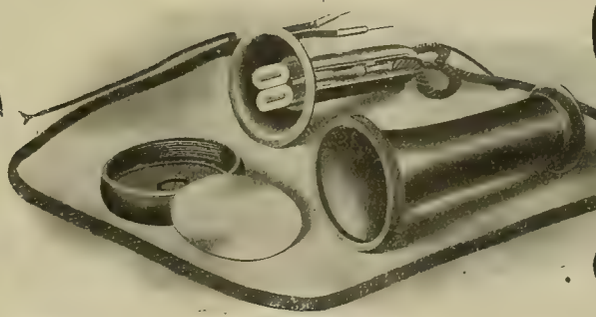
FIFTEEN DIFFERENT STYLES; HIGH GRADE GOODS;

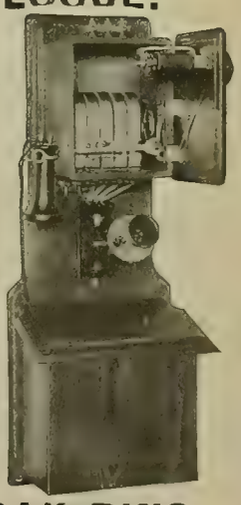
ALL PARTS SOLD SEPARATE IF DESIRED.

AT WHOLESALE PRICES. SEND FOR OUR CATALOGUE.

WE ARE ONE OF THE OLDEST
TELEPHONE MANUFACTURERS IN THE UNITED STATES







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Single Duct. Multiple Duct.
2, 3, 4, 6 and 9 Duct.

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LARGEST FACTORIES IN THE WORLD

EXCLUSIVELY . CONDUIT . AND . INSULATORS

ANNUAL CAPACITY
25,000,000 Ft. Conduit.
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ARE SPECIFIED BY ELECTRICAL ENGINEERS AND ARCHITECTS EVERYWHERE.

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INTERNATIONAL EXPOSITION
OMAHA NEB 1898
PARIS EXPOSITION 1900
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CHICAGO
NEW YORK
PITTSBURG

AMERICAN ELECTRIC TELEPHONE CO.

MANUFACTURERS OF
HIGH GRADE TELEPHONE APPARATUS
36 TO 58 WEST JACKSON BOULEVARD

CHICAGO, June 8th 1903.

INDEPENDENT TELEPHONE OPERATING COMPANIES

Gentlemen-

In view of the confirmation of the Kellogg sale to the Bell Company (sale made about sixteen months past) and of the persistent rumors of another Bell affiliation, we take this occasion to reassure the independent operating companies that they need fear no embarrassment in securing extensions to their present switchboards and apparatus.

THIS COMPANY IS PREPARED TO MAKE ALL DIES AND TOOLS, TO PRACTICALLY DUPLICATE ANY PARTS OF APPARATUS HERETOFORE MADE BY ANY OTHER MANUFACTURER.

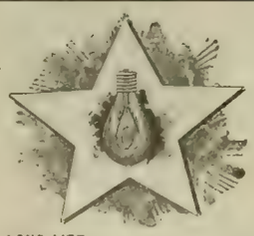
We have always been independent and have won many important patent suits effecting all makes of independent apparatus. If you will continue to co-operate with us, the Bell Company can work no injury by acquiring the alleged independent factories.

The reason recent patent suits have been won and other suits brought by the Bell Company, against these alleged independent factories, is now easily understood.

AMERICAN ELECTRIC TELEPHONE COMPANY
P. C. Burns, President.

P. S. We have already arranged to build a new factory double the capacity of our present ones.

"STAR" INCANDESCENT LAMPS



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GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

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The Strowger Automatic Telephone Exchange PLEASES THE SUBSCRIBER; makes the stockholder WANT MORE STOCK, and enables the exchange manager to feel that LIFE IS WORTH LIVING.

Are you acquainted with the many merits of the Automatic System?

No?

Then you are a straggler in the march of progress.

Close up!

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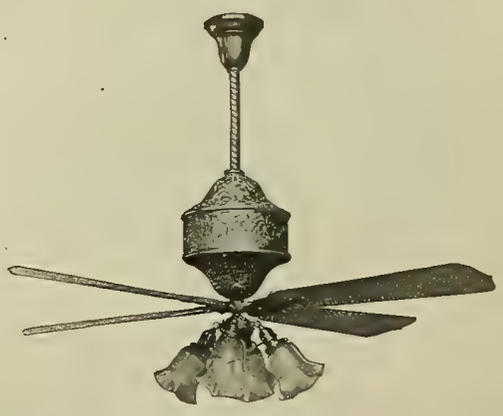
Chicago, U. S. A.

Fan Motors

ALL STYLES.
LARGE STOCK.



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Chicago New York
St. Louis Denver Kansas City Philadelphia

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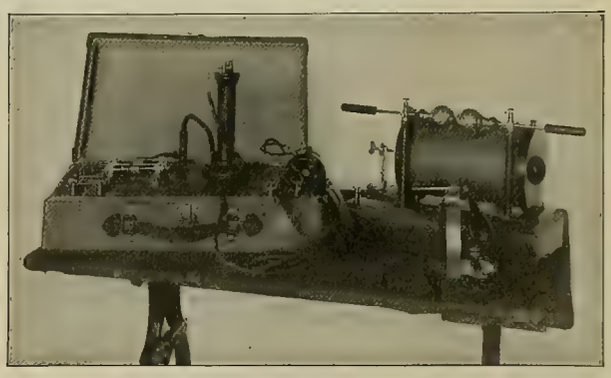
WIRELESS

TELEGRAPH APPARATUS



This Set Costs $50.00 F. O. B. Factory.

Comprises Complete Sender and Receiver for Stationary or Portable Work.

Write us for Anything Pertaining to Wireless Telegraph Apparatus and Supplies.

We can furnish you separate parts, or any special parts that you may require. Spark Coils, Coherers, Relays, Registers, Recorders, Automatic Tappers. We can furnish you prices on Special College Sets, Students' Sets, and also on our Special Commercial Wireless Telegraph Sets, for short-distance or long-distance telegraph. Write us for pamphlet and circular.

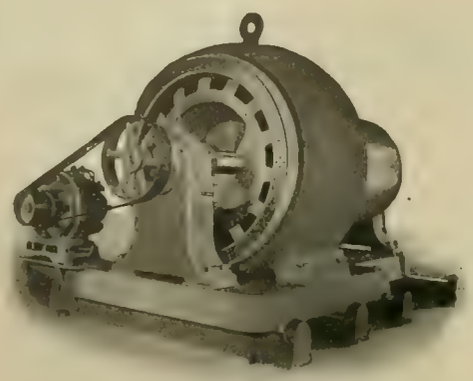
If you are interested in the Wireless Telegraph, the Clark Wireless System has shown its merit in all tests and requirements. We can fill your orders for high-grade apparatus.

Thos. E. Clark Wireless Telegraph & Telephone Co.

Detroit, Mich., U. S. A.

The Warren Alternator.

OUR PRODUCT.



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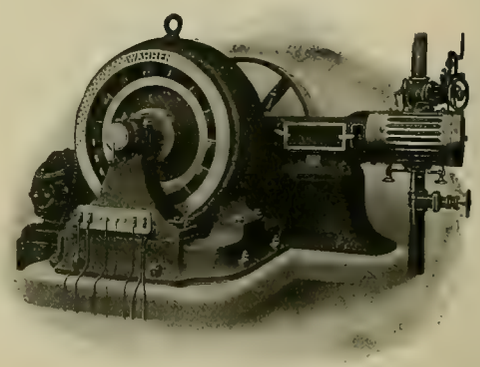

ENGINE TYPE.

OUR FACTORY.

Recent additions to our shop plant, new tools, electric crane, etc., afford us increased capacity to manufacture sizes up to

1000 KILOWATT Machines of the Engine Type and,
1500 KILOWATT Machines of the Water Wheel Type.

BULLETINS ON APPLICATION—THEY TELL YOU ABOUT IT.

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Western Electrical Supply Co., St. Louis, Mo.

C. W. Hobson, Waco, Texas.

A. M. Searles, 1200 Fisher Bldg., Chicago, Ill.

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CHELSEA,
MASS.

For all special lighting purposes use "Electra" Flame Light Carbons.

Ask for special list on High Grade Battery Carbons.

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MAGNET WIRE AND BARE AND TINNED COPPER WIRE.

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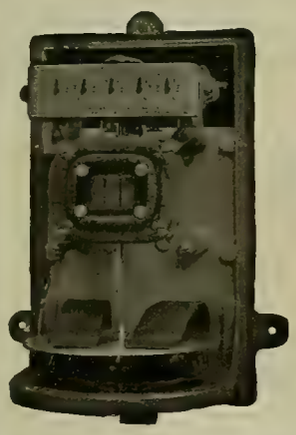
CHICAGO RHEOSTAT CO.
MOLONEY ELECTRIC CO.

Francis Raymond III.
1218-19 Marquette Building
CHICAGO

"MEET ME ½ WAY"
(ASK FOR PRICES!)



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MOST ACCURATE AND UP-TO-DATE METER UPON THE MARKET.

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NO CONSTANTS
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NO REVENUE LOST.
ALL CURRENT USED RECORDED.

Send for description and book full of good information
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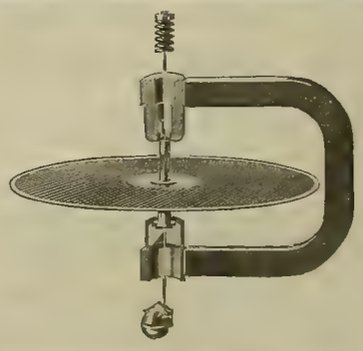

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The McBride "ARKLESS" fuse is a cartridge or enclosed fuse. It meets all of the requirements of present day methods and the objectionable features of the link fuse are eliminated

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For use in portable lighting devices—electric candle sticks, pocket lanterns, carriage and bicycle lamps, clock lights for bed rooms, ruby lanterns for photography and for optical, dental and surgical instruments.

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Not a rubber friction tape, but a tape coated with linseed oil left slightly tacky. Ninety times the electrical restivity of friction tape. Send for samples and prices.

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For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
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The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen.
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ARE OF THE

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Good to look upon.
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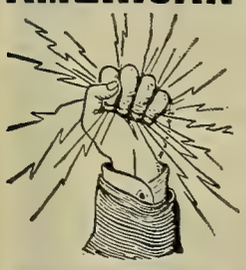

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Style A—Lights when door is open; out when door is closed.
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THE ECO DOOR SWITCH OPERATES LIGHTS "EVERY OTHER TIME."
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The "P-K"
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Slow-Burning Weatherproof and Slow-Burning Wire.
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STOMBAUGH GUY ANCHOR
is used by
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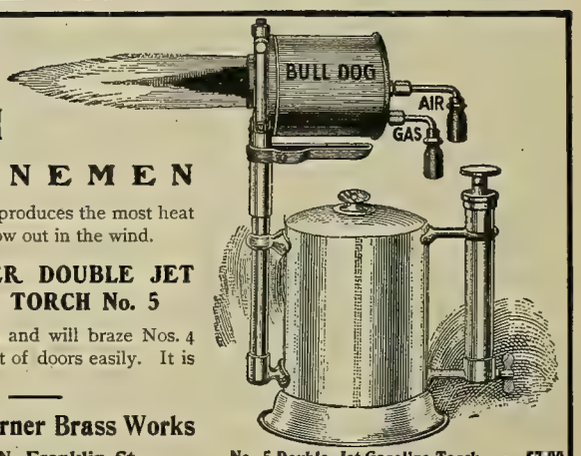
is the one that produces the most heat and will not blow out in the wind.

The TURNER DOUBLE JET Gasoline TORCH No. 5
is such a torch, and will braze Nos. 4 and 6 wires out of doors easily. It is wind proof.



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No. 5 Double Jet Gasoline Torch. - $7.00
Send for Illustrated Catalogue.
We make a full line of Torches.

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MULTIPLE SWITCH MOTOR STARTERS WITH AUTOMATIC RELEASE

(10 H. P. 220-VOLT SIZE.)

THE IDEAL STARTER
Operated by throwing in one lever after another; levers interlocking, so that it is impossible to close them other than in their regular order.

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A mechanical and electrical engineer of technical training and seven years' practical experience, who is now employed as superintendent of power in a modern factory, desires to correspond with those in need of a central station man. Best of references from past and present employers. Address BOX 214, care Western Electrician, 510 Marquette Building, Chicago.

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As superintendent of lighting and power plant, or as constructing engineer; ten years' practical experience with Corliss and high speed engines, A. C. and D. C. apparatus. Am acquainted with the business from furnace end to that of the office. Have had complete charge of present system for the past four years with excellent success. Strictly temperate, a hustler and business getter. Results guaranteed. Central states preferred. Address BOX 215, care Western Electrician, 510 Marquette Building, Chicago.

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Wanted managers for branch offices. Correspondence strictly confidential.

GENERAL INCANDESCENT ARC LIGHT CO.
Marquette Building, Chicago.

Salesmen Wanted.

Wanted Experienced Salesmen.

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60 wood tanks for electrolytic refining. 50 Weston & Keystone voltmeters and ammeters. Old machinery and material of all kinds purchased. WALSH'S SONS & CO., 261 Washington Street, Newark, N. J.

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Alternators 125-133 cycles, 1,100 volts.
1—400 K. W. Westinghouse, with exciter.
1—200 K. W. Stanley inductor, with exciter.
2—200 K. W. Wood (3 bearings), with exciter.
1—150 K. W. Slattery (3 bearings). Big bargain.
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Large stock of direct-current machines.

Send for monthly bargain sheet with complete list and net prices of machines. All apparatus fully guaranteed.

FOR SALE.

One 12x14 McEwen center crank engine with sub-base. 120 H. P. at 110 Lbs. and ¾ cut-off and 275 R. P. M. Wheels, 56x12½. Engine is brand new, has never been erected and has usual complement of fittings. Cheap for cash. Address FRED W. C. BAILEY, 501 Spahr Bldg. Columbus, Ohio.

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One 13 x 13 Armington & Sims engine, one L. D., T. H. arc machine, both in operation; one 50 b. p. slide valve, Atlas engine. 275 rev. Address JOHN H. PACKER, Gen. Mgr. The Council Grove Electric Light & Power Co., Council Grove, Kan.

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One-half interest in electrical supply and contracting house doing a good business. A good opportunity for a good man. I have good reasons for selling a new light plant under construction and will make a boom in town. Located in central Pennsylvania. For full particulars address BOX 213, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

FOR SALE.

One 1,000 K. W. direct connected vertical cross compound, side crank, McIntosh & Seymour engine now completed. Revolutions per minute 120. Steam pressure 125 lbs. Rated load and indicated horsepower 1,520. Cut-off $\frac{3}{16}$. This engine was ordered previous to our purchase of the Citizens Light & Power Company. We now wish to dispose of same at a bargain. The engine can be seen at McIntosh & Seymour Factory, Auburn, N. Y. Address, Electric Department, Rochester Gas & Electric Company, Rochester, N. Y.

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The City of Casselton, N. D., offers for sale at a reasonable price its Electric Light Plant. Will accept lighting for city in whole or part payment of purchase price, if desired. Plant is well equipped and doing a good business. Address all inquiries to BRUCE D. YOUELLS, City Auditor.

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$12,000 will purchase a well established and profitable electrical contracting, inspection and repair business, established eight years in New York City; owner retiring. Complete machinery and equipment. Thorough investigation to principals only. Address BOX 216, care Western Electrician, Times Building, New York City.

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Direct connected, high grade generating set consisting of 7 x 7 vertical enclosed engine and 10 K. W. generator, 375 R. P. M., entirely new.

Price, $650.00 f. o. b. Milwaukee.

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Dynamos and Motors.

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SCHUREMAN & HAYDEN,
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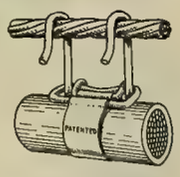
CABLE HANGERS

NATIONAL HANGER
is Simple, Durable, Adjustable, Practical.



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Breaking Strain, 650 lbs. Made according to Bell specifications.

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FOR IMMEDIATE DELIVERY.

600 H. P. 21 and 36x30 Williams tandem compound engine.
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250 H. P. 13 and 20½x15 Armington & Sims cross compound.
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DYNAMOS.

180 K. W. and 120 K. W., G. E., 60 cy. A. S. type 1,100 or 2,200 V. alternators.
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200 H. P. Edison 200 V. motor.
Direct current 110 V. generators, all sizes.

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CITY OF LAUNCESTON, TASMANIA

ELECTRIC LIGHT DEPARTMENT.

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The Mayor and Aldermen of the City of Launceston, Tasmania, are prepared to receive tenders for the supply of

500 OR MORE ELECTRIC METERS.

Specifications and conditions of contract in duplicate may be obtained on application to Mr William Corin, City Electrical Engineer, Launceston, Tasmania, or to Messrs. John Terry & Co., 7 Gt. Winchester Street, London, E. C. England, on payment of Two Guineas, which sum will be refunded on receipt of a bona-fide tender.

Sealed tenders endorsed "tenders for supply of electric meters" must be addressed to the undersigned and lodged in his office not later than 12 o'clock, noon, of Monday the 28th day of September, 1903.

C. W. ROCHER,
Town Clerk.

Town Hall,
Launceston, Tasmania.
21st April, 1903.

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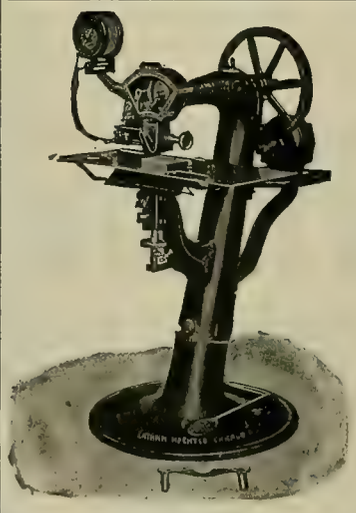

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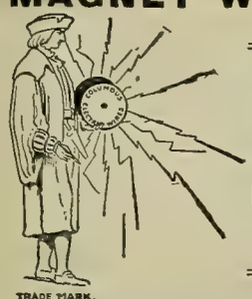

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COLUMBUS, OHIO.

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A combination of a portable socket handle and a cord adjuster; six inches long; very practical and convenient; takes up 12 to 15 feet of surplus lamp cord.

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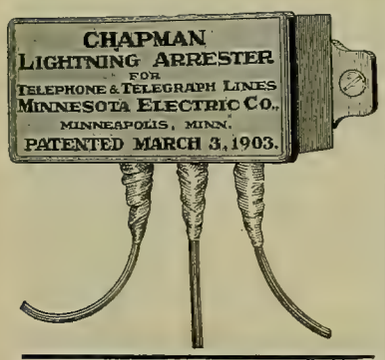

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For Central Station and Power House Equipment

A three hundred kilowatt alternating unit, consisting of one 300 K. W. Stanley, two-phase, 60-cycle, 2,400-volt alternator, directly connected to a 16-32x24 McIntosh, Seymour & Co. vertical cross-compound engine.

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One 180 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 180 K. W. Westinghouse 2,200 volts, 60 cycles two-phase.
One 150 K. W. Westinghouse, 2,300 volts, 60 cycles, single-phase.
One 150 K. W. Stanley, 1,100-2,200 volts, 133 cycles, two-phase.
Two 120 K. W. General Electric, 1,040 volts, 125 cycles, single-phase.
One 120 K. W. General Electric, 2,080 vo ts, 125 cycles, single-phase.
One 90 K. W. General Electric, 2,300 volts, 60 cycles, single-phase.
One 75 K. W. Stanley, 1,200-2,400 volts, 133 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, two-phase.
One 60 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
One 45 K. W. Westinghouse, 2,200 volts, 60 cycles, single-phase.
Three 35 K. W. Thomson-Houston, 1,100 volts, 125 cycles, single-phase.

RAILWAY GENERATORS 500-550 VOLTS.

Two 500 K. W. General Electric, 6-pole, speed, 300 R. P. M.
Two 300 K. W. General Electric, 4-pole, speed, 400 R. P. M.
Two 225 K. W. General Electric, 6-pole, speed, 465 R. P. M.
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Two 200 K. W. General Electric, 4-pole, speed, 425 R. P. M.
Two 180 K. W. Westinghouse, 4-pole, speed, 535 R. P. M.
One 110 K. W. Eddy, 4-pole speed, 600 R. P. M.
Two 100 K. W. General Electric, 4-pole, speed, 650 R. P. M.
One 100 K. W. Walker, 4-pole, speed, 750 R. P. M.
Two 100 K. W. Edison, bi-polar, speed, 620 R. P. M.
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One 80 K. W. General Electric, 4-pole, speed, 700 R. P. M.
Two 80 K. W. Detroit, bi-polar, speed, 620 R. P. M.
Five 62 K. W. Thomson-Houston, type D, speed, 900 R. P. M.
One 50 K. W. Brush, type Q, speed, 1,050 R. P. M.

DIRECT CONNECTED UNITS.

One 200 K. W. Westinghouse, 8-pole, 500-550-volt generator, with 18-30x16 Westinghouse compound engine.
One 130 K. W. General Electric, 8-pole, 125-volt generator, with 12-20x16 Erie Ball tandem compound engine.
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One 50 K. W. Commercial, 6-pole, 125-volt generator, with 8½-13x12 Armington & Sims tandem compound engine.
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One 50 K. W. unit, consisting of two 25 K. W. General Electric, 4-pole, 125-volt generators, with one triple expansion vertical engine.
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Two 25 K. W. Westinghouse 6-pole, 250-volt generators, each with 9x10 Ball and Wood engine.

ENGINES.

One 26x48 Harris Corliss, 500 H. P.
One 18-34x48 Cooper Corliss, cross compound, 500 H. P.
One 23x48 Harris Corliss, 400 H. P.
One 20x36 Hewes & Phillips, 200 H. P.
One 18x48 George H. Corliss, 250 H. P.
One 16x42 Providence Greene, 200 H. P.
Two 18-30x16 Westinghouse compound, 250 H. P. each.
Three 18½x18 Armington & Sims, 250 H. P. each.
One 18½x18 New York Safety, 250 H. P.
Two 10-18x20 Payne tandem compound, 150 H. P. each.
One 13-19x15 McIntosh, Seymour & Co. tandem, 175 H. P.
Two 14x13 Armington & Sims, 150 H. P.
One 14x14 Rice automatic, 125 H. P.
One 13x12 Armington & Sims, 125 H. P.
One 12-20x12 Westinghouse compound, 100 H. P.
One 12x12 New York Safety, 100 H. P.
One 10½-16½x12 Armington & Sims cross compound, 100 H. P.
One 9x16 Rice automatic, 75 H. P.
One 12x10 Westinghouse Junior, 75 H. P.
One 8x10 B. F. Sturtevant, 40 H. P.
One 7x8 Payne, 20 H. P.
Three 6x5 Westinghouse Junior, 12 H. P. each,
Two 5x4 Westinghouse Junior, 6 H. P. each.

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Alternating-current motors, 60 and 125 cycles.
Brush and Thomson-Houston arc generators—all sizes.
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Transformers, arc lamps, street railway motor equipments.

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REPAIR SHOP
OPEN DAY AND NIGHT

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Armature Fields Rewound

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GENERATORS—500 Volts.

Two T. H., 500 K. W.
Four T. H., 270 K. W., arranged to be driven with a single pulley clutch coupling on each side of pulley.
One General Electric, 250 K. W.
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Two General Electric, 100 K. W., 4 pole.
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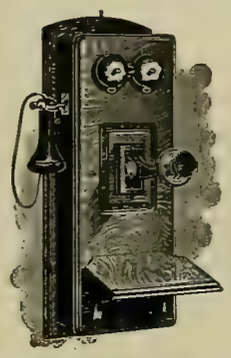

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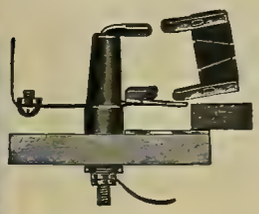

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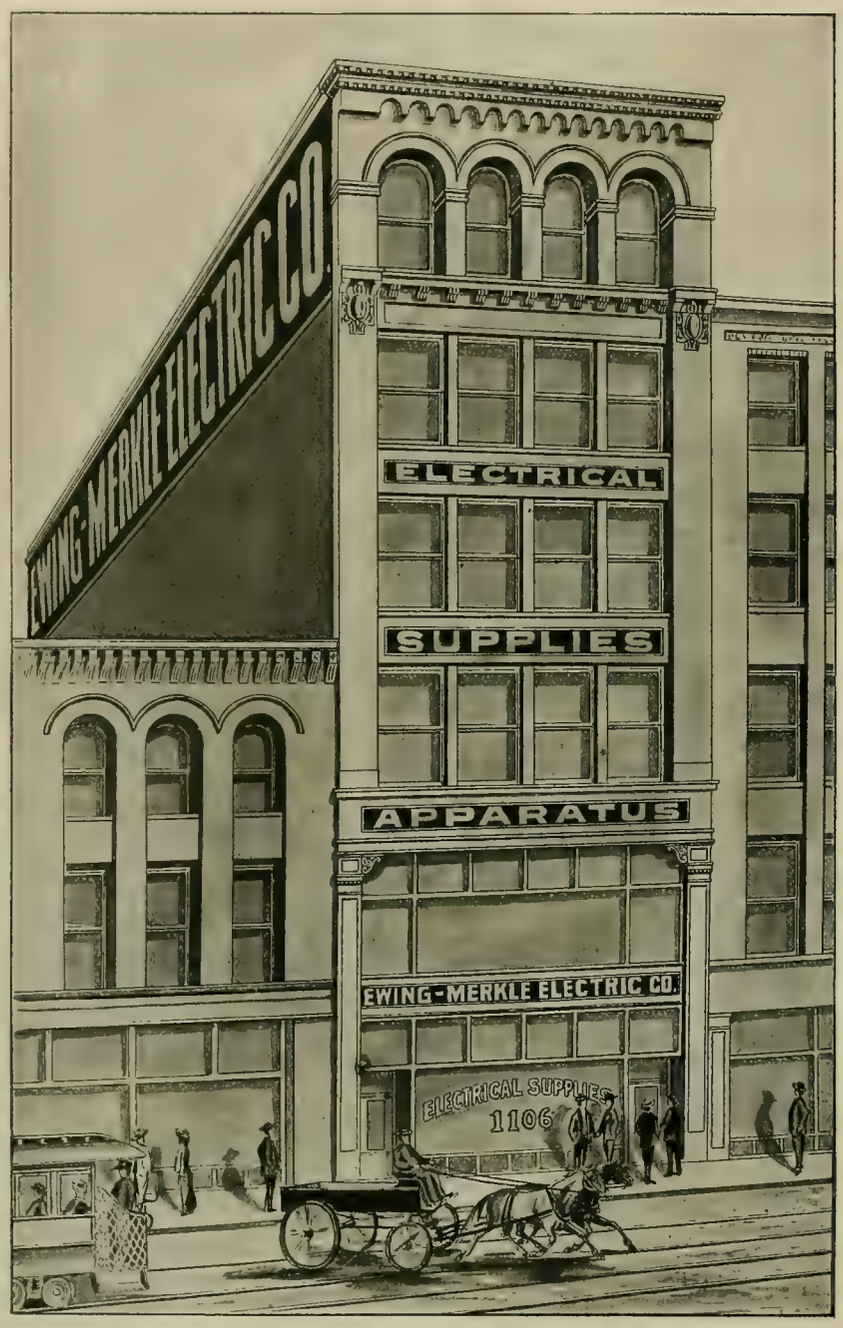

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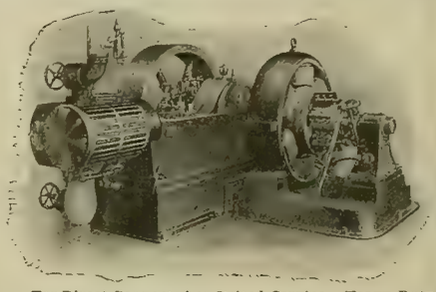

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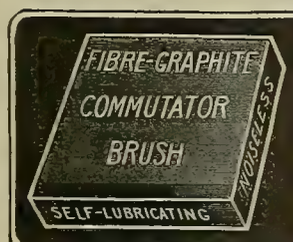

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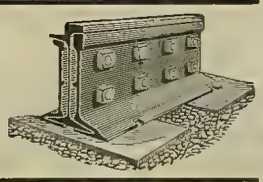

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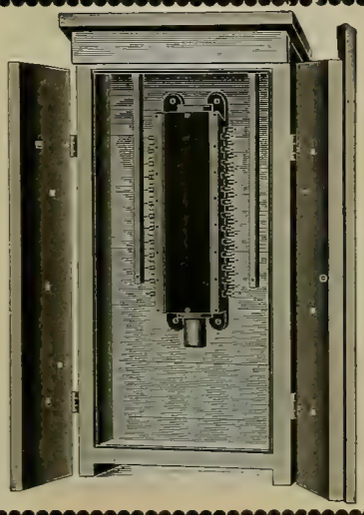

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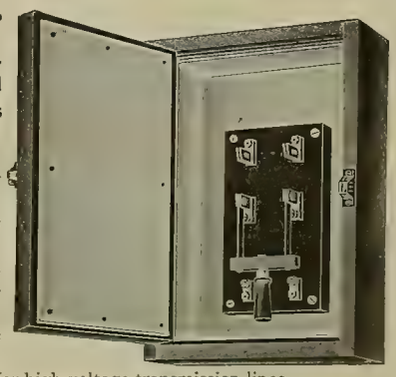

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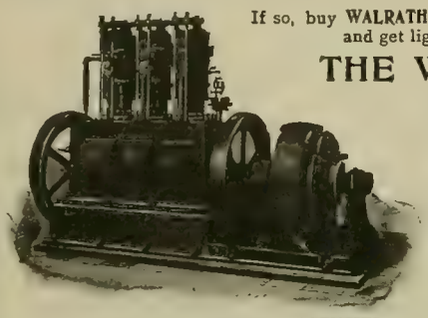
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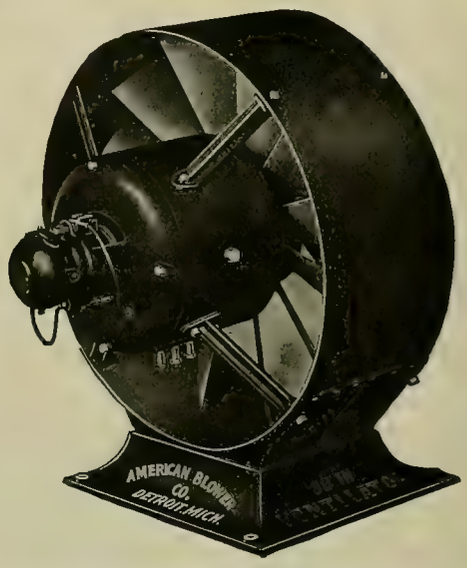

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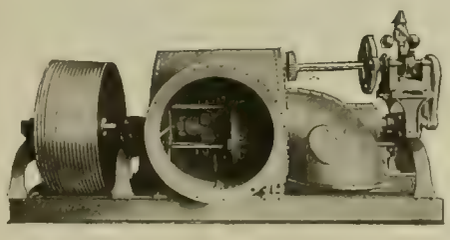
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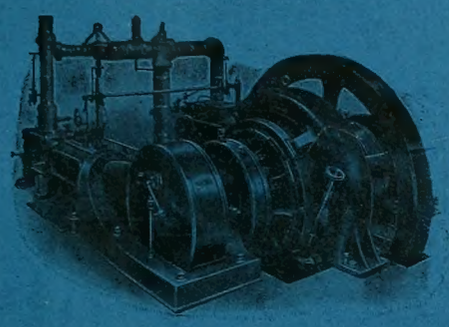

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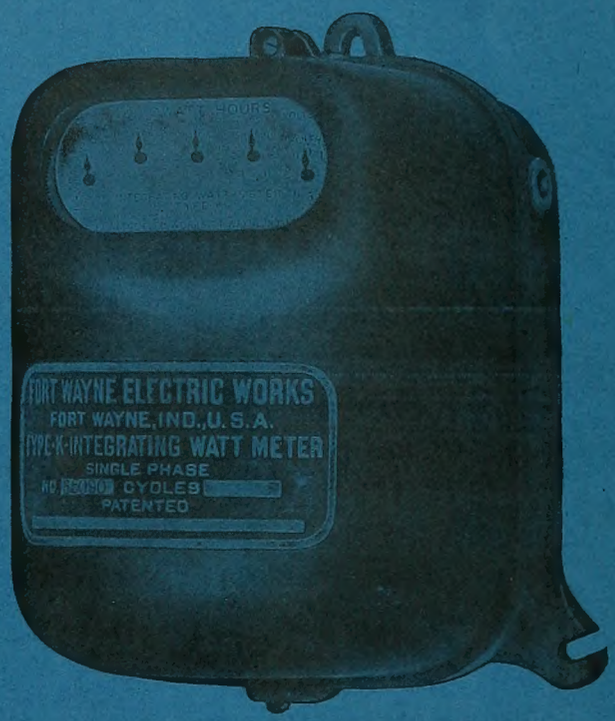

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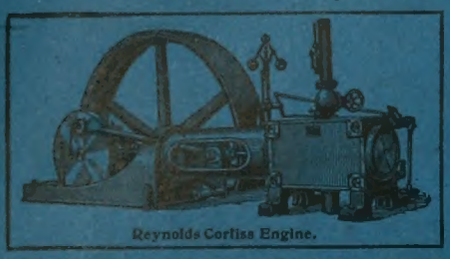
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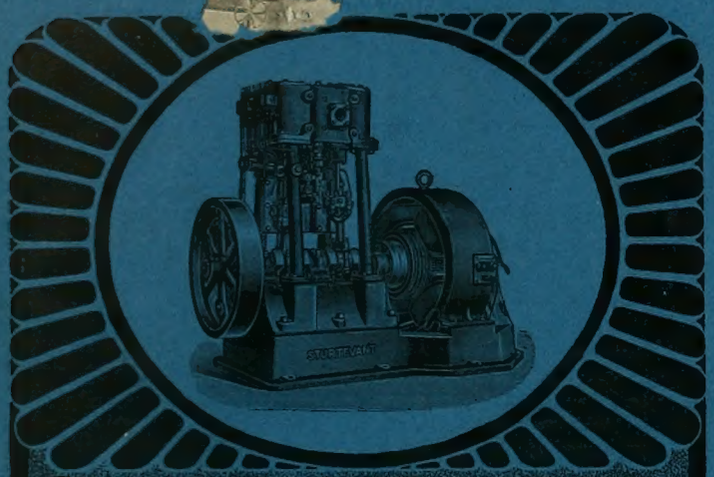

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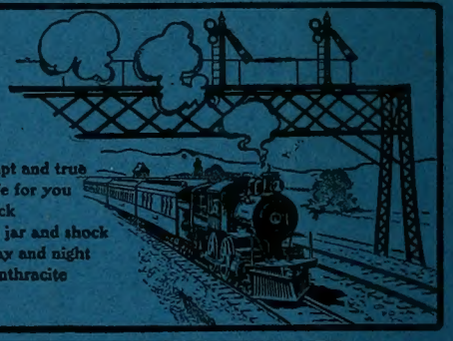

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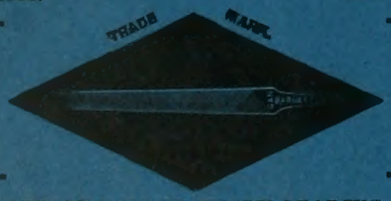

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